

ENGINEERING....Technical Superiority

| RING CTION IDE | 1. Identify Application Parameters: Shaft Speed in RPM: Desired Operating Life in Hours: Bearing Loads in Lbs.: Environments: U Wet Radial: Chemical Thrust: Dirty Other Operating Temperature: -30° to 200° F * 200° to 400° F -100° to -30° F * |
|----------------------|---|
| | 2. Select Bearing Type and Bore: |
| | Check Ball and Roller Bearing Ratings <i>Pages 178-186.</i> Selected Bore Size: Bearing Type: Ball Roller |
| | 3. Select Housing Type Page 187. Housing Selected: |
| | 4. Select Seal Design Pages 188-189. Seal Selected: ☐ Felt Seal ☐ Contact Seal ☐ Other |
| | 5. Select Lock Mechanism Pages 190-191. Shaft Lock Selected: Single Lock Set Screw Double Lock Set Screw Skwezloc (Ball Bearings Only) |
| | Refer to |
| | <i>Refer to Pages 96-97</i> For Roller Bearing Nomenclature and Pictorial index to locate Dimensional Specifications. |
| | Bearing Selected: |
| | For Application Parameters outside capabilities of selected components *Contact Application Engineering (630-898-9620) or you can fax the Application Worksheet on Page 207 to (630-898-6064). |
| | For Ordering Information Contact Customer Service (800-354-9820) |

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Bearing Life Calculation

While both Ball and Roller bearings may be considered as possible designs on a given application, the formulas and calculations are different and will be treated separately. Typically, Ball bearings are usually specified on applications with lighter loads but have a higher speed capacity. As Ball bearings usually cost less for a given shaft size they are considered first. If the desired life or load capacity cannot be achieved with a ball bearing then a tapered roller bearing should be considered (see page 182 for Tapered Roller bearing life calculations).

- BEARING SYMBOLS FOR LIFE CALCULATION
- С -Basic Dynamic Rating (lbs)
- C₀ Static Rating (lbs) n Speed (RPM) Equivalent Radial Load (lbs)
- P -L10 -Rated Life (Hours)

Κ -Geometry Factor -Radial Factor Х

Thrust Factor

-

- L F F -Adjusted Rated Life Applied Thrust Load (lbs)
 - Applied Radial Load (lbs)
 - -Geometry Ratio

Ball Bearing Life Calculation

The following formula provided by the Anti Friction Bearing Manufacturers Association (ABMA) provide 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.

C = The Basic Dynamic Load Rating in Lbs.

P = The equivalent Radial Load in Lbs.

n = Shaft speed in RPM.

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

$$L_{na} = a_1 x a_2 x a_3 x L_{10}$$

Where:

L_{na} = Adjusted Rated Life.

a, = Reliability Factor.

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

Table No. 1 Life Adjustment Factor for Reliability

| REALIABILITY % | 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, = Material Factor.

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

a₂ = 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 250°F and tight fitted to the shaft, the a, factor should be 1.0.

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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, 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 a₃, Life Adjustment Factors are recommended. The shock factor is used in combination with the "slip fit" factor.

Table No. 2 Shock/Vibration Factor

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

The a₃ factor takes into account a wide range of application and mounting conditions as well as bearing features and design. Accurate determination of this factor is normally achieved through testing and in-field experience. Sealmaster offers a wide range of options which can maximize bearing performance. Consult SEALMASTER Application Engineering for more information. *See sample calculations on page 184.

Selection

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 L_m 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 the L10 life formula.

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

- For applications with only a thrust load present Contact SEALMASTER Application Engineering.

Calculate (P) equivalent radial Load.

- 1. Use Table 4 to identify the relative axial load factor (ND²).
- 2. Determine the relative axial load (RAL):

$$RAL = \frac{F_a}{1000}$$
 -applied thrust load

- 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 $F_{/}/F_{/}$ and compare value to the "e" value found in step #3 above.
- Choose values for "X" and "Y" based on step #3 & 4 and from 5. 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 182 for Relevant Disclaimer.

SEAL ASTER® BALL BEARING RATING & SELECTION

Load Ratings - Ball Bearings

Explanation of Rating Selection:

details.

1. For standard and medium duty spherical outer race inserts as well as "AR" bearings, match the bearing insert number to the insert number on the ratings chart (i.e. 2-15, AR-2-15, 2-15D, and 2-15T all use 2-15 insert rating.)

Table No. 4

 For "ER', "RB" and "TXP" inserts, match bearing insert number to "ER" number (i.e. ER-23 & TXP 23 both use an ER-23 insert rating.)

Contact SEALMASTER Engineering for additional

Ball Bearing Selection -New Applications:

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.*

- Determine required application hours (L_{na}).
- Calculate L10 using adjustment factors:

$$L10 = \frac{L_{na}}{a_f x a_2 x a_3}$$

3. Calculate Basic Dynamic Radial Rating (Creq).

$$\operatorname{Creq} = \operatorname{P} x \left(\begin{array}{c} \underline{10 \times N} \\ 16,667 \end{array} \right)^{1/3}$$

- 4. Use Table No. 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 Creq is greater than the largest Basic Dynamic Radial Rating Value of Table No. 4, go to Roller Bearing Selection on page 182.
- 6. If Ball bearing is selected, proceed with housing, seal, lock selection pages 187-191.

Typical operating temperature range for standard bearings is -20° to 200° F. For operating temperatures outside this range contact application engineering. For Maximum speed information, see tables on pages 180 and 181.

Table No. 3

Equivalent Load Calculation Data - Ball Bearings

| Relative Axial | е | Fa/F | r≤e | Fa/F | r > e |
|-------------------|------|------|-----|------|-------|
| Load | Ũ | х | у | х | у |
| 24.92 | 0.19 | | | | 2.30 |
| 50.03 | 0.22 | | | | 1.99 |
| 99.91 | 0.26 | | | | 1.71 |
| 149.35 | 0.28 | | | | 1.55 |
| 200.10 | 0.30 | 1 | 0 | 0.56 | 1.45 |
| 300.15 | 0.34 | | | | 1.31 |
| 500.25 | 0.38 | | | | 1.15 |
| 749.65 | 0.42 | | | | 1.04 |
| 999.05 | 0.44 | | | | 1.00 |

| I able No |).4 LC | oad Ratings - B | ali Bearing | js | | | RELATIVE | |
|--|--|---|--------------------------|------------------------|------------------|------------------|-----------------------|--------|
| | STANDARD I | DUTY | MEDIU | M DUTY | BASIC DYNAMIC | STATIC RADIAL | AXIAL | THRUST |
| SHAFT SIZE | INSERT # | ER # | SHAFT SIZE | INSERT # | RADIAL RATING | RATING | FACTOR | RATING |
| 1/2 9/16 5/8 11/16 3/4 | 2-08 2-09 2-010 2-011 2-012 | ER/RB-8 ER-9 ER/RB-10 ER-11 ER/RB-12 ER/RB-204 | | | 2611 | 1444 | <u>ND^2</u> 0.7056 | 741 |
| 20mm 13/16 7/8 15/16 25mm 1 | 5204 2-013 2-014 2-015 5205 2-1 | ER/RB-204 ER/RB-14 ER/RB-15 ER/RB-205 ER/RB-16 | | | 2801 | 1651 | 0.7840 | 490 |
| 1 1/16 1 1/8 30mm 1 3/16 1 1/4 | 2-11 2-12 5206 2-13 1-14 | ER/RB-17 ER/RB-18 ER/RB-206 ER/RB-19 RB-20R | 15/16 25mm 1 | 3-015 5305 3-1 | 4381 | 2567 | 1.2996 | 1177 |
| 1 1/4 1 5/16 1 3/8 35mm 1 7/16 | 2-14 2-15 2-16 5207 2-17 | ER-20 ER-21 ER-22 ER-207 ER-23 | 30mm 1 3/16 | 5306 3-13 | 5782 | 3493 | 1.7424 | 1709 |
| 1 1/2 1 9/16 40mm | 2-18 2-19 5208 | ER-24 ER-25 ER-208 | 35mm 1 7/16 | 5307 3-17 | 7340 | 4467 | 2.2500 | 2254 |
| 1 5/8 1 11/16 1 3/4 45mm | 2-110 2-111 2-112 5209 | ER-26 ER-27 ER-28 ER-209 | 1 1/2 40mm | 3-18 5308 | 7901 | 5139 | 2.5000 | 2350 |
| 1 13/16 1 7/8 1 15/16 50mm 2 | 2-113 2-114 2-115 5210 1-2 | ER-30 ER-31 ER-210 | 1 11/16 1 3/4 45mm | 3-111 3-112 5309 | 7889 | 5216 | 2.5000 | 2350 |
| 2 2 1/8 55mm 2 3/16 | 2-2 2-22 5211 2-23 | ER-32 ER-34 ER-211 ER-35 | 1 15/16 50mm | 3-115 5310 | 9752 | 6601 | 3.3160 | 2886 |
| 2 1/4 2 5/16 60mm 2 3/8 2 7/16 | 2-24 2-25 5212 2-26 2-27 | ER-36 ER-212 ER-38 ER-39 | 55mm 2 3/16 | 5311 3-23 | 11789 | 8150 | 3.9690 | 4105 |
| 2 1/2 2 11/16 70mm | 2-211 5214 | ER-40 ER-43 ER-214 | 2 7/16 2 1/2 65mm | 3-27 3-28 5313 | 13971 | 10063 | 4.7610 | 4503 |
| 2 7/8 2 15/16 75mm | 2-214 2-215 5215 | ER-46 ER-47 ER-215 | 2 11/16 70mm | 3-211 5314 | 14839 | 11224 | 5.2371 | 5207 |
| 3 80mm 3 3/16 | 5216 2-33 | ER-48 ER-216 ER-51 | 2 15/16 75mm 3 | 3.215 5315 3-3 | 17412 | 13174 | 6.1875 | 6032 |
| 3 1/4 3 3/8 3 7/16 | 2-34 2-36 2-37 | ER-52 ER-54 ER-55 | 80mm 3 3/16 | 5316 3-33 | 18681 | 14496 | 6.6924 | 7474 |
| 3 1/2 90mm | 2-38 5218 | | 3 7/16 | 3-37 | 21566 | 16301 | 7.7440 | 7839 |
| 3 15/16 4 | | ER-63 ER-64 | 100mm 3 15/16 4 | 5320 3-315 3-4 | 29905 | 23553 | 11.2360 | 11097 |
| | | | 4 7/16 4 15/16 | 3-47 3-415 | 37482 | 33267 | 15.6250 | 16697 |
| | | | | | | | | 179 |

BALL BEARING RATING TABLES

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GOLDLINE BALL BEARING RATING TABLES

This chart displays the Goldline Ball Bearing load capacities for a given L10 life, speed, and shaft size. The shaded area indicates the maximum speed ratings for SKWEZLOC[®] and double lock bearings (applicable on sizes available). All speeds listed are for the standard felt seal. See Seal Selection for alternate seals, pages 188-189.

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 the load in the table by 1.3. Values in the table represent equivalent radial loads only. For combined load determination, see page 178. Areas designated by "-" exceed maximum value for standard bearings. Consult SEALMASTER Application Engineering for load and speed applications not covered in this table.

Double Lock and SKWEZLOC use same bearing insert ratings as single lock inserts shown below.

For RB, TX, and ETX inserts use standard duty load ratings for the appropriate shaft size.

 Table No. 5
 Load Ratings - Ball Bearings

| STAN | NDARD D | DUTY | MEDIU | M DUTY | | | | | | | REVO | LUTIO | NS PE | R MIN | UTE | | | | | | |
|---|---|---|--------------------------|------------------------|---|--------------------------------------|--------------------------------------|------------------------------------|-----------------------------------|----------------------------------|----------------------------------|----------------------------------|----------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|---------------------------------|-------------------------------|
| SHAFT SIZE | INSERT # | ER # | SHAFT SIZE | INSERT # | L10 HOURS | 50 | 150 | 500 | 1000 | 1750 | 2000 | 2500 | 3500 | 4500 | 5000 | 5500 | 6000 | 6500 | 7500 | 8000 | 10000 |
| 1/2 9/16 5/8 11/16 3/4 20mm | 2-08 2-09 2-010 2-011 2-012 5204 | ER-8 ER-9 ER-10 ER-11 ER-12 ER-204 | - | - | 5000 10000 30000 50000 100000 | 619 583 583 491 390 | 619 583 404 341 270 | 491 390 270 228 181 | 390 310 215 181 144 | 324 257 178 150 119 | 310 246 170 144 114 | 287 228 158 133 106 | 257 204 141 119 95 | 236 188 130 110 87 | 228 181 126 106 84 | 221 175 122 103 81 | 215 170 118 100 79 | 209 166 115 97 77 | 199 158 109 92 73 | 195 154 107 90 71 | 181 143 100 84 67 |
| 13/16 7/8 15/16 25mm 1 | 2-013 2-014 2-015 5205 2-1 | ER-14 ER-15 ER-205 ER-16 | - | - | 5000 10000 30000 50000 100000 | 664 625 625 527 418 | 664 625 433 366 290 | 527 418 290 245 194 | 418 332 230 194 154 | 347 276 191 161 128 | 332 264 183 154 122 | 308 245 170 143 114 | 276 219 152 128 102 | 253 201 139 118 93 | 245 194 135 114 90 | 237 188 130 110 87 | 230 183 127 107 85 | 224 177 123 104 82 | 213 169 117 99 78 | 213 169 117 99 78 | |
| 1 1/16 1 1/8 1 3/16 30mm 1 1/4R | 2-11 2-12 2-13 5206 1-14 | ER-17 ER-18 ER-19 ER-206 | 15/16 1 25mm | 3-015 3-1 5305 | 5000 10000 30000 50000 100000 | 1039 978 978 825 654 | 1039 978 678 572 454 | 825 654 454 383 304 | 654 519 360 304 241 | 543 431 299 252 200 | 519 412 286 241 191 | 482 383 265 224 178 | 431 342 237 200 159 | 396 315 218 184 146 | 383 304 211 178 141 | 370 294 204 172 136 | 360 286 198 167 133 | 351 278 193 163 129 | 334 265 184 155 123 | 334 265 184 155 123 | - - - - |
| 1 1/4 1 5/16 1 3/8 35mm 1 7/16 | 2-14 2-15 2-16 5207 2-17 | ER-20 ER-21 ER-22 ER-207 ER-23 | 30mm 1 3/16 | 5306 3-13 | 5000 10000 30000 50000 100000 | 1290 1290 1290 1088 864 | 1290 1290 895 755 599 | 1088 864 599 505 401 | 864 686 475 401 318 | 717 569 394 333 264 | 686 544 377 318 253 | 636 505 350 295 234 | 569 452 313 264 210 | 523 415 288 243 193 | 505 401 278 234 186 | 489 388 269 227 180 | 475 377 262 221 175 | 463 367 255 215 171 | | - - - - | - - - - |
| 1 1/2 1 9/16 40mm | 2-18 2-19 5208 | ER-24 ER-25 ER-208 | 1 7/16 35mm | 3-17 5307 | 5000 10000 30000 50000 100000 | 1638 1638 1638 1381 1096 | 1638 1638 1136 958 760 | 1381 1096 760 641 509 | 1096 870 603 509 404 | 910 722 501 422 335 | 870 691 479 404 321 | 808 641 445 375 298 | 722 573 397 335 266 | 664 527 365 308 245 | 641 509 353 298 236 | 621 493 342 288 229 | 603 479 332 280 222 | | | - - - - | - - - - |
| 1 5/8 1 11/16 1 3/4 45mm | 2-110 2-111 2-112 5209 | ER-26 ER-27 ER-28 ER-209 | 1 1/2 45mm | 3-18 5308 | 5000 10000 30000 50000 100000 | 1763 1763 1763 1487 1180 | 1763 1763 1222 1031 818 | 1487 1180 818 690 548 | 1180 937 650 548 435 | 979 777 539 455 361 | 937 744 516 435 345 | 870 690 479 404 320 | 777 617 428 361 286 | 715 567 393 332 263 | 690 548 380 320 254 | 669 531 368 310 246 | - - - - | | | | - - - - |
| 1 13/16 1 7/8 1 15/16 50mm | 2-113 2-114 2-115 5210 1-2 | ER-30 ER-31 ER-210 | 1 11/16 1 3/4 45mm | 3-111 3-112 5309 | 5000 10000 30000 50000 100000 | 1760 1760 1760 1485 1178 | 1760 1760 1221 1029 817 | 1485 1178 817 689 547 | 1178 935 649 547 434 | 978 776 538 454 360 | 935 742 515 434 345 | 868 689 478 403 320 | 776 616 427 360 286 | 714 567 393 331 263 | 689 547 379 320 254 | | | | | | - - - - |
| 2 2 1/8 55mm 2 3/16 | 2-2 2-22 5211 2-23 | ER-32 ER-34 ER-211 ER-35 | 1 15/16 50mm | 3-115 5310 | 5000 10000 30000 50000 100000 | 2176 2176 2176 1835 1457 | 2176 2176 1509 1273 1010 | 1835 1457 1010 852 676 | 1457 1156 802 676 537 | 1209 959 665 561 445 | 1156 918 636 537 426 | 1073 852 591 498 395 | 1010 802 556 469 372 | 959 762 528 445 353 | | | - - - - | | | | - - - - |

Notes:

1. For high load-high speed applications, see engineering section, page 204.

2. Typical operating temperature range for standard bearings is -20° to 200° F. For operating temperatures outside this range contact application engineering.

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BALL BEARING RATING TABLES

GOLDLINE BALL BEARING RATING TABLES

This chart displays the Goldline Ball Bearing load capacities for a given L10 life, speed, and shaft size. The shaded area indicates the maximum speed ratings for SKWEZLOC[®] and double lock bearings (applicable on sizes available). All speeds listed are for the standard felt seal. See Seal Selection for alternate seals, pages 188-189.

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 the load in the table by 1.3. Values in the table represent equivalent radial loads only. For combined load determination, see page 178. Areas designated by "-" exceed maximum value for standard bearings. Consult SEALMASTER Application Engineering for load and speed applications not covered in this table.

Double Lock and SKWEZLOC use same bearing insert ratings as single lock inserts shown below.

For RB, TX, and ETX inserts use standard duty load ratings for the appropriate shaft size.

| STAN | NDARD D | UTY | MEDIU | M DUTY | | | | | | R | EVOLU | TIONS | PER M | INUTE | | | | | | |
|--------------------------|----------------------|--------------------------|-------------------------|----------------------|---|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|--------------------------------------|-------------------------------------|------------------------------------|----------------------------|--------------------|------------------|
| SHAFT SIZE | INSERT # | ER # | SHAFT SIZE | INSERT # | L10 HOURS | 50 | 150 | 250 | 500 | 750 | 1000 | 1250 | 1500 | 1750 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 |
| 2 1/4 2 5/16 60mm | 2-24 2-25 5212 | ER-36 ER-212 | 55mm 2 3/16 | 5311 3-23 | 5000 10000 30000 | 2631 2631 2631 | 2631 2631 1824 | 2631 2219 1538 | 2219 1761 1221 | 1938 1538 1067 | 1761 1398 969 | 1635 1298 900 | 1538 1221 847 | 1461 1160 804 | 1398 1109 769 | 1298 1030 714 | 1221 969 672 | 1160 921 638 | 1109 881 611 | - |
| 2 3/8 2 7/16 | 2-26 2-27 | ER-38 ER-39 | | | 50000 50000 100000 | 2031 2219 1761 | 1538 1221 | 1298 1030 | 1030 817 | 900 714 | 909 817 649 | 900 759 602 | 714 567 | 678 538 | 649 515 | 602 478 | 567 450 | 538 427 | 515 409 | - |
| 2 1/2 2 11/16 70mm | 2-211 5214 | ER-40 ER-43 ER-214 | 2 7/16 2 1/2 65mm | 3-27 3-28 5313 | 5000 10000 30000 50000 | 3118 3118 3118 2629 | 3118 3118 2162 1823 | 3118 2629 1823 1538 | 2629 2087 1447 1220 | 2297 1823 1264 1066 | 2087 1656 1149 969 | 1937 1538 1066 899 | 1823 1447 1003 846 | 1732 1375 953 804 | 1656 1315 912 769 | 1538 1220 846 714 | 1447 1149 796 672 | 1375 1091 756 638 | | |
| 2 7/8 | 2-214 | ER-46 | 2 | 3-211 | 100000 | 2087 3311 | 1447 3311 | 1220 3311 | 969 2793 | 846 2440 | 769 2217 | 714 2058 | 672 1936 | 638 1839 | 610 1759 | 567 1633 | 533 1537 | 506 1460 | - | - |
| 2 15/16 75mm | 2-215 5215 | ER-47 ER-215 | 11/16 70mm | 5314 | 10000 30000 50000 100000 | 3311 3311 2793 2217 | 3311 2296 1936 1537 | 2793 1936 1633 1296 | 2217 1537 1296 1029 | 1936 1343 1132 899 | 1759 1220 1029 817 | 1633 1132 955 758 | 1537 1066 899 713 | 1460 1012 854 678 | 1396 968 817 648 | 1296 899 758 602 | 1220 846 713 566 | 1159 803 678 538 | | |
| 3 80mm 3 3/16 | 5216 2-33 | ER-48 ER-216 ER-51 | 75mm | 3-215 5315 3-3 | 5000 10000 30000 | 3885 3885 3885 | 3885 3885 2694 | 3885 3277 2272 | 3277 2601 1803 | 2863 2272 1575 | 2601 2064 1431 | 2415 1916 1329 | 2272 1803 1250 | 2158 1713 1188 | 2064 1639 1136 | 1916 1521 1055 | 1803 1431 992 | - - - | - | - - - |
| 0.4/4 | 0.04 | | 3 | 5010 | 50000 100000 | 3277 2601 | 2272 1803 | 1916 1521 | 1521 1207 | 1329 1055 | 1207 958 | 1121 890 | 1055 837 | 1002 795 | 985 761 | 890 706 | 837 664 | - | - | - |
| 3 1/4 3 3/8 3 7/16 | 2-34 2-36 2-37 | ER-52 ER-54 ER-55 | 80mm 3 3/16 | 5316 3-33 | 5000 10000 30000 50000 100000 | 3975 3975 3975 3516 2791 | 3975 3975 2890 2438 1935 | 3975 3516 2438 2056 1632 | 3516 2791 1935 1632 1295 | 3071 2438 1690 1426 1132 | 2791 2215 1536 1295 1028 | 2591 2056 1426 1202 954 | 2438 1935 1342 1132 898 | 2316 1838 1274 1075 853 | 2215 1758 1219 1028 816 | 2056 1632 1132 954 757 | 1935 1536 1065 898 713 | - | - | - |
| 3 1/2 90mm | 2-38 5218 | - | 3 7/16 | 3-37 | 5000 10000 30000 50000 100000 | 4812 4812 4812 4059 3222 | 4812 4812 3337 2814 2234 | 4812 4059 2814 2374 1884 | 4059 3222 2334 1884 1495 | 3546 2814 1951 1646 1306 | 3222 2557 1773 1495 1187 | 2991 2374 1646 1388 1102 | 2814 2234 1549 1306 1037 | 2673 2122 1471 1241 985 | 2557 2029 1407 1187 942 | 2374 1884 1306 1102 874 | | | | |
| 3 15/16 4 | - | ER-63 ER-64 | 100mm 3 15/16 4 | 5320 3-315 3-4 | 5000 10000 30000 50000 100000 | 6673 6673 6673 5628 4467 | 6673 6673 4627 3902 3097 | 6673 5628 3902 3291 2612 | 5628 4467 3097 2612 2074 | 4917 3902 2706 2282 1811 | 4467 3546 2458 2074 1646 | 4147 3291 2282 1925 1528 | 3902 3097 2148 1811 1438 | 3707 2942 2040 1721 1366 | 3546 2814 1951 1646 1306 | - | - - - - | | - - - - | - - - - |
| - | - | - | 4 7/16 4 15/16 | 3-47 3-415 | 5000 10000 30000 50000 100000 | 7975 7975 7975 7054 5599 | 7975 7975 5799 4891 3882 | 7975 7054 4891 4125 3274 | 7054 5599 3882 3274 2599 | 6163 4891 3391 2860 2270 | 5599 4444 3081 2599 2063 | 5198 4125 2860 2413 1915 | 4891 3882 2692 2270 1802 | 4646 3688 2557 2157 1712 | 4444 3527 2446 2063 1637 | | | | | - - - - |

Table No. 5 (Continued) Load Ratings - Ball Bearings

Notes:

1. For high load-high speed applications, see engineering section, page 204.

2. Typical operating temperature range for standard bearings is -20° to 200° F. For operating temperatures outside this range contact application engineering.

ROLLER BEARING RATING & SELECTION SEAL ASTER®

This section outlines the formula used to select bearing size or calculate expected bearing life for RPB type 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.*

Roller Bearing Life Calculation

- 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.
- C = The Basic Dynamic Load Rating in Lbs. (2 Row)
- P = The equivalent Radial Load in Lbs.
- n = Shaft speed in RPM.

L10 = $(C/P)^{10/3}$ x $\frac{3000 \text{ hours x 500 RPM}}{2}$

LIFE CALCULATIONS

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.

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 SEALMASTER Application Engineering.

Calculate (P) equivalent radial Load.

FIR

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

$$= \frac{0.6 \text{ x F}_{r}}{\text{K}} - \text{applied radial load}$$
-factor K in Tabel No. 6

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

$$P = (0.5 \text{ x } F_{r}) + (0.83 \text{ x } \text{K } \text{x } F_{a})$$

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

$$P = (0.4 \text{ x F}_{r}) + (K \text{ x F}_{a})$$

4. Calculate the expected L10 life using the single row basic dynamic load rating:

| 1.10 | single row load rating | 10/3 | 3000 x 500 |
|-------|------------------------|------|------------|
| L10 = | P | × | n |

| | RADIAL RATI | NG (POUNDS) | (1) THRUST RATING | FACTOR | ALLOWABLE THRUST ON PILLOW BLOCK HOUSING | | | |
|-----------------|-------------|-------------|----------------------|--------|---|-------------|--|--|
| (INCHES) | 2 ROW | 1 ROW | (POUNDS) | к | 2 BOLT BASE | 4 BOLT BASE | | |
| 1 3/16 - 1 1/4 | 2975 | 1710 | 1390 | 1.23 | 960 | - | | |
| 1 3/8 - 1 7/16 | 4760 | 2740 | 2080 | 1.31 | 1600 | - | | |
| 1 1/2 - 1 11/16 | 6410 | 3530 | 2600 | 1.36 | 1580 | - | | |
| 1 3/4 - 2 | 8070 | 4640 | 2540 | 1.83 | 2500 | - | | |
| 2 3/16 | 8570 | 4910 | 2980 | 1.65 | 2360 | - | | |
| 2 1/4 - 2 1/2 | 9030 | 5220 | 3470 | 1.51 | 2350 | 5700 | | |
| 2 11/16 - 3 | 9630 | 5510 | 4260 | 1.30 | 3340 | 5700 | | |
| 3 3/16 - 3 1/2 | 15320 | 8790 | 7410 | 1.19 | 4450 | 10980 | | |
| 3 15/16 - 4 | 20980 | 12100 | 9800 | 1.23 | - | 7250 | | |
| 4 7/16 - 4 1/2 | 25750 | 14800 | 13100 | 1.13 | - | 6680 | | |
| 4 15/16 - 5 | 35520 | 20400 | 16000 | 1.27 | - | 9000 | | |

(1) For thrust load pillow block applications, the bearing thrust rating must be compared to the allowable thrust load capacity of the housing. In a number of sizes, the allowable thrust capacity of the pillow block housing is less than the thrust rating of the bearing. When this circumstance exists, do not exceed the pillow block housing thrust capacity.

In thrust applications utilizing flange or piloted flange housings, please contact SEALMASTER engineering for allowable housing thrust limits.

NOTE: EPT believes that the information provided above is true and accurate. However, individual applications may vary. Thus, the information provided above cannot be relied upon as complete. The customer assumes all risk from the use thereof, and EPT assumes no responsibility for any use of the foregoing information by its customers.

Table No. 6 Load Ratings - Roller Bearings

SEAL MASTER®

TAPERED ROLLER BEARING RATING TABLES

This chart displays the SEALMASTER RPB Roller Bearing load capacities for a given L10 life, speed, and shaft size. For combined load determination see Page 182. Areas designated by "-" exceed maximum value for standard bearings. Consult SEALMASTER Application Engineering for load and speed applications not covered in this table.

| | | - | | | | REVO | LUTIONS | PER MIN | UTE | - | - | | | | |
|---------------|-----------------|----------------|----------------|----------------|----------------|----------------|----------------|--------------|--------------|--------------|--------------|--------------|-------------|-------------|------|
| SHAFT SIZE | L10 HOURS | 50 | 100 | 250 | 500 | 750 | 1000 | 1250 | 1500 | 1750 | 2000 | 2500 | 3000 | 3500 | 4000 |
| 1 3/16 | 5000 | 3360 | 3360 | 3142 | 2552 | 2260 | 2073 | 1939 | 1836 | 1753 | 1684 | 1575 | 1491 | 1424 | 1368 |
| 1 1/4 | 10000 | 3360 | 3360 | 2552 | 2073 | 1836 | 1684 | 1575 | 1491 | 1424 | 1368 | 1279 | 1211 | 1156 | 1111 |
| | 30000 | 2975 | 2416 | 1836 | 1491 | 1320 | 1211 | 1279 | 1072 | 1024 | 984 | 920 | 871 | 832 | 902 |
| | 50000 | 2552 | 2073 | 1575 | 1279 | 1133 | 1039 | 1081 | 920 | 878 | 844 | 789 | 747 | 714 | 763 |
| | 100000 | 2073 | 1684 | 1279 | 1039 | 920 | 844 | 971 | 747 | 714 | 685 | 641 | 607 | 580 | 685 |
| 1 3/8 | 5000 | 5376 | 5376 | 5028 | 4084 | 3616 | 3317 | 3104 | 2937 | 2804 | 2694 | 2520 | 2386 | 2278 | - |
| 1 7/16 | 10000 | 5376 | 5376 | 4084 | 3317 | 2937 | 2694 | 2521 | 2386 | 2278 | 2188 | 2047 | 1938 | 1850 | - |
| | 30000 | 4760 | 3866 | 2937 | 2386 | 2112 | 1938 | 2048 | 1716 | 1638 | 1574 | 1472 | 1394 | 1331 | - |
| | 50000 100000 | 4084 3317 | 3317 2694 | 2520 2047 | 2047 1662 | 1812 1472 | 1662 1350 | 1732 1555 | 1472 1196 | 1406 1142 | 1350 1097 | 1263 1026 | 1196 971 | 1142 927 | - |
| 1 1/2 | 5000 | 6934 | 6934 | 6485 | 5268 | 4664 | 4279 | 4000 | 3789 | 3617 | 3475 | 3250 | 3077 | 927 | - |
| 1 5/8 | 10000 | 6934 6934 | 6934 6934 | 5268 | 4279 | 3789 | 3475 | 3249 | 3077 | 2938 | 2823 | 2640 | 2500 | | - |
| 1 11/16 | 30000 | 6140 | 4987 | 3789 | 3077 | 2725 | 2500 | 2640 | 2213 | 2113 | 2020 | 1899 | 1798 | | |
| 1 | 50000 | 5268 | 4279 | 3250 | 2640 | 2338 | 2144 | 2231 | 1899 | 1813 | 1742 | 1629 | 1542 | - | - |
| | 100000 | 4279 | 3475 | 2640 | 2144 | 1899 | 1742 | 2007 | 1542 | 1473 | 1415 | 1323 | 1253 | - 1 | - |
| 1 3/4 | 5000 | 9114 | 9114 | 8524 | 6923 | 6130 | 5624 | 5259 | 4979 | 4754 | 4568 | 4272 | - | - | - |
| 1 15/16 | 10000 | 9114 | 9114 | 6923 | 5624 | 4979 | 4568 | 4271 | 4045 | 3862 | 3710 | 3470 | - | - | - |
| 2 | 30000 | 8070 | 6555 | 4979 | 4045 | 3581 | 3285 | 3470 | 2909 | 2777 | 2668 | 2496 | - | - | - |
| | 50000 | 6923 | 5624 | 4272 | 3470 | 3072 | 2818 | 2934 | 2496 | 2383 | 2289 | 2141 | - | - | - |
| | 100000 | 5624 | 4568 | 3470 | 2818 | 2496 | 2289 | 2636 | 2027 | 1935 | 1859 | 1739 | - | - | - |
| 2 3/16 | 5000 | 9679 | 9679 | 9052 | 7352 | 6510 | 5972 | 5584 | 5288 | 5049 | 4851 | 4537 | - | - | - |
| | 10000 | 9679 | 9679 | 7352 | 5972 | 5288 | 4851 | 4587 | 4295 | 4101 | 3940 | 3685 | - | - | - |
| | 30000 | 8570 | 6961 | 5288 | 4295 | 3803 | 3489 | 3684 | 3089 | 2950 | 2834 | 2650 | - | - | - |
| | 50000 100000 | 7352 5972 | 5972 4851 | 4538 3685 | 3585 2993 | 3263 2650 | 2993 2431 | 3115 | 2650 2153 | 2530 2055 | 2431 1975 | 2274 | - | - | - |
| 2 1/4 | 5000 | 10198 | 10198 | 9538 | 7747 | 6860 | 6293 | 2799 5940 | 5572 | 5320 | 5111 | 1847 | - | | - |
| 2 7/16 | 10000 | 10198 | 10198 | 7747 | 6293 | 5572 | 5111 | 4824 | 4526 | 4321 | 4152 | | | | |
| 2 1/2 | 30000 | 9030 | 7335 | 5572 | 4526 | 4007 | 3676 | 3918 | 3255 | 3108 | 2986 | - | - | - | - |
| | 50000 | 7747 | 6293 | 4780 | 3883 | 3438 | 3154 | 3313 | 2793 | 2666 | 2562 | - | - | - | - |
| | 100000 | 6293 | 5111 | 3883 | 3154 | 2793 | 2562 | 2977 | 2268 | 2166 | 2081 | - | - | - | - |
| 2 11/16 | 5000 | 10876 | 10876 | 10171 | 8262 | 7316 | 6711 | 6279 | 5942 | 5674 | - | - | - | - | - |
| 2 3/4 | 10000 | 10876 | 10876 | 8262 | 6711 | 5942 | 5451 | 5100 | 4826 | 4608 | - | - | - | - | - |
| 2 15/16 | 30000 | 9630 | 7822 | 5942 | 4826 | 4274 | 3920 | 4143 | 3471 | 3314 | - | - | - | - | - |
| 3 | 50000 | 8262 | 6711 | 5098 | 4141 | 3666 | 3363 | 3502 | 2978 | 2843 | - | - | - | - | - |
| | 100000 | 6711 | 5451 | 4141 | 3363 | 2978 | 2732 | 3147 | 2419 | 2310 | - | - | - | - | - |
| 3 3/16 | 5000 | 17302 | 17302 | 16181 | 13143 | 11638 | 10676 | 9983 | 9453 | - | - | - | - | - | - |
| 3 7/16 | 10000 | 17302 | 17302 | 13143 | 10676 | 9453 | 8671 | 8109 | 7678 | - | - | - | - | - 1 | - |
| 3 1/2 | 30000 50000 | 15320 13143 | 12444 10676 | 9453 8110 | 7678 6587 | 6799 5833 | 6237 5351 | 6587 5569 | 5522 4738 | - | - | - | - | - | - |
| | 100000 | 10676 | 8671 | 6587 | 5351 | 4738 | 4346 | 5004 | 3848 | | _ | _ | | | |
| 3 15/16 | 5000 | 23694 | 23694 | 22159 | 17999 | 15938 | 14620 | 13673 | - | - | - | - | - | - | - |
| 4 | 10000 | 23694 | 23694 | 17999 | 14620 | 12945 | 11875 | 11106 | - | - | - | - | - | - | - |
| | 30000 | 20980 | 17041 | 12945 | 10515 | 9311 | 8541 | 9021 | - | - 1 | - | - | - | - | - |
| | 50000 | 17999 | 14620 | 11106 | 9021 | 7988 | 7327 | 7627 | - | - | - | - | - | - | - |
| | 100000 | 14620 | 11875 | 9021 | 7327 | 6488 | 5952 | 6852 | - | - | - | - | - | - | - |
| 4 7/16 | 5000 | 29081 | 29081 | 27198 | 22091 | 19561 | 17944 | 16783 | - | - | - | - | - | - | - |
| 4 1/2 | 10000 | 29081 | 29081 | 22091 | 17944 | 15889 | 14575 | 13632 | - | - | - | - | - | - | - |
| | 30000 | 25750 | 20915 | 15889 | 12906 | 11427 | 10483 | 10072 | - | - | - | - | - | - | - |
| | 50000 | 22091 | 17944 | 13631 | 11072 | 9804 | 8993 | 9362 | - | - | - | - | - | - | - |
| 4 4 5 /4 5 | 100000 | 17944 | 14575 | 11072 | 8993 | 7963 | 7305 | 8412 | - | - | - | - | - | - | - |
| 4 15/16 | 5000 | 40114 | 40114 | 37517 | 30473 | 26983 | 24752 | - | - | - | - | - | - | - | - |
| 5 | 10000 30000 | 40114 35520 | 40114 28851 | 30473 | 24752 17802 | 21917 | 20105 14460 | - | - | - | - | - | - | - | - |
| | 50000 | 35520 30473 | 28851 24752 | 21917 18803 | 17802 | 15763 13524 | 12405 | | | | | | | | |
| | 100000 | 24752 | 24752 | 15273 | 12405 | 10985 | 12405 | | | | | | | | |
| | 100000 | 24102 | 20100 | 15215 | 12400 | 10900 | 10070 | <u> </u> | | | - | · · | | | |

 Table No. 7
 Load Ratings - Tapered Roller Bearings

1. For high load-high speed applications, see page 204.

2. Typical operating temperature range for standard bearings is -20° to 200° F. For operating temperatures outside this range contact application engineering.

SAMPLE CALCULATIONS

APPLICATION EXAMPLES:

EXAMPLE # 1 **Pure Radial Load**

Question # 1:

What is the adjusted bearing life (L, hours) for an NP-39 SEALMASTER Ball Bearing with no shock conditions and the following application criteria?

| Design Load (P) | = | 1300 lbs. |
|-----------------------|---|--------------|
| Speed (n) | = | 1000 RPM |
| Shaft Size | = | 27/16 Inches |
| Operating Temperature | = | 125°F |

Solution:

1. Begin with the L₁₀ life formula: L₁₀ = (C/P)³ x $\frac{16667}{P}$

Look up the insert of an NP-39 on page 20. From Table No. 4 on page 179, the Basic Dynamic Radial Rating is 11,789 lbs.

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

2. Apply the life adjustment factors:

 $L_{na} \text{ hours} = L_{10} \text{ x } a_1 \text{ x } a_2 \text{ x } a_3 \\ L_{na} \text{ hours} = 12,430 \text{ x } 1 \text{ x } 1 \text{ x } 0.456$ L_{na} hours = 5,700 hours

Question # 2:

What is the adjusted bearing life (L₁₀ hours) for an NP-39 SEALMASTER Ball Bearing with moderate shock conditions and the same application criteria from above?

Solution:

1. From Table # 2 on page 178: $a_3 = 0.5 \times 0.456$.

2. Re-Apply the life adjustment factors to the previously calculated L10 life:

 $\begin{array}{l} {{L_{na}}\text{ hours} = {L_{10}}\,x\,{a_1}\,x\,{a_2}\,x\,{a_3}}\\ {{L_{na}}\text{ hours} = 12,430\,x\,1\,x\,1\,x\,(0.5\,x\,0.456)} \end{array}$ L_{na}^{ma} hours = 2,830 hours

Question # 3:

What is the bearing life (L_{10} hours) for an RPB-207-2 Tapered Roller Bearing with no shock conditions and the same application criteria from above?

Solution:

- 1. Begin with the L_{10} life formula: $L_{10} = (C/P)^{10/3} \times \frac{500 \times 3,000}{P}$
- 2. RPB-207 has 2 7/16" shaft size. From Table No. 6 on page 182, the Radial Rating is 9,030 lbs.

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

Question # 4:

What is the bearing life (L_{10} hours) for an RPB-207-2 Tapered Roller Bearing with moderate shock conditions and the same application criteria from above?

Solution:

1. From Table No. 2 on page 178:

$$L_{10} = 0.5 \text{ x} \left(\frac{9030}{1300}\right)^{10/3} \text{ x} \frac{500 \text{ x} 3,000}{1000} = 479,500 \text{ hrs.}$$

Refer to page 182 for relevant disclaimer.

SEALMAS

EXAMPLE # 2 **Combined Radial and Thrust Load**

Question # 1:

What is the adjusted bearing life (L, hours) for an NP-39 SEALMASTER Ball Bearing with no shock conditions and the following application criteria?

| Design Radial Load (F,) | = | 500 lbs. |
|-------------------------|---|--|
| Design Thrust Load (F | = | 1000 lbs. |
| Speed (n) Shaft Size | = | 1000 RPM |
| Shaft Size | = | 2 ⁷ / ₁₆ Inches 125°F |
| Operating Temperature | = | 125°F |
| | | |

Solution:

1. Calculate $F_{r}/F_{r} = 1000/500 = 2$ 2. Begin by calculating the Relative Axial Load (RAL): (From Table No. 4, page 17

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

3. From Table No. 3 on page 179, 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 No. 3 on page 179, 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 $F_{1}/F_{2} > e$;

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

Therefore Y = 1.38

X = .56

5. Determine the equivalent radial load (P): P = (X F) + (Y F)

$$= (X F_r) + (Y F_a)$$

= (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 NP-39 on page 30. From Table No. 4 on page 179, the Basic Dynamic Radial Rating is 11,789 lbs.

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

Question # 2:

What is the bearing life (L_{10} hours) for an RPB-207-2 Tapered Roller Bearing with no shock conditions and the same application criteria from above?

Solution:

- 1. Find the K factor value from Table No. 6 on page 182, K = 1.51.
- 2. Calculate the internal thrust reaction (FIR):

$$FIR = \frac{0.6 \times F_r}{1000}$$
 -applied radial load

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

3. Since the thrust load is greater than the internal thrust reaction (FIR) use the following formula from page 182 to calculate the equivalent radial load.

$$P = (0.4 \text{ x F}_{r}) + (K \text{ x F}_{a})$$

- $\mathbf{P} = (0.4 \times 500) + (1.51 \times 1000) = 1710 \text{ lbs.}$
- 4. Caclulate the expected L_{10} life using the single row rating. Single row rating = 5,220 lbs. This is found in Table No. 6 on page 182.

$$L_{10} = \left(\frac{\text{single row load rating}}{P}\right)^{10/3} x \quad \frac{500 \text{ x } 3000}{\text{n}}$$
$$L_{10} = \left(\frac{5220}{1710}\right)^{10/3} x \quad \frac{3000 \text{ x } 500}{1000} = 61,900 \text{ hrs.}$$

SEAL MASTER®

COMPUTING BEARING LOADS:

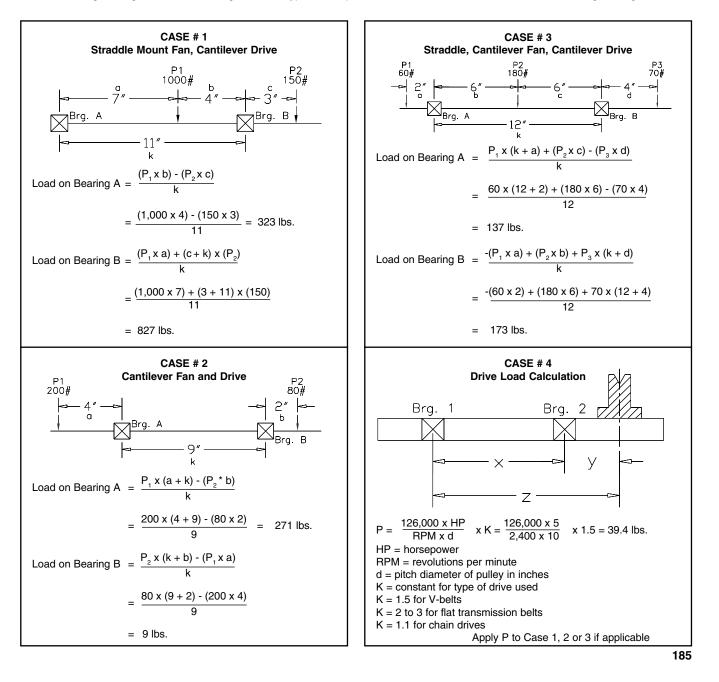
In the computation of bearing loads in any application of a SEALMASTER unit, the principal factor determining the selection of the unit is the equivalent radial load to which the bearing will be subjected. These radial loads result from any one or any combination of the following sources:

- 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.



SAMPLE CALCULATIONS

SEAL MASTER.

CASE # 5 Vibrating Drives

Load due to Centrifugal and Inertial Forces - In a shaker or gyrating screen bearing application, the load on the bearings is increased by sudden stopping, starting, and reversing of typically large loads. This can be expressed as a basic physical law:

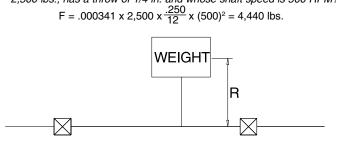
Force = Mass x Acceleration

In order to use this law we develop from it the following equation:

F = .000341 x WR(RPM)²

where: F = load or force in lbs.
 W = weight of rotating mass in lbs.
 R = radius of rotation or throw in feet
 RPM = shaft rotation in revolutions per minute

What is the centrifugal bearing load on a shaker screen which weighs 2,500 lbs., has a throw of 1/4 in. and whose shaft speed is 500 RPM?



CASE # 6 Variable Load Application

When bearings are used on applications with a variable load and a variable number of hours each day the equivalent radial load must be calculated.

For example a bearing supporting a flat belt idler roll sees the following loads throughout the day:

75 lb. radial load - 90% of a 24 hour day 575 lb. radial load - 9% of a 24 hour day 742 lb. radial load - 1% of a 24 hour day Speed = 750 RPM

A five year bearing life is required with approximately 7,200 operating hours per year. This means that the L10 life will be 5 x 7,200 or 36,000 hours.

A formula for variable loading can be written for equivalent load as follows:

$$P^{3}N = P^{3}_{1}N_{1} + P^{3}_{2}N_{2} + P^{3}_{3}N_{3}$$

In which:

P = equivalent load in lbs. the bearing must support.

N = hours of operation.

This load formula does not necessarily limit the calculation to three varying loads, but is a form of progression, which can have any number of variable loads and hours. The first load of 75 lbs., imposed for 90% of a 24 hour day, becomes P₁ and 90% of total required life of 36,000 hours or 32,400 hours is the value of N₁. Value for P₂, P₃, N₂ and N₃ are derived in similar fashion. Place these values in the formula as follows:

 $(P^3 \times 36,000) = (75^3 \times 32,400) + (575^3 \times 3,240) + (742^3 \times 360)$

Thus: P = 278.4 lbs.

Using the Ball Bearing selection formula on page 179, calculate the required dynamic radial rating (Creq):

Creq = P x
$$\left(\frac{L10 \text{ x RPM}}{16,667 \text{ x }.456}\right)^{1/3}$$
 = 278.4 x $\left(\frac{36,000 \text{ x }750}{16,667 \text{ x }.456}\right)^{1/3}$

Creq = 42472 pounds.

From Table No. 4 on page 179, the closest *Basic Dynamic Radial Rating* value greater than Creq is 4381 pounds. The bore sizes listed in that row, 1 1/16" to 1 1/4" will be satisfactory for this application. Actual L10 hours can be calculated by plugging the actual *Basic Dynamic Radial Rating (4381 lbs)* into the L10 formula.

L10 =
$$(C/P)^3 \times \frac{10,007}{n}$$

L10 = $\left(\frac{4381}{278.4}\right)^3 \times \frac{16,667}{750} = 86,598$ hrs

. 10.007

Refer to page 182 for relevant disclaimer.

SEALMASTER.

HOUSING SELECTION

GOLD LINE **BALL BEARING PILLOW BLOCKS**



Pillow blocks are the most popular housing style for mounted ball bearings and are available with two or four bolt mounting holes.

- One piece housing design.
- The most popular housing design is the NP Series.
- A variety of configurations are available to fit specific dimensional requirements to interchange with competitive units.
- · Gray cast iron, Class 25.
- · Alternate materials available on request:
- Malleable, Ductile Iron, Cast Steel.
- Self-Aligning to ±2°

GOLD LINE **RPB SELF-ALIGNING** TAPERED ROLLER BEARING **PILLOW BLOCKS**



Pillow blocks are the most popular housing style for mounted tapered roller bearings and are available as two piece-split housings with two or four bolt mounting holes. Split housings allow easy cartridge replacement without having to disturb the bearings housing position.

CARTRIDGE INSERTS

Bearing Cartridge inserts: ERCI.

(BALL AND ROLLER BEARINGS)

Cartridge inserts are cylindrical OD bearing

units designed to be mounted in a cylindrical

ID housing supplied by the user. Sealmaster Ball Bearing Cartridge inserts: ER, SC, MSC. Sealmaster RPB Series Tapered Roller

- Two piece-split housing design.
- The most popular housing design is the RPB Series pillow blocks.
- RPB interchanges with Type E tapered roller bearings.
- · Self-Aligning to ±3°.
- · Gray cast iron, Class 25
- Alternate materials available on request:
 - Malleable, Ductile Iron, Cast Steel (SPB Series).



FLANGES

(BALL AND ROLLER BEARINGS)

Flange units are the second most popular housing style for mounted bearings. Twobolt, three-bolt, and four-bolt housing styles are available. Flange blocks are strongest when the load is applied toward the base (thrust). They are often used for vertical shaft mount.



(BALL BEARINGS)

Take-up units are designed for take-up frames to provide adjustment capability of bearing position. These are commonly used on belt conveyors to adjust belt tension. Sealmaster ST Ball Bearing units have slotted sides that fit into STH Take-up frame rails. The acme threaded adjustment rod are self-cleaning and positions the bearing.



HANGER BEARINGS (BALL BEARINGS)

These units are uniquely configured to be threaded onto the end of a pipe. They typically hang down to support a screw conveyor shaft or as linkage ends. There are two series:

SCHB (Screw Conveyor) units have a lubrication fitting inside the threaded shank for remote lubrication by extending a grease line through the pipe.

SEHB (Eccentric Drive) units have grease fittings on the external body of the unit as shown in picture above. SEHB units are frequently ordered with the BDZ suffix (i.e. SEHB-16 BDZ) for tight internal clearances and housing fits for better performance in high vibration.

Table No. 8

HOUSING TYPE COMPARISON



FLANGE CARTRIDGES (BALL AND ROLLER BEARINGS)

Flange cartridges are made in four-bolt and six-bolt housing styles. They are strongest when the load is applied in a radial direction and can withstand rotating radial loads in eccentric load situations.

| STYLE | RADIAL | THRUST** | SPACE LIMITATION | LOAD DIRECTION CHANGE | MATERIAL | | | |
|------------------|-------------|-----------------------|------------------|--------------------------|--------------|--|--|--|
| Pillow Block | <i>\\\\</i> | ~~ | ~~ | ~ | CAST IRON | | | |
| Tapped Base | <i>\\\\</i> | ~~ | ~~~~ | ~ | CAST IRON | | | |
| 4 Bolt Flange | ~~~ | ~~~ | ~~~ | ~~ | CAST IRON | | | |
| 2 Bolt Flange | ~~ | ~~ | ~~~~ | ~ | CAST IRON | | | |
| Flange Cartridge | <i>\\\\</i> | ~~~~ | ~~~ | ~~~ | CAST IRON | | | |
| Flange Bracket | ~~ | ~~ | ~~~~ | ~ | CAST IRON | | | |
| Hangar | ~~ | ✓ | N/A | ~ | DUCTILE IRON | | | |
| Take-Up | ~~ | ✓ | N/A | ~ | CAST IRON | | | |
| Cartridge Insert | ~~~ | * | ~~~~ | * | * | | | |

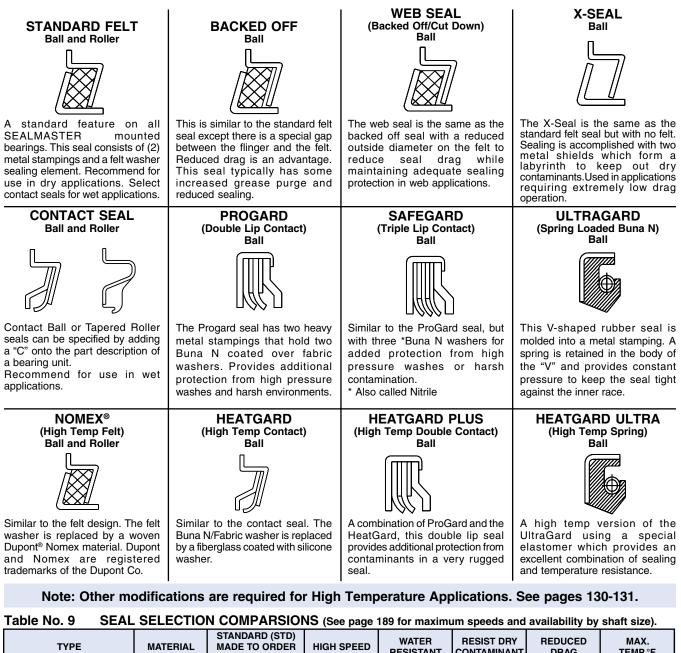
Legend: Excellent 🗸 🗸 🏑, Good 🗸 🗸 🗸, Fair 🗸 🏑, Poor 🗸

* Depends on mounting configuration

** Consult SEALMASTER Application Engineering for Housing Thrust Capacity.

SEAL SELECTION

SEAL MASTER.



| ТҮРЕ | | MATERIAL | MADE TO ORDER (MTO) | HIGH SPEED | WATER RESISTANT | RESIST DRY CONTAMINANT | REDUCED DRAG | MAX. TEMP.°F |
|-----------------------|----------------|--------------------------|------------------------|------------------|--------------------|---------------------------|-----------------|-----------------|
| | Standard | Felt | STD | \checkmark | Not Rec. | <i>」 」 」 」 」</i> | \checkmark | 250°F |
| Felt | Backed Off | Felt | MTO | \checkmark | Not Rec. | 11 | \checkmark | 250°F |
| | Web Seal | Felt | MTO | \checkmark | Not Rec. | <i>√ √</i> | \checkmark | 250°F |
| | Contact | *Buna N coated Dacron | STD | <i>」 」 」</i> | <i>√ √</i> | <i>」 」 」</i> | 11 | 250°F |
| Contact | ProGard | *Buna N coated Dacron | МТО | <i>\ \</i> | <i>\\\</i> | <i>」 」 」 」 」</i> | Not Rec. | 250°F |
| | SafeGard | *Buna N coated Dacron | МТО | 1 | <i>\ \ \ \ \</i> | <i>」 」 」 」 」</i> | Not Rec. | 250°F |
| | UltraGard | *Buna N | MTO | \checkmark | \checkmark | <i>」 」 」 」</i> | 1 | 250°F |
| Nomex | - | Nomex | МТО | <i>\\\\</i> | Not Rec. | 1111 | <i>\ \ \</i> | 400°F |
| Ciliaan | HeatGard | Silicon Fiberglass | МТО | 1 | <i>\ \ \</i> | <i>\\\\</i> | Not Rec. | 400°F |
| Silicon Fiberglass | HeatGard Plus | Silicon Fiberglass | МТО | 1 | <i>」 」 」</i> | <i>\\\\</i> | Not Rec. | 400°F |
| | HeatGard Ultra | FKM | MTO | <i>」 」 」 」</i> | <i>」 」 」 」 」</i> | <i>\\\</i> | 1 | 400°F |
| X-Seal | - | - | MTO | <i>」 」 」 」 」</i> | Not Rec. | 1 | \checkmark | 400°F |

Legend: Excellent I I I I, Good I I, Fair I I, Poor I

* Also called Nitrile.

SEAL MASTER.

BALL BEARING SEAL SPEED TABLES

This chart displays maximum speed rating for various ball bearing seals and locking devices. Values in the table represent speeds at ideal conditions. Other application factors may reduce the speed rating of a bearing. The blue color numbers indicate ideal maximum speeds using a double lock system or a SKWEZLOC system. Mounting methods become important when running near the maximum speeds. See the Installation Section. Check the insert pages for SKWEZLOC and Double Lock availability.

TAPERED ROLLER BEARING MAXIMUM INNER SPEEDS

Roller Bearing maximum speeds are not limited by seals. See Tapered Roller Bearing Rating tables on page 183 for maximum speeds for felt, contact and nomex seal.

Table No. 10

| ST | ANDARD DU | тү | MEDIU | N DUTY | MAX SEAL SPEED REVOLUTIONS PER MINUTE | | | | | | | |
|------------------------|----------------|-----------------|-----------------|---------------|--|-----------------|---------|----------|----------|------------|-----------|-------------------|
| Shaft Size | Insert# | ER# | Shaft Size | Insert # | Standard Felt Backed off Felt (Web) Cut Down Backed off Felt Nomex | Contact Seal | ProGard | SafeGard | HeatGard | HeatGard + | UltraGard | HeatGard Ultra |
| 1/2 | 2-08 | ER-8 | - | - | | | | | | | | |
| 9/16 | 2-09 | ER-9 | - | - | 7300 | | | | | | | |
| 5/8 11/16 | 2-010 2-011 | ER-10 ER-11 | | - | | 6450 | 1600 | N/A | 1600 | N/A | 6450 | N/A |
| 3/4 | 2-012 | ER-12 | - | - | 10200 | | | | | | | |
| 20mm | 5204 | ER-204 | - | - | | | | | | | | |
| 13/16 | 2-013 | | - | - | | | | | | | | |
| 7/8 | 2-014 | ER-14 | • | - | 6350 | | | | | | 0500 | |
| 15/16 25mm | 2-015 5205 | ER-15 ER-205 | 1 | - | 9000 | 6350 | N/A | 550 | 1400 | N/A | 2500 | 2500 |
| 2511111 | 2-1 | ER-205 ER-16 | 1 . | - | 9000 | | | | | | | |
| 1 1/16 | 2-11 | ER-17 | 15/16 | 3-015 | | | | | | | | |
| 1 1/8 | 2-12 | ER-18 | 1 | 3-1 | 5450 | | | | | | | |
| 1 3/16 | 2-13 | ER-19 | 25mm | 5305 | | 5450 | N/A | 500 | 1050 | 500 | 2200 | 2200 |
| 30mm | 5206 | ER-206 | | | 7600 | | | | | | | |
| <u>1 1/4R</u> 1 1/4 | 1-14 2-14 | ER-20 | 30mm | 5306 | | | | | | | | |
| 1 5/16 | 2-14 | ER-20 | 1 3/16 | 3-13 | 4650 | | | | | | | |
| 1 3/8 | 2-16 | ER-22 | 1 0/10 | 010 | 1000 | 4650 | N/A | 450 | 1000 | 450 | 2000 | 2000 |
| 35mm | 5207 | ER-207 | | | 6500 | | | | | | | |
| 1 7/16 | 2-17 | ER-23 | | | | | | | | | | |
| 1 1/2 | 2-18 | ER-24 | 35 mm | 5307 | 4150 | 4450 | | 400 | 400 005 | 400 | N1/A | 1000 |
| 1 9/16 40mm | 2-19 5208 | ER-25 ER-208 | 1 7/16 | 3-17 | 5850 | 4150 | N/A | 400 | 400 925 | 400 | N/A | 1900 |
| 1 5/8 | 2-110 | ER-200 | | | | | | | | | | |
| 1 11/16 | 2-111 | ER-27 | 1 1/2 | 3-18 | 3800 | 2000 | N//A | 250 | 050 | 050 | NI/A | 1000 |
| 1 3/4 | 2-112 | ER-28 | 40mm | 5308 | 5300 | 3800 | N/A | 350 | 850 | 350 | N/A | 1000 |
| 45mm | 5209 | ER-209 | | | 3300 | | | | | | | |
| 1 13/16 | 2-113 | ED 20 | 1 11/16 | 3-111 | 3550 | | | | | | | |
| 1 7/8 1 15/16 | 2-114 2-115 | ER-30 ER-31 | 1 3/4 | 3-112 | 3350 | 3550 | N/A | 325 | 775 | 325 | N/A | N/A |
| 50mm | 5210 | ER-210 | 45mm | 5309 | 5000 | 0000 | 10/7 | 020 | 115 | 020 | 19/5 | 11/7 |
| •••• | 1-2 | | | | | | | | | | | |
| 2 | 2-2 | ER-32 | 1 15/16 | 3-115 | 3250 | | | | | | | |
| 2 1/8 | 2-22 | ER-34 | 50mm | 5310 | 0200 | 3250 | 700 | 300 | 700 | 300 | N/A | N/A |
| 55mm 2 3/16 | 5211 2-23 | ER-211 ER-35 | | | 4500 | | | | | | | |
| 2 1/4 | 2-23 | ER-36 | 55mm | 5311 | | | | | | | | |
| 2 5/16 | 2-25 | ER-212 | 2 3/16 | 3-23 | 3000 | | | | | | | |
| 60mm | 5212 | ER-38 | | | | 2550 | 650 | N/A | 650 | 250 | N/A | N/A |
| 2 3/8 | 2-26 | ER-39 | | | 4100 | | | | | | | |
| 2 7/16 | 2-27 | ER-40 | 2 7/16 | 3-27 | 2500 | | | | | | | |
| 2 1/2 2 11/16 | 2-211 | ER-40 ER-43 | 2 1/16 | 3-27 3-28 | 2300 | 2225 | 550 | N/A | 550 | 225 | N/A | N/A |
| 70mm | 5214 | ER-214 | 65mm | 5313 | 3600 | | | 17/5 | 000 | | 11/7 | 14/17 |
| 2 7/8 | 2-214 | ER-46 | 2 11/16 | 3-211 | 2450 | | | | | | | |
| 2 15/16 | 2-215 | ER-47 | 70mm | 5314 | | 2100 | 525 | N/A | 525 | 200 | N/A | N/A |
| 75mm | 5215 | ER-215 | 0.15/10 | 0.615 | 3400 | | | | | | | |
| 3 80mm | 5216 | ER-48 ER-216 | 2 15/16 75mm | 3-215 5315 | 2250 | 1950 | 500 | N/A | 500 | N/A | N/A | N/A |
| 3 3/16 | 2-33 | ER-216 ER-51 | 3 | 3-3 | 3150 | 1950 | 500 | IN/A | 500 | IN/A | IN/A | N/A |
| 3 1/4 | 2-34 | ER-52 | 80mm | 5316 | 2125 | | | | | | | |
| 3 3/8 | 2-36 | ER-54 | 3 3/16 | 3-33 | | 1850 | 450 | N/A | 450 | N/A | N/A | N/A |
| 3 7/16 | 2-37 | ER-55 | | | 3000 | | | | | | | |
| 3 1/2 | 2-38 | - | 3 7/16 | 3-37 | 2000 | 1705 | 405 | NVA | 405 | NI/A | NI/A | NI/A |
| 90mm | 5218 | - | | | 2800 | 1725 | 425 | N/A | 425 | N/A | N/A | N/A |
| 3 15/16 | - | - ER-63 | 100mm | 5320 | 1700 | | | | | | | |
| 4 | | ER-64 | 3 15/16 | 3-315 | 1,00 | 1450 | 375 | N/A | 375 | N/A | N/A | N/A |
| | - | | 4 | 3-4 | 2400 | | | | | | | |
| - | - | - | 4 7/16 | 3-47 | 1375 | | | | | | | |
| - | - | - | 4 15/16 | 3-415 | 1050 | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| - | - | | | | 1950 | | | | | | | |

* If seal max speed in this chart exceeds bearing max speed from rating tables or speed that is deemed acceptable for the application, lowest applicable speed applies.

LOCK SELECTION

SEAL MASTER.

"SLIP FIT" MOUNTING

SEALMASTER Mounted Ball and RPB Series Tapered Roller Bearings are designed to slip fit onto the shaft. Slip fit means that the shaft is usually slightly smaller, and the inner ring bore is slightly larger than the nominal shaft sizes listed in the bearing tables. Slip fit mounting is very popular and economical as it does not require specialized equipment or tooling to mount the bearing on the shaft. Reliability of the lock is still dependent on the proper mounting techniques and proper shaft size control.

SHAFT LOCKING SYSTEM SELECTION

Selection of the shaft locking system may be dependent on some or all of the following application criteria:

- Lock reliability.
- Shaft run-out.
- Vibrating systems.
- Vibration reduction (isolation devices).
- · Shaft fretting.
- · Distress on the shaft surface.
- · Shafting material.
- · Space on the shaft.
- Shaft orientation (Vertical, Horizontal).
- · Ease of installation.

SINGLE SIDED (SINGLE LOCK) SETSCREW LOCKING SYSTEM

Single sided set screw lock has an extended inner ring on one side of the bearing. This locking system is held to the shaft by two set screws. Single lock is the most popular bearing mounting method for SEALMASTER Ball Bearings and is also available for Sealmaster RPB Tapered Roller Bearings. It is easy to mount because it requires tightening only two set screws and takes up minimal space along the shaft. SEALMASTER Ball Bearings have a unique package of features including: wide inner ring design, zone hardened inner rings, specially designed setscrews and 120° set screw position. These features are unmatched in the mounted bearing industry and are designed to maximize lock reliability.



SEALMASTER RPB Tapered Roller Bearings incorporate a concentric collar that fits over the inner ring extension. The collar is threaded to accept set screws which are located at 120°. The set screws pass through the inner ring holes and contact the shaft.

Single lock set screw design is specified in a wide range of applications for moderate loads and speeds. This lock is sometimes specified in flange block and cartridge housings because of inacessibility of back side set screws. **Upset set screw marks on the shaft can be minimized for removal of the bearing by removing the set screws and using a flat punch, tapping the upset shaft material flat onto the shaft.** For high speed, heavy load (radial or thrust), vibration, eccentric loading, stainless steel or hollow shafting, reduction of fretting, vibration or marking of the shafting, review alternate locks below or consult SEALMASTER Application Engineering. (630-898-9620)

DOUBLE SIDED (DOUBLE LOCK) SET SCREW LOCKING SYSTEM

Double sided set screw lock is extended on both sides of the inner ring. The inner race is locked to the shaft by four screws. This design is the preferred lock for the heavy duty SEALMASTER RPB Tapered Roller Bearing. SEALMASTER Ball Bearings with double lock incorporate the same unique package of locking features included in the single lock design: wide inner ring design, zone hardened inner rings, specially designed set screws, and 120° set screw position.

SEALMASTER RPB Tapered Roller Bearings incorporate a concentric collar that fits over the inner ring extension. The collar is threaded to accept set screws which are located at 120°. The set screws pass through the inner ring holes and to lock to the shaft.

The double lock design is specified for demanding applications or where shaft lock reliability is critical. This design is often specified on high load applications, high thrust load applications, vertical shafts where extra holding power is required, eccentric drive applications, high

vibration applications, and high speed applications. Double lock increases lock reliability on stainless steel shafting. It also helps to reduce fretting corrosion on the shaft. Upset set screw marks on the shaft can be minimized for removal of the bearing by removing the set screws and, using a flat punch, tapping the upset shaft material flat onto the shaft. For stainless steel shafting, or where vibration reduction is required, refer to SKWEZLOC locking below or consult SEALMASTER Application Engineering.



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SKWEZLOC LOCKING SYSTEM

SEALMASTER SKWEZLOC locking system for ball bearings has an inner ring extension which is slit into 6 tangs. The split Skwezloc collar is tightened over the inner ring extension, gripping the bearing to the shaft. The SKWEZLOC design friction grips to the shaft with 360° of holding.



THE SKWEZLOC LOCKING SYSTEM

- -Centers the shaft in the bore of the bearing, reducing vibration and shaft runout.
- -Maintains manufactured ball path roundness reducing vibration and enhances bearing life.
- -Excellent for high speed applications
- -Does not mark the shaft like set screw or eccentric lock.
- -Is easy to install, requiring tightening only one Torx head capscrew.

SKWEZLOC is often specified in air handling, HVAC, fan and blower applications where noise and vibration reduction is essential. High speed applications such as saws and routers or high speed spindles are natural applications for SKWEZLOC locking. Coating roll and sanding applications are also good applications for the SKWEZLOC where runout control of the rotating system is essential. SKWEZLOC is recommended for stainless steel or hardened shafting. In vertical shaft or high thrust load applications, a thrust collar or axial locating device is required to insure safety of the friction grip lock.

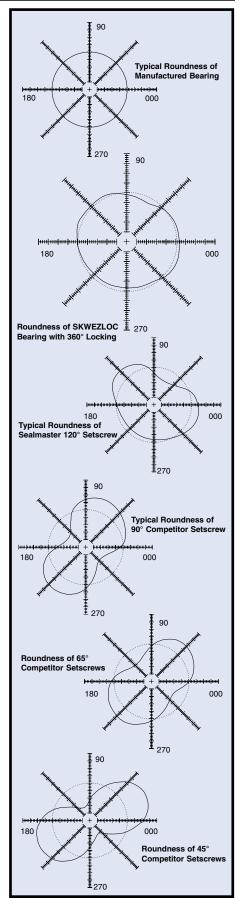
Table No. 11

| | SHAFT LOCK COMPARISON | | | | | | |
|---------------------------|---|----------------|---|--|--|--|--|
| CHARACTERISTIC | SINGLE LOCK | DOUBLE LOCK | SKWEZLOC | | | | |
| High Speeds | √ √ | 111 | \checkmark \checkmark \checkmark \checkmark | | | | |
| Heavy Loads | √ √ | \checkmark | <i>\\\\</i> | | | | |
| Radial Loads | \checkmark \checkmark \checkmark \checkmark | <i>\\\\</i> | <i>\\\\</i> | | | | |
| Thrust Loads | <i>」 」 」</i> | <i>\\\\</i> | √ | | | | |
| Fretting Control | √ √ | <i>J J J</i> | <i>\\\\</i> | | | | |
| Run out Control | √ √ | 11 | <i>\\\\</i> | | | | |
| Reliability of Lock | <i>」 」 」</i> | <i>\\\\</i> | <i>\\\\</i> | | | | |
| Vertical Shaft | <i>」 」 」</i> | <i>✓ ✓ ✓ ✓</i> | √ | | | | |
| Eccentric Loads | √ √ | <i>JJJJ</i> | \checkmark \checkmark \checkmark | | | | |
| Hardened/Stainless Shafts | <i>√ √</i> | <i>J J J</i> | \checkmark \checkmark \checkmark \checkmark | | | | |

Legend: Excellent $\checkmark \checkmark \checkmark \checkmark$, Good $\checkmark \checkmark \checkmark$, Fair $\checkmark \checkmark$, Poor \checkmark ★ Review use of thrust device.

Note: SEALMASTER premium locking systems are not intended to be a fix for worn, damaged or undersized shafting or poor mounting practices. Consult SEALMASTER Installation Instructions for proper installation. (See pages 200-205).

LOCK SELECTION



BEARING BASICS

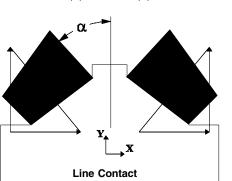
SEAL MASTER.

BALL BEARINGS

Ball bearings create a point contact between the ball-path and rolling element distributing loads across a small area. Surface contact is minimized and less friction and heat is generated which gives ball bearings a higher speed range.

TAPERED ROLLER BEARINGS

Tapered roller bearings create a line contact between the raceway and rolling element distributing loads across a larger area. Also, a double row provides twice as many rolling elements available to carry bearing load which increases bearing load capacity. Because tapered roller bearings are set at an angle, they can accept heavy loads from both the radial (Y) and thrust (X) directions.



ROD ENDS AND SPHERICAL BEARINGS

Spherical bearings are friction bearings. There are two surface areas in contact rubbing against each other. This generates large amounts of heat which limits rotation, but bearing configuration allows for large misalignment angles and oscillation.

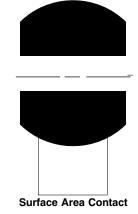


Table No. 12 Bearing Comparison

Point Contact

| | BEARING TYPE COMPARISON | | | | | | |
|---|-------------------------|-----------|---|--|--|--|--|
| CHARACTERISTIC GOLD LINE "RPB" SELF-ALIGNING SEALMASTER BALL BEARING TAPERED ROLLER BEARING ROD ENDS | | | | | | | |
| High Speeds | J J J J | J J J | - | | | | |
| Heavy Loads | J J | J J J J J | J J J J | | | | |
| Radial Loads | J J J | J J J J J | J J J J | | | | |
| Thrust Loads | J J | J J J J J | <i>J J</i> | | | | |
| Static Misalignment | J J J J | J J J J J | J J J J | | | | |
| Dynamic Misalignment | 1 | <i>✓</i> | J J J J | | | | |
| Rotation | J J J J | J J J J J | \checkmark | | | | |
| Oscillation | 1 | ✓ | \checkmark \checkmark \checkmark \checkmark | | | | |

Legend: Excellent $\checkmark \checkmark \checkmark \checkmark$, Good $\checkmark \checkmark \checkmark$, Fair $\checkmark \checkmark$, Poor \checkmark Columns marked "-" are unacceptable.

BEARING FUNCTION

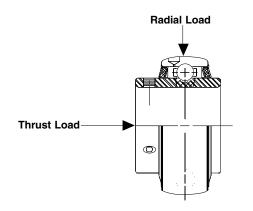
Bearings have three basic functions:

- 1. Support shaft and its associated load
- 2. Allow for shaft or housing rotation
- 3. Minimize frictional losses

Mounted bearings are self contained unitized assemblies. They facilitate assembly and replacement by having their own housing and by their slip-fit mount to shafting.

LOADING

Bearings can support a combination of radial and thrust loads.



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MISALIGNMENT

Internal Bearing Misalignment...

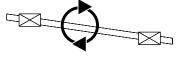
Because of small clearance between the rolling elements and raceway, bearings can misalign a slight amount internally.

External Bearing Misalignment...

Angular movement in the radial direction of the entire insert relative to the housing. Static misalignment will induce external bearing misalignment.

Static System Misalignment...

Bearings mounted on different planes causing an angular shaft displacement.



Dynamic System Misalignment...

Eccentric shaft rotation caused by shafting imperfections.



BEARING CLEARANCES

Anti-Friction bearings are manufactured with specific clearances between the raceways and rolling elements. The clearances are designed for normal operating temperatures and application conditions.

Ball bearing clearances are measured in the radial direction when the insert is manufactured. Clearances are measured by fixing the outer ring and measuring the total movement of the inner ring in the radial direction.

Tapered roller bearing clearances are measured in the axial direction (end play) when the insert is manufactured. Clearances are measured by fixing the cup and measuring the total movement of the cone in the axial direction.

Various standard clearance ranges are available for SEALMASTER Bearings.

Table No. 13a Bearing Clearance

| Characteristic | Ball Bearing Clearance * |
|-----------------------|-----------------------------|
| Vibration | Tight * |
| Light Load | Tight * |
| Standard Applications | Standard * |
| High Speed | Loose * |
| High Temperature | Loose * |
| Misalignment | Loose * |

Table No. 13b Bearing Clearance

| Table No. 155 Dealin | ig clearance |
|--|---------------------------------------|
| Characteristic | Tapered Roller Bearing Clearance * |
| Vibration | Standard * |
| Light Load | Standard * |
| High Speed | Standard * |
| High Temperature | Standard * |
| Vertical Shaft/W Vibration or Unbalance | Tight * |
| | |

HOUSING FIT-UP

SEALMASTER Bearings are manufactured with specific fit-ups between the spherical O.D. outer ring (or cup) and the housing I.D. This fit-up is measured in torque required to misalign the bearing in the housing. Various housing fit-up ranges are available for SEALMASTER Bearings:

Standard Fit - For most applications

Hand Fit (Ball only) - Where minimal misalignment torque can be tolerated

"AC" (Ball)/ "AH" (Tapered Roller)-Reduced fit-up torque for high speed, fan or other applications where reduced fit-up torque is preferred Tight-Fit - Specified for shock/vibration applications.

| | | - | - | |
|---|-------------------------|---|---------------------------|-----------------------------|
| С | haracteristic | | Ball Bearing Fit-Ups * | Tapered Roller Fit-Ups * |
| v | ibration/Shock | | Tight * | Tight * |
| S | tandard Applications | | Standard | Standard |
| F | an | | "AC" * | "AH" * |
| н | igh Speed | | "AC" * | "AH" * |
| V | ertical Shaft/Vibration | | Tight * | "AH" * |
| | | | | |

Table No. 14 Housing Fit-Up

* General Recommendations Only. Consult SEALMASTER Application Engineering for your particular application.

VIBRATION ANALYSIS

SEAL MASTER.

GOLD LINE BALL BEARINGS VIBRATION ANALYSIS

The following equations are used to calculate the fundamental frequencies for SEALMASTER Ball Bearings.

- 1. If the SEALMASTER insert number is known, proceed to step 2. For housed units, identify the bearing insert number by looking up the unit in the dimension tables, then proceed to step 2.
- 2. Find the SEALMASTER insert number in Table No. 15 below and identify the series.
- 3. Select the vibration geometry information (O, I, B, F) from Table No. 16.
- 4. Use this information to calculate the fundamental bearing frequencies:

| Outer Ball Pass Frequency (Hz) | = | O x RPM |
|----------------------------------|---|---------|
| Inner Ball Pass Frequency (Hz) | = | I x RPM |
| Ball Spin Frequency (Hz) | = | B x RPM |
| Fundamental Train Frequency (Hz) | = | F x RPM |

| Symbol | Description | Units |
|--------|-------------------------------------|-------|
| RPM | Revolutions per Minute | RPM |
| 0 | Outer Race Frequency Factor. | |
| I | Inner Race Frequency Factor. | |
| В | Ball Spin Frequency Factor. | |
| F | Fundamental Train Frequency Factor. | |

Table No. 15 Gold line Insert Series

| SERIES | GOLDLINE INSERT SERIES | | | | | | | |
|--------|------------------------|-------|-------|-------|-------|-------|-------|------|
| 2-012 | 2-08 | 2-09 | 2-010 | 2-011 | 2-012 | 5204 | - | - |
| 2-015 | 2-013 | 2-014 | 2-015 | 5205 | 2-1 | 3-012 | - | - |
| 2-13 | 2-11 | 2-12 | 2-13 | 5206 | 1-14 | 3-015 | 5305 | 3-1 |
| 2-17 | 2-14 | 2-15 | 5207 | 2-16 | 2-17 | 1-18 | 5306 | 3-13 |
| 2-19 | 2-18 | 2-19 | 5208 | 1-110 | 5307 | 3-17 | - | - |
| 2-111 | 2-110 | 2-111 | 2-112 | 5209 | 3-18 | 5308 | - | - |
| 2-115 | 2-113 | 2-114 | 2-115 | 5210 | 1-2 | 3-111 | 3-112 | 5309 |
| 2-23 | 2-2 | 2-22 | 5211 | 2-23 | 3-115 | 5310 | - | - |
| 2-27 | 2-24 | 2-25 | 5212 | 2-26 | 2-27 | 5311 | 3-23 | - |
| 2-211 | 2-210 | 2-211 | 2-212 | 5214 | 3-27 | 3-28 | 5313 | - |
| 2-215 | 2-213 | 2-214 | 2-215 | 5215 | 3-211 | 3-212 | 5314 | - |
| 2-33 | 5216 | 2-33 | 3-215 | 5315 | 3-3 | - | - | - |
| 2-37 | 2-34 | 2-36 | 2-37 | 5316 | 3-33 | - | - | - |
| 2-38 | 2-38 | 5218 | 3-37 | - | - | - | - | - |
| 2-43 | 2-43 | 5320 | 3-315 | 3-4 | - | - | - | - |
| 3-47 | 2-5 | 3-47 | 3-415 | - | - | - | - | - |

| Table No. 16 | Vibration | Geometry | /Information |
|--------------|-----------|----------|--------------|
|--------------|-----------|----------|--------------|

| SERIES | PITCH DIAMETER (IN.) | NUMBER OF BALLS | SIZE OF BALLS (INS.) | FACTOR FOR OUTER RACE FREQ. | FACTOR FOR INNER RACE FREQ. | FACTOR FOR BALL SPIN FREQ. | FACTOR FOR F.T.F. |
|--------|-------------------------|--------------------|----------------------------|-----------------------------------|-----------------------------------|----------------------------------|----------------------|
| | dM | N | D | 0 | | В | F |
| 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 |
| 3-47 | 7.087 | 10 | 1 1/4 | 0.0686 | 0.0980 | 0.0458 | 0.0069 |

Contact SEALMASTER Application Engineering for additional details.

SEAL MASTER®

VIBRATION ANALYSIS

GOLD LINE TAPERED ROLLER BEARINGS VIBRATION ANALYSIS

The following equations are used to calculate the fundamental frequencies for SEALMASTER RPB Tapered Roller Bearings.

1. All information can be linked to three factors:

| a) | Shaft | Size |
|----|-------|------|
|----|-------|------|

| b) Unit number | For RPB- <u>208</u> -C2; |
|------------------------------------|------------------------------------|
| | the unit number is "208". |
| c) Insert number | For RPB- <u>104</u> -2; the insert |
| | number is "RCI-104". |

- 2. Use the information obtained from step 1 to select the vibration geometry information (O, I, B, F, and G) from Table No. 17.
- 3. Use this information to calculate the fundamental bearing
 - frequencies: Roller Spin Frequency (Hz)

| Inner Roller Pass Frequency (Hz) | = | - I |
|---|-----|-----|
| Outer Roller Pass Frequency (Hz) | = | В |
| Fundamental Train Frequency (Hz); shaft rotation | = | F |
| Fundamental Train Frequency (Hz); housing rotatio | n = | G |
| | | |

| Symbol | Description | Units |
|----------|--|----------------|
| Z RPM | Number of Rollers/row Revolutions per Minute | integer RPM |
| 0 | Roller Spin Frequency Factor. Inner Roller Pass Frequency Factor. | |
| D | Outor Bollor Base Frequency Easter | |

B Outer Roller Pass Frequency Factor.

F Factor for Fundamental Train (Shaft Rot).

G Factor for Fundamental Train (Hsg.Rot)

| = | O x RPM |
|---|---------|
| = | I x RPM |
| = | B x RPM |
| = | F x RPM |
| = | G x RPM |

Table No. 17 Vibration Geometry Information

| SHAFT SIZE | UNIT NO. | INSERT NO. | FACTOR FOR ROLLER SPIN | FACTOR FOR INNER ROLLER PASS | FACTOR FOR OUTER ROLLER PASS | FACTOR FOR FUND. TRAIN (SHAFT ROT.) | FACTOR FOR FUND. TRAIN (HSG. ROT.) | NUMBER OF ROLLERS/ROW |
|------------|----------|------------|---------------------------|------------------------------------|------------------------------------|---|--|--------------------------|
| | | | 0 | I | В | F | G | Z |
| 1 3/16 | 103 | RCI-103 | 0.12580 | 0.17823 | 0.13844 | 0.00729 | 0.00938 | 19 |
| 1 1/4 | 104 | RCI-104 | 0.12580 | 0.17823 | 0.13844 | 0.00729 | 0.00938 | 19 |
| 1 3/8 | 106 | RCI-106 | 0.11732 | 0.18917 | 0.14416 | 0.00721 | 0.00946 | 20 |
| 1 7/16 | 107 | RCI-107 | 0.11732 | 0.18917 | 0.14416 | 0.00721 | 0.00946 | 20 |
| 1 1/2 | 108 | RCI-108 | 0.11320 | 0.17101 | 0.12899 | 0.00717 | 0.00950 | 18 |
| 1 5/8 | 110 | RCI-110 | 0.11320 | 0.17101 | 0.12899 | 0.00717 | 0.00950 | 18 |
| 1 11/16 | 111 | RCI-111 | 0.11320 | 0.17101 | 0.12899 | 0.00717 | 0.00950 | 18 |
| 1 3/4 | 112 | RCI-112 | 0.10828 | 0.16264 | 0.12069 | 0.00710 | 0.00957 | 17 |
| 1 15/16 | 115 | RCI-115 | 0.10828 | 0.16264 | 0.12069 | 0.00710 | 0.00957 | 17 |
| 2 | 200 | RCI-200 | 0.10828 | 0.16264 | 0.12069 | 0.00710 | 0.00957 | 17 |
| 2 3/16 | 203 | RCI-203 | 0.10828 | 0.17921 | 0.13745 | 0.00724 | 0.00943 | 19 |
| 2 1/4 | 204 | RCI-204 | 0.12160 | 0.19584 | 0.15416 | 0.00734 | 0.00933 | 21 |
| 2 7/16 | 207 | RCI-207 | 0.13446 | 0.19584 | 0.15416 | 0.00734 | 0.00933 | 21 |
| 2 1/2 | 208 | RCI-208 | 0.13446 | 0.19584 | 0.15416 | 0.00734 | 0.00933 | 21 |
| 2 11/16 | 211 | RCI-211 | 0.15781 | 0.22018 | 0.17982 | 0.00749 | 0.00917 | 24 |
| 2 3/4 | 212 | RCI-212 | 0.15781 | 0.22018 | 0.17982 | 0.00749 | 0.00917 | 24 |
| 2 15/16 | 215 | RCI-215 | 0.15781 | 0.22018 | 0.17982 | 0.00749 | 0.00917 | 24 |
| 3 | 300 | RCI-300 | 0.15781 | 0.22018 | 0.17982 | 0.00749 | 0.00917 | 24 |
| 3 3/16 | 303 | RCI-303 | 0.17061 | 0.23678 | 0.19656 | 0.00756 | 0.00911 | 26 |
| 3 7/16 | 307 | RCI-307 | 0.17061 | 0.23678 | 0.19656 | 0.00756 | 0.00911 | 26 |
| 3 1/2 | 308 | RCI-308 | 0.17061 | 0.23678 | 0.19656 | 0.00756 | 0.00911 | 26 |
| 3 15/16 | 315 | RCI-315 | 0.16448 | 0.23758 | 0.19576 | 0.00753 | 0.00914 | 26 |
| 4 | 400 | RCI-400 | 0.16448 | 0.23758 | 0.19576 | 0.00753 | 0.00914 | 26 |
| 4 7/16 | 407 | RCI-407 | 0.16005 | 0.22885 | 0.18781 | 0.00751 | 0.00915 | 25 |
| 4 1/2 | 408 | RCI-408 | 0.16005 | 0.22885 | 0.18781 | 0.00751 | 0.00915 | 25 |
| 4 15/16 | 415 | RCI-415 | 0.15868 | 0.22922 | 0.18745 | 0.0075 | 0.00917 | 25 |
| 5 | 500 | RCI-500 | 0.15868 | 0.22922 | 0.18745 | 0.0075 | 0.00917 | 25 |

Contact SEALMASTER Application Engineering for additional details.

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BALL AND ROLLER BEARINGS

INTRODUCTION

Lubricant is a basic element in rolling element bearings. It is as essential to proper operation as are the races and rolling elements. Oil provides a separating layer between rolling elements and raceways and lubricates the sliding surfaces between the rolling elements and retainer. This lubricating layer eliminates or minimizes metal to metal contact and distributes stresses. Lubrication can also provide protection against corrosion, a barrier to contamination, and dissipation of heat.

GREASE

Grease is the primary lubricant used in most industrial mounted bearing units. Grease usually consists of three primary components: oil, thickener, and additives.

Grease comes in various thicknesses. Standard bearings are generally packed with grease of NLGI-grade 2 thickness. For most applications this grade is sufficient for retention in the bearing, is easily pumped through most grease guns, and operate under most speed conditions. Other greases can be used for special situations.

THICKENERS

The thickener's primary purposes are to retain the oil so that it remains in the bearing, release the oil as needed, and reabsorb the oil as needed. The thickener can also provide additional sealing and protection from contamination and heat dissipation. There are many types of grease thickeners including lithium, calcium, sodium, aluminum, etc. Lithium thickeners are the most common type with the others being useful in specialized situations, such as high temperature, low drag, and low temperature, etc.

OIL

Oil is the primary lubricating component in grease and consists of two types: petroleum and synthetic. Petroleum oils are the primary oils used today. Synthetic hydrocarbons can be thought of as synthetic petroleum oils. Other synthetics include esters, silicones, fluorinated hydrocarbons, etc.

Oil is a fluid and can be obtained in varying viscosities. Viscosity refers to the "thickness" of the oil and is usually directly related to an oils' shear strength or its ability to resist loading.

Elastohydrodynamic (EHL) lubrication is the model that explains the lubrication of anti-friction bearings. EHL takes into account the deformation of the rolling elements and raceways as well as the increased viscosity of the lubricant in the load zone.

In a rotating rolling element bearing there is one of (3) types of lubrication conditions present; 1.) Boundry 2.) thin film 3.) thick film. Bearing operating speed is an important element in determining the lubrication condition. Boundry lubrication occurs when there is metal on metal contact between rolling elements and races. This may be due to low speed and/or oil viscosity too low to separate the surfaces. Boundry lubrication is the most severe condition for antifriction bearings and distress of the rolling elements and races will occur. In the thin film condition, partial separation of the surfaces of the rolling elements and races occur with some asperities in contact. This condition may be due to low speed and/or oil viscosity too low to separate the surfaces completely. Some distress of the bearing surfaces will take place in thin film lubrication. Thick film lubrication is the preferred condition for optimum bearing performance. The speed of the bearing and/or the lubricant viscosity is sufficient to separate the rolling elements and raceways. Higher viscosity oils (or higher operating speeds) can help to attain the thick film lubrication condition, but excessively high oil viscosities may lead to higher operating temperatures from churning of the oil or skidding of the rolling elements. Lower viscosity oils sufficient to attain a thick film lubrication condition at the operating speed are selected in high speed applications as they have less tendency to churn or cause skidding.

ADDITIVES

Greases also contain additives. These additives may increase load capacity, resist corrosion, resist temperature extremes, resist oxidation, effect oil viscosity, thickener consistency characteristics, as well as many other characteristics.

Consult SEALMASTER Application Engineering when using EP additives or other solid additives such as molybdenum disulfide, graphite, brass, nickel, etc.

COMPATIBILITY

Combinations of different types of thickeners (soaps) may cause reactions that can reduce bearing performance.

Petroleum oils and synthetic hydrocarbons are, generally speaking, compatible. Other synthetic oils are, more often than not, incompatible with other oils.

Additives may cause compatibility problems in some cases.

Caution should be used when relubricating with or combining different greases. Contact SEALMASTER Application Engineering for current grease specifications and your grease manufacturer to verify grease compatibility.

OIL SATURATED POLYMER (OSP)

Oil saturated polymers are generally porous plastics that retain oil and are used in place of grease. This option may be used in inaccessible areas where relubrication is difficult. SEALMASTER's solid lubricant OSP is an option in these applications since OSP can hold more oil in the bearing chamber, thus providing a longer lived lubricant supply. OSP should not be used over 200° F.

FOOD GRADE GREASE

"Food Grade" grease is an option in all SEALMASTER Bearings. Consult SEALMASTER Application Engineering for current specifications.

REDUCED MAINTENANCE

Some bearings are considered "lubricated for life" and are not provided with provisions for relubrication. This type of bearing may be limited by the life of the original grease fill and the ability of the seals to protect the bearing from contamination. SEALMASTER has many seal and grease options for lubricated for life bearings.

HIGH TEMPERATURE GREASE

High temperature greases are available in SEALMASTER ball and roller Bearings. SEALMASTER tapered roller bearings are lubricated with a lithium complex soap and synthetic hydrocarbon oil grease (N suffix). SEALMASTER ball bearings can be specified with silicone oil or synthetic hydrocarbon oil greases, or other options. Consult SEALMASTER Application Engineering for proper lubricant for your application.

Contact SEALMASTER Application Engineering for further information.

MASTER® SEAL

LUBRICANT

* Most SEALMASTER bearing product lines are lubricated at the factory with a high quality NLGI #2 grease as follows:

| | BALL | TAPERED ROLLER |
|------------------|---------------------|--|
| Thickener (Soap) | Lithium Complex | Lithium Calcium |
| Oil | Petroleum Petroleum | |
| High Temperature | Optional * | Lithium Complex/Synthetic Hydrocarbon (N Suffix) |

These greases were selected to provide high performance in general applications operating at -20 to 200° F (intermittent to 250° F). The high viscosity index oils in these greases include additive packages to provide oxidation stability and corrosion protection. * Some SEALMASTER Bearings are used in applications where a specialty lubricant is required. These include:

HF - HFT Bearings

Corrosion Duty Bearings

High Temperature Bearings (Including RPB-xxxN)

Low Drag Bearings

Low Temperature Bearings

* Grease specified may change from time to time, consult SEALMASTER Application Engineering for current specifications.

RELUBRICATION

* Most SEALMASTER Bearings can be relubricated with a high quality NLGI #2, lithium soap grease with petroleum oil. * Compatibility of grease is critical, therefore consult with SEALMASTER Application Engineering for current grease specifications and your grease supplier to insure greases are compatible.

Greases should always be stored in a clean, dry area and carefully protected from any contaminants.

Relubricatable SEALMASTER Bearings are supplied with grease fittings or zerks for ease of lubrication. (See page 198) with hand or automatic grease guns. Always wipe the fitting and grease gun nozzle clean. For safety, stop rotating equipment. Add grease slowly until a small bead of grease is present at the seals. Start equipment slowly, if more purging of the grease is necessary, stop equipment and repeat above.

A temperature rise (sometimes 30° F) after relubrication is normal. Typically the temperature will decrease after a short operating time when excess grease has purged and bearing has stabilized.

RECOMMENDED RELUBRICATION SCHEDULE

Table No. 18 **Ball Bearings**

| LUBRICATION INSTRUCTIONS | | | | | |
|--|--|---|---|--|--|
| SPEED | TEMPERATURE | CLEANLINESS | GREASING INTERVALS | | |
| 100 RPM 500 RPM 1000 RPM 1500 RPM | Up to 120°F Up to 150°F Up to 210°F Over 210°F - 250°F | Clean Clean Clean Clean | 6 to 12 Months 2 to 6 Months 2 Weeks to 2 Months Weekly | | |
| 1500 to Max. Catalog Rating | Up to 150°F Over 150°F - 250°F Up to - 250°F Up to - 250° F | Dirty Dirty Very Dirty Extreme Conditions | 1 Week to 1 Month Daily to 2 Weeks Daily to 2 Weeks Daily to 2 Weeks | | |

Table No. 19

| LUBRICATION OF SEALMASTER BALL BEARINGS | | | | |
|---|---|--|--|--|
| SHAFT SIZE (INCHES) | RECOMMENDED RELUBRICATION GREASE CHARGE (OUNCES) | | | |
| 1/2 - 3/4 | .02 | | | |
| 7/8 - 1 3/16 | .06 | | | |
| 1 1/4 - 1 1/2 | .09 | | | |
| 1 11/16 - 1 15/16 | .19 | | | |
| 2 - 2 7/16 | .28 | | | |
| 2 1/2 - 2 15/16 | .50 | | | |
| 3 - 3 7/16 | 1.00 | | | |
| 3 1/2 - 4 | 1.70 | | | |
| 4 3/16 - 4 15/16 | 3.0 | | | |

Table No. 20 **Roller Bearings**

| ROLLER LUBRICATION INSTRUCTIONS | | | | | |
|---|---|--|--|--|--|
| SPEED TEMPERATURE CLEANLINESS GREASING INTERVALS | | | | | |
| 100 RPM 500 RPM 1000 RPM | Up to 125°F Up to 150°F Up to 210°F | Clean Clean Clean | 6 Months 2 Months 2 Weeks | | |
| 1500 to Max. Catalog Rating | Up to 150°F Over 150°F Up to - 250° Up to - 250° | Dirty Dirty Very Dirty Extreme Conditions | 1 Week to 1 Month Daily to 1 Week Daily to 1 Week Daily to 1 Week | | |

Table No. 21

| LUBRICATION OF RPB ROLLER BEARINGS | | | | |
|------------------------------------|--|--|--|--|
| SHAFT SIZE (INCHES) | RECOMMENDED RELUBRICATION GREASE CHARGE (OUNCES) | | | |
| 1 3/16 - 1 1/4 | .10 | | | |
| 1 3/8 - 1 7/16 | .22 | | | |
| 1 1/2 - 1 11/16 | .32 | | | |
| 1 3/4 - 2 | .50 | | | |
| 2 3/16 | .55 | | | |
| 2 1/4 - 2 1/2 | .65 | | | |
| 2 11/16 - 3 | .85 | | | |
| 3 3/16 - 3 1/2 | 1.25 | | | |
| 3 15/16 - 4 | 2.50 | | | |
| 4 7/16 - 4 1/2 | 3.10 | | | |
| 4 15/16 - 5 | 4.75 | | | |

These charts are general recommendations. Experience and testing may be required for specific applications. For speeds, temperatures and conditions not listed in these tables, contact SEALMASTER Application Engineering at 630-898-9620.

LUBRICATION FITTINGS

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LUBRICATION FITTING

Lubrication fittings are provided on most SEALMASTER Mounted Bearings. The grease fitting provides a means for adding fresh lubricant to the bearing.

Ball Bearings - The lubrication fitting on SEALMASTER Goldline Ball Bearings also functions to position the lock pin utilized in the unique lock pin and dimple system.

Adjustment or Replacement of the fitting may result in the bearing not performing to expectations. When using lube lines, an adapter is recommended to insure proper lock pin positioning.

Standard Lubrication Fittings

Ball Bearings - See Opposite Page 199.

Roller Bearings

Every SEALMASTER RPB Tapered Roller Bearing has a style "B" lubrication fitting. When replacing cartridge inserts always check to be sure that the rubber grommet is located in the recess beneath the housing cap. This ensures positive lubrication flow into the bearing insert.

Rod Ends

SEALMASTER Rod Ends can be ordered with a lubrication fitting. Attach the suffix "N" to specify zerk type threaded grease fittings or the suffix "FN" to specify a flush type fitting. Table No. 22 indicates thread size for rod end grease fittings.

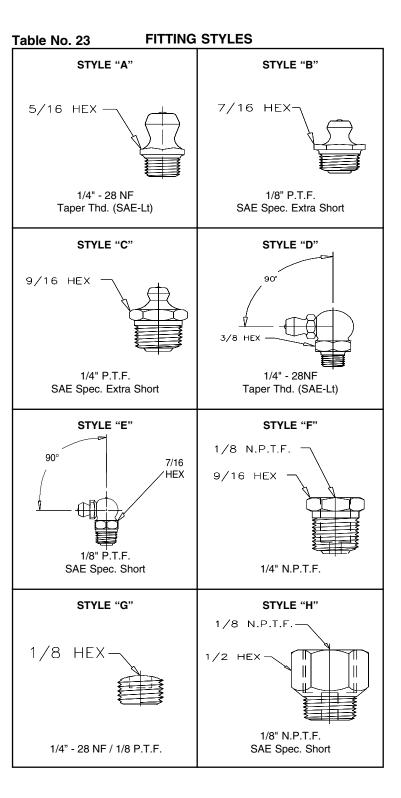
Table No. 22

| BORE SIZE (INCHES) | THREAD | |
|-----------------------|-----------|--|
| 1/4 - 7/16 | 6-40 UNF | |
| 1/2 - 1 | 10-32 UNF | |

Optional Fittings

Optional fittings can be ordered factory installed to meet most customer requirements. Some of the optional fittings are shown at the right. Other optional fittings include:

- Connectors for lube lines
- Button head fittings
- Relief fittings
- Angled adapter fittings



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Table No. 24 Gold Line Ball Bearings

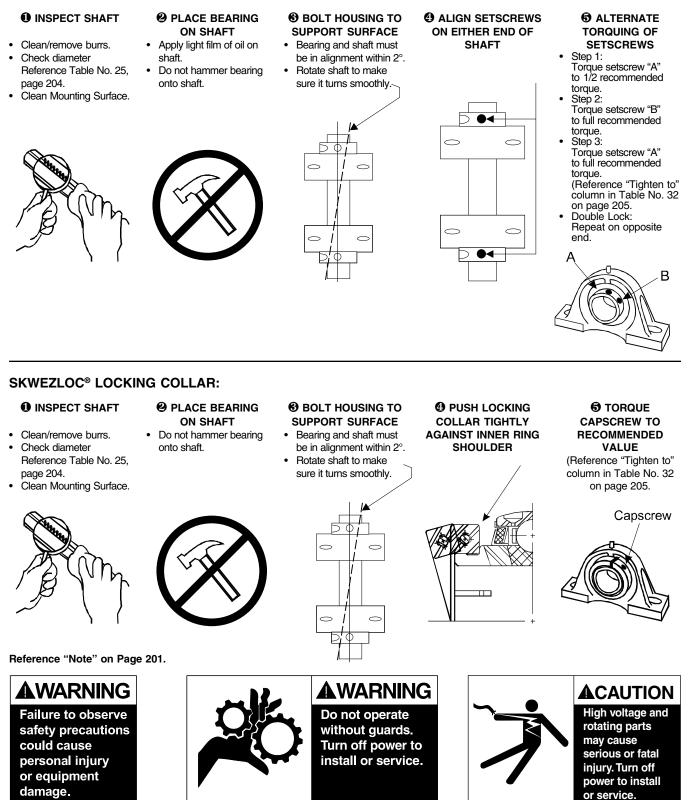
| LUBRICATION FITTING CHART UNITS BORE SIZES | | | | | | | | | | |
|---|-----------|-----------|----------------|-------|---|---|-----------------|-----------------|---------|----------|
| - | MED. DUTY | 1/2 - 3/4 | 15/16 - 1 7/16 | 1 1/2 | - | | 2 3/16 - 2 7/16 | 2 1/2 - 2 11/16 | 2 15/16 | 3 AND UP |
| - | EMP | - | A | A | A | B | В | в | B | C |
| - | EMP-T | - | A | A | A | B | B | - | - | - |
| - | EMSF | - | - | В | В | B | В | В | С | С |
| - | EMSF-T | - | - 1 | B | B | B | B | - | - | - |
| ENP | - | A | А | A | A | B | - | - | - | - |
| ENP-T | - | A | A | A | A | B | В | - | - | - |
| ESF | - | A | A | A | A | B | B | В | В | - |
| ESF-T | - | A | A | A | A | B | B | - | - | - |
| ETXP | - | - | В | В | В | В | В | - | - | - |
| FB | - | А | А | - | - | В | - | - | - | - |
| FB-T | - | А | А | - | - | В | - | - | - | - |
| - | MFC | - | А | А | В | В | В | В | С | С |
| - | MFC-T | - | А | A | В | В | В | - | - | - |
| - | MFP | - | - 1 | - | - | В | В | В | С | С |
| - | MP | - | A | A | В | B | B | В | C | C |
| - | MP-T | - | A | A | B | B | B | - | - | - |
| - | MPD | - | A | A | B | B | B | В | С | С |
| - | MSC | - | А | A | А | A | В | В | B | B |
| - | MSC-T | - | A | A | A | А | В | - | - | - |
| - | MSF | - | A | A | В | В | B | В | С | С |
| - | MSF-T | - | A | A | B | B | B | - | - | - |
| - | MSFPD | - | - | - | _ | - | - | - | - | |
| - | MSFT | - | А | A | - | В | - | - | - | - |
| - | MSFT-T | - | A | A | - | B | - | - | - | |
| - | MSPD | - | - | - | | - | - | - | - | |
| - | MST | - | D | D | E | E | E | E | E+F | E+F |
| - | MST-T | - | D | D | E | E | E | - | - | - |
| NP | - | A | A | A | A | B | B | - | - | - |
| NP-T | - | A | A | A | A | B | B | - | - | - |
| NPD | - | A | A | A | A | B | B | - | - | - |
| NPL | - | A | A | A | A | B | B | - | - | - |
| NPL-T | - | A | A | A | A | B | B | - | - | - |
| SC | - | A | A | A | A | A | A | В | В | - |
| SC-T | - | A | A | A | A | A | A | - | - | - |
| SCHB | - | - | G | G | Н | H | Н | Н | Н | F |
| SEHB | - | A | A | A | В | B | В | В | В | C |
| SF | - | А | А | A | А | В | В | В | В | - |
| SF-T | - | A | A | A | A | B | B | - | - | - |
| SFC | - | - | A | A | A | B | B | В | В | С |
| SFC-T | - | - | A | A | A | B | B | - | - | - |
| SFT | - | A | A | A | A | B | B | В | В | С |
| SFT-T | - | A | A | A | A | B | B | - | - | - |
| SP | - | - | A | A | A | B | B | В | В | С |
| SP-T | - | - | A | A | A | B | B | - | - | - |
| SPD | - | - | A | A | A | B | B | В | В | С |
| - | SPM | - | A | A | - | B | B | B | C | - |
| ST | - | D | D | D | E | E | E | E | E | E |
| ST-T | - | D | D | D | E | E | E | - | - | - |
| TB | - | A | A | A | A | B | | - | - | - |
| TB-T | - | A | A | A | A | B | - | - | - | - |
| TFT | - | A | A | - | - | - | - | - | - | - |
| ТХР | - | - | A | - | - | - | B | - | - | - |



SHAFT MOUNTING INSTALLATION PROCEDURES FOR BALL AND ROLLER BEARINGS

Note: Setscrew marks on the shaft can be removed by backing out the setscrews and using a flat punch to tap down the setscrew burrs on the shaft.

SETSCREW LOCKING:



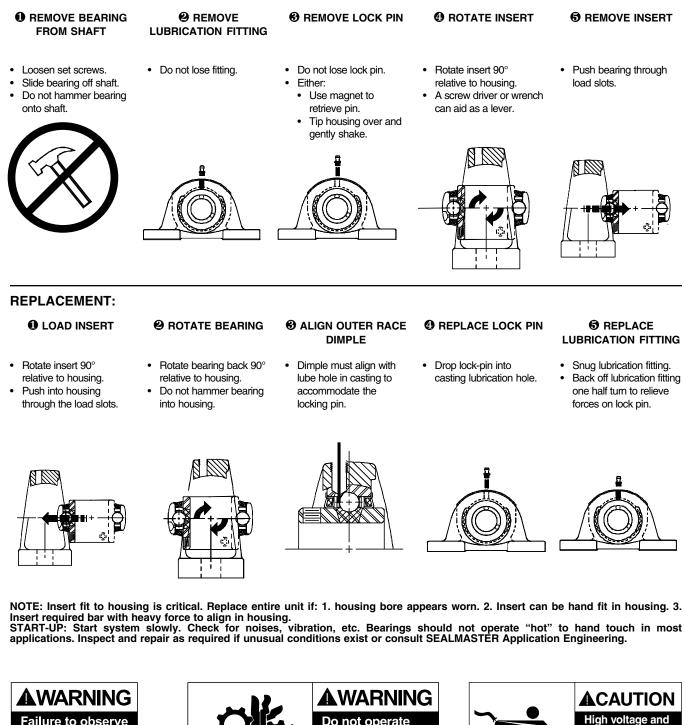
SEALMASTER®

INSTALLATION

SPHERICAL OD BEARING INSERT REMOVAL AND REPLACEMENT - BALL BEARING UNITS

Ball bearing spherical OD Insert removal and replacement procedure. SEALMASTER Bearing Inserts are selectively fit into castings, therefore our engineering department recommends replacing entire unit.

REMOVAL:



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



Do not operate

without guards. Turn off power to install or service.

rotating parts

serious or fatal

injury. Turn off

power to install

may cause

or service.

INSTALLATION



EXPANSION BEARING INSERT REMOVAL AND REPLACEMENT - BALL BEARING UNITS

SEALMASTER bearing inserts are selectively fit into castings. Our experienced engineering department recommends replacing entire insert unit.

SETSCREW LOCKING:

| REMOVE BEARIN | G FROM |
|---------------|--------|
| SHAFT | |

Do not hammer bearing off of

Loosen set screws.

shaft.

Slide bearing off shaft.

2 REMOVE LUBRICATION FITTING

Do not lose fitting.

- **O** REMOVE LOCK PIN
- Do not lose lock pin.
- Either: • Use magnet to retrieve pin.
- Tip housing over and gently shake.



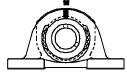
Insert should push straight out of

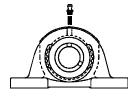
housing.

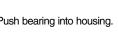
REPLACEMENT:

LOAD INSERT

· Push bearing into housing.





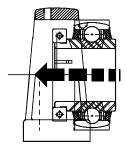


| ALIGN OUTER RACI | Ξ |
|------------------|---|
| DIMPLE | |

- Dimple must align with lube hole in casting to accommodate the locking pin.
- **O REPLACE LOCK PIN**
- Drop lock-pin into casting ٠ lubrication hole.

REPLACE LOCK PIN

- Snug lubrication fitting. ٠
- Back off lubrication fitting one half turn to relieve forces on lock pin.



Reference "Start-Up" on Page 201.



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



m

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



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

SEAL MASTER.

INSTALLATION

SELF-ALIGNING TAPERED ROLLER BEARING INSERT REMOVAL AND REPLACEMENT

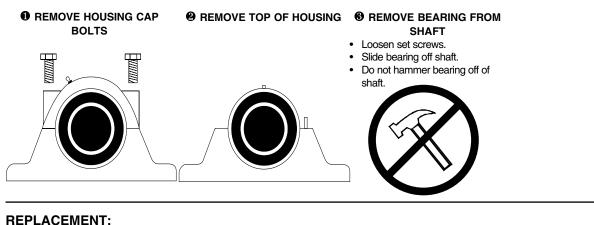


RCI Cartridge inserts with double or single locking collar. RCI fits Sealmaster RPB pillow blocks, flanges and piloted flange split housings.



ERCI Cartridge inserts designed to mount directly into customer housings and as inserts in expansion ERPB housings.

RPB SERIES SELF-ALIGNING TAPERED ROLLER BEARINGS FIXED AND EXPANSION TYPE DESIGNS CARTRIDGE INSERT REMOVAL AND REPLACEMENT



- LOAD NEW INSERT
- Slide bearing onto shaft.
- Seat bearing into housing. Position cartridge lock pin to line
- up with pin slot in housing.



Reference "Note" on Page 201.

AWARNING

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

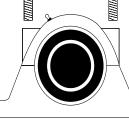
2 INSTALL TOP HOUSING HALF

- Align location pin with location hole.
- · Insure rubber grommet is under grease fitting.



O INSTALL HOUSING CAP

- torque (Refer to Table No. 31 on page 204.
- Rotate shaft to make sure it turns smoothly.



Do not operate

without guards.

Turn off power to

install or service.

O TORQUE SETSCREWS

- · Align setscrews on either end of shaft.
- Secure one side on insert:
- Step 1: Torque one setscrew to 1/2 recommended torque.
- Step 2: Torque second setscrew to recommended torque.
- Step 3: Torque first setscrew to full recommended torque. (Refer to "tighten to" column in Table no. 33 on page 205.)
- If applicable, secure second side of insert as above.



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

INSTALLATION

SEAL MASTER.

BALL BEARINGS

Table No. 25

| SHAFT TOLERANCES FOR BALL BEARINGS | | | | |
|--|---------------------------|--|--|--|
| Shaft Diameter (in.) Shaft Tolerance (in.) | | | | |
| 1/2 - 1 15/16 | Plus .0000 to minus .0005 | | | |
| 2 - 3 3/16 | Plus .0000 to minus .0010 | | | |
| 3 1/4 - 4 15/16 Plus .0000 to minus .0015 | | | | |

Table No. 26

| BORE TOLERANCES FOR BALL BEARINGS | | | | |
|---|---------------------------|--|--|--|
| Shaft Diameter (in.) Bore Tolerance (in.) | | | | |
| 1/2 - 1 15/16 | Plus .0006 to minus .0000 | | | |
| 2 - 3 3/16 | Plus .0006 to minus .0000 | | | |
| 3 1/4 - 4 15/16 Plus .0007 to minus .0000 | | | | |

Table No. 27

| HF & HFT SETSCREW SIZES FOR BALL BEARINGS | | | |
|---|---------------|--|--|
| Bore | Setscrew Size | | |
| 1 | 1/4 - 28 | | |
| 1 3/16 | 1/4 - 28 | | |
| 1 1/4 | 1/4 - 28 | | |
| 1 7/16 | 5/16 - 24 | | |
| 1 1/2 5/16 - 24 | | | |
| 1 3/4 | 5/16 - 24 | | |

Table No. 28

| HIGH TEMPERATURE FURNACE BALL BEARINGS HEC SHAFT EXPANSION SLOT SIZES | | | | | | | |
|--|---|-------------|-------------|--|--|--|--|
| Bore Size | Square Head Depth Width Setscrew (Inches) (Inches) | | | | | | |
| 1 | 1/4 - 28 | 0.25 - 0.28 | 0.28 - 0.31 | | | | |
| 1 3/16 | 1/4 - 28 | 0.25 - 0.28 | 0.28 - 0.31 | | | | |
| 1 1/4 | 1 1/4 1/4 - 28 | | 0.28 - 0.31 | | | | |
| 1 7/16 | 5/16 - 24 | 0.30 - 0.33 | 0.34 - 0.37 | | | | |
| 1 1/2 | 5/16 - 24 | 0.30 - 0.33 | 0.34 - 0.37 | | | | |
| 1 3/4 | 5/16 - 24 | 0.30 - 0.33 | 0.34 - 0.37 | | | | |

HIGH SPEED/HIGH LOAD APPLICATIONS

High Load Applications

Applications where the loading approaches the load listed in the rating tables on pages 180, 181 and 183 at 5000 hours life and 150/250 RPM, should be reviewed and given special consideration. Modifications to consider Include:

- Shafting size should be closely controlled for a line to line to a light press fit.
- SKWEZLOC or double lock is the preferred lock.
- Lubricants with "EP" extreme pressure additives may be required.
- Care in housing selection, load direction, and mounting techniques should be exercised.

ROLLER BEARINGS

Table No. 29

| SHAFT TOLERANCES FOR TAPERED ROLLER BEARINGS | | | | |
|--|---------------------------|--|--|--|
| Shaft Diameter (in.) Shaft Tolerance (in.) | | | | |
| 1 3/16 - 1 7/16 Plus .0000 to minus .0005 | | | | |
| 1 1/2 - 3 | Plus .0000 to minus .0010 | | | |
| 3 3/16 - 3 15/16 Plus .0000 to minus .0010 | | | | |
| 4 - 5 Plus .0000 to minus .0020 | | | | |

Table No. 30

| BORE TOLERANCES FOR TAPERED ROLLER BEARINGS | | | |
|---|---------------------------|--|--|
| Shaft Diameter (in.) Shaft Tolerance (in.) | | | |
| 1 3/16 - 1 7/16 Plus .0010 to minus .0000 | | | |
| 1 1/2 - 3 | Plus .0010 to minus .0000 | | |
| 3 3/16 - 3 15/16 Plus .0020 to minus .0000 | | | |
| 4 - 5 Plus .0020 to minus .0000 | | | |

Table No. 31

| SELF ALIGNING TAPERED ROLLER BEARING (RPB) CAP BOLT TORQUE TIGHTENING RECOMMENDATIONS (FT-LBS) | | | | | | | | |
|--|--------|--------|-----------------------|-----------------|-----|--|--|--|
| | Pillow | Flange | PILOTED FLANGE Expans | | | | | |
| Sizes | Block | Block | Outside Bolts | Pillow Block | | | | |
| 1 3/16 - 1 1/4 | 17 | 31 | 17 | 4 | 17 | | | |
| 1 3/8 - 1 7/16 | 31 | 31 | 17 | 4 | 31 | | | |
| 1 1/2 - 1 11/16 | 31 | 31 | 17 | 4 | 31 | | | |
| 1 3/4 - 2 | 31 | 31 | 17 | 4 | 31 | | | |
| 2 3/16 | 31 | 75 | 49 | 8 | 31 | | | |
| 2 1/4 - 2 1/2 | 75 | 75 | 49 | 8 | 75 | | | |
| 2 11/16 - 3 | 75 | 75 | 49 | 8 | 75 | | | |
| 3 3/16 - 3 1/2 | 266 | 150 | 75 | 17 | 266 | | | |
| 3 15/16 - 4 | 266 | 150 | 75 | 17 | 150 | | | |
| 4 7/16 - 4 1/2 | 266 | - | 150 | 75 | 150 | | | |
| 4 15/16 - 5 | 394 | - | 150 | 75 | 266 | | | |

High Speed Applications

Applications where the speed is in the range of 80-100% of the maximum speeds listed in the rating tables on pages 180, 181 and 183, should be reviewed and given special consideration. Modifications to consider include:

- Shaft size should be controlled to specifications listed in the installation section. See tables above.
- SKWEZLOC and double lock are the preferred lock systems for high speed applications.
 - High quality lubricatants should be used.
 - Grease should be added more frequently and in small amounts. See Page 197.
 - Care in mounting techniques should be exercised. See Page 200-205.

SEAL MASTER® SET SCREW & CAPSCREW INFORMATION

Table No. 32 BALL BEARINGS

| STANDARD DUTY | | MEDIUM DUTY | | SETSCREW AND CAPSCREW INFORMATION | | | | | | | | |
|---|---|---|-----------------------------------|-----------------------------------|---------|----------|---------------------------|---------------------------|--------|-----------|---------------------------|---------------------------|
| | | | SETSCREW LOCKING SKWEZLOC LOCKING | | | | | | | | | |
| SHAFT SIZE | INSERT # | ER # | SHAFT SIZE | INSERT # | THREAD | HEX SIZE | TIGHTEN TO (INLBS.) | TIGHTEN TO (FTLBS.) | THREAD | BORE SIZE | TIGHTEN TO (INLBS.) | TIGHTEN TO (FTLBS.) |
| 1/2 9/16 5/8 11/16 3/4 20mm | 2-08 2-09 2-010 2-011 2-012 5204 | ER-8 ER-9 ER-10 ER-11 ER-12 ER-204 | - | - | 1/4-28 | 1/8 | 66 - 85 | 5.5 - 7.2 | 8-32 | T-25 | 63 - 70 | 5.3 - 5.8 |
| 13/16 7/8 15/16 25mm 1 | 2-013 2-014 2-015 5205 2-1 | ER-14 ER-15 ER-205 ER-16 | - | - | 1/4-28 | 1/8 | 66 - 85 | 5.5 - 7.2 | 8-32 | T-25 | 63 - 70 | 5.3 - 5.8 |
| 1 1/16 1 1/8 1 3/16 30mm 1 1/4R | 2-11 2-12 2-13 5206 1-14 | ER-17 ER-18 ER-19 ER-206 | 15/16 1 25mm | 3-015 3-1 5305 | 1/4-28 | 1/8 | 66 - 85 | 5.5 - 7.2 | 8-32 | T-25 | 63 - 70 | 5.3 - 5.8 |
| 1 1/4 1 5/16 1 3/8 35mm 1 7/16 | 2-14 2-15 2-16 5207 2-17 | ER-20 ER-21 ER-22 ER-207 ER-23 | 1 3/16 30mm | 3-13 5306 | 5/16-24 | 5/32 | 126 - 164 | 10.5 - 13.7 | 10-24 | T-27 | 81 - 90 | 6.8 - 7.5 |
| 1 1/2 1 9/16 40mm | 2-18 2-19 5208 | ER-24 ER-25 ER-208 | 1 7/16 35mm | 5307 3-17 | 5/16-24 | 5/32 | 126 - 164 | 10.5 - 13.7 | 10-24 | T-27 | 81 - 90 | 6.8 - 7.5 |
| 1 5/8 1 11/16 1 3/4 45mm | 2-110 2-111 2-112 5209 | ER-26 ER-27 ER-28 ER-209 | 1 1/2 40mm | 3-18 5308 | 5/16-24 | 5/32 | 126 - 164 | 10.5 - 13.7 | 10-24 | T-27 | 81 - 90 | 6.8 - 7.5 |
| 1 13/16 1 7/8 1 15/16 50mm 2R | 2-113 2-114 2-115 5210 1-2 | ER-30 ER-31 ER-210 | 1 11/16 1 3/4 45mm | 3-111 3-112 5309 | 3/8-24 | 3/16 | 228 - 296 | 19.0 - 24.7 | 1/4-20 | T-30 | 162 - 180 | 13.5 - 15.0 |
| 2 2 1/8 55mm 2 3/16 | 2-2 2-22 5211 2-23 | ER-32 ER-34 ER-211 ER-35 | 1 15/16 50mm | 3-115 5310 | 3/8-24 | 3/16 | 228 - 296 | 19.0 - 24.7 | 1/4-20 | T-30 | 162 - 180 | 13.5 - 15.0 |
| 2 1/4 2 5/16 60mm 2 3/8 2 7/16 | 2-24 2-25 5212 2-26 2-27 | ER-36 ER-212 ER-38 ER-39 | 55mm 2 3/16 | 5311 3-23 | 3/8-24 | 3/16 | 228 - 296 | 19.0 - 24.7 | 1/4-20 | T-45 | 360 - 400 | 30.0 - 33.3 |
| 2 1/2 2 11/16 70mm | 2-211 5214 | ER-40 ER-43 ER-214 | 2 7/16 2 1/2 65mm | 3-27 3-28 5313 | 7/16-20 | 7/32 | 348 - 452 | 29.0 - 37.7 | - | - | - | - |
| 2 7/8 2 15/16 75mm | 2-214 2-215 5215 | ER-46 ER-47 ER-215 | 2 11/16 70mm | 3-211 5314 | 7/16-20 | 7/32 | 348 - 452 | 29.0 - 37.7 | - | - | - | - |
| 3 80mm 3 3/16 | 5216 2-33 | ER-48 ER-216 ER-51 | 2 15/16 75mm 3 | 3-215 5315 3-3 | 7/16-20 | 7/32 | 348 - 452 | 29.0 - 37.7 | - | - | - | - |
| 3 1/4 3 3/8 3 7/16 | 2-34 2-36 2-37 | ER-52 ER-54 ER-55 | 80mm 3 3/16 | 5316 3-33 | 7/16-20 | 7/32 | 348 - 452 | 29.0 - 37.7 | - | - | - | - |
| 3 1/2 90mm | 2-38 5218 | - | 3 7/16 | 3-37 | 1/2-20 | 1/4 | 504 - 655 | 42.0 - 54.6 | - | - | - | - |
| 3 15/16 4 | - | ER-63 ER-64 | 100mm 3 15/16 4 | 5320 3-315 3-4 | 5/8-18 | 5/16 | 1104 - 1435 | 92.0 - 119.6 | - | - | - | - |
| - | - | - | 4 7/16 4 15/16 | 3-47 3-415 | 5/8-18 | 5/16 | 1104 - 1435 | 92.0 - 119.6 | - | - | - | - |

Table No. 33 RPB ROLLER BEARINGS

| SETSCREW TIGHTENING TORQUE INFORMATION | | | | | | | | |
|--|-----------|----------|------------------------|------------------------|--|--|--|--|
| SHAFT SIZE (IN.) | THREAD | HEX SIZE | TIGHTEN TO (INLBS.) | TIGHTEN TO (FTLBS.) | | | | |
| 1 3/16 - 1 11/16 | 5/16 - 24 | 5/32 | 108 - 140 | 9 - 12 | | | | |
| 1 3/4 - 2 1/2 | 3/8 - 24 | 3/16 | 180 - 230 | 15 - 19 | | | | |
| 2 11/16 - 3 1/2 | 1/2 - 20 | 1/4 | 408 - 530 | 34 - 45 | | | | |
| 3 15/16 - 4 | 5/8 - 18 | 5/16 | 876 - 1000 | 73 - 95 | | | | |
| 4 7/16 - 4 15/16 | 3/4 - 16 | 3/8 | 1440 - 1850 | 120 - 150 | | | | |

ER, ERCI & SC HOUSING BORES

SEAL MASTER®

BALL BEARINGS

Table No. 34

| | Dimensions in mm/inches | | | | | | | | | |
|----------------|--------------------------------|----------|--------------------|----------|-----------------|--------|-------------------|----------|-----------------|--------|
| Cartridge | O.D. Of Cartridge Diameters | | Stationary Housing | | | | Revolving Housing | | | |
| Number | | | Diameter | | Theoretical Fit | | Diameter | | Theoretical Fit | |
| | Min. | Max. | Min. | Max. | Tight | Loose | Min. | Max. | Tight | Loose |
| ER-8 thru | 46.9875 | 47.0002 | 46.9976 | 47.0129 | 0.0025 | 0.0254 | 46.9849 | 47.0002 | 0.0152 | 0.0127 |
| ER-12T, ER-204 | 1.8499 | 1.8504 | 1.8503 | 1.8509 | 0.0001 | 0.0010 | 1.8498 | 1.8504 | 0.0006 | 0.0005 |
| ER-14 thru | 51.9836 | 51.9989 | 51.9963 | 52.0090 | 0.0025 | 0.0254 | 51.9836 | 51.9963 | 0.0152 | 0.0127 |
| ER-16T, ER-205 | 2.0466 | 2.0472 | 2.0471 | 2.0476 | 0.0001 | 0.0010 | 2.0466 | 2.0471 | 0.0006 | 0.0005 |
| ER-17 thru | 61.9836 | 61.9989 | 61.9963 | 62.0090 | 0.0025 | 0.0254 | 61.9836 | 61.9963 | 0.0152 | 0.0127 |
| ER-19T,ER-206 | 2.4403 | 2.4409 | 2.4408 | 2.4413 | 0.0001 | 0.0010 | 2.4403 | 2.4408 | 0.0006 | 0.0005 |
| ER-20 thru | 71.9836 | 71.9988 | 71.9963 | 72.0090 | 0.0025 | 0.0254 | 71.9836 | 71.9963 | 0.0152 | 0.0127 |
| ER-23T, ER-207 | 2.8340 | 2.8346 | 2.8345 | 2.8350 | 0.0001 | 0.0010 | 2.8340 | 2.8345 | 0.0006 | 0.0005 |
| ER-24, ER-24T | 79.9846 | 79.9998 | 79.9973 | 80.0100 | 0.0025 | 0.0254 | 79.9846 | 79.9973 | 0.0152 | 0.0127 |
| ER-25, ER-208 | 3.1490 | 3.1496 | 3.1495 | 3.1500 | 0.0001 | 0.0010 | 3.1490 | 3.1495 | 0.0006 | 0.0005 |
| ER-26 thru | 84.9808 | 85.0011 | 84.9986 | 85.0138 | 0.0025 | 0.0330 | 84.9833 | 84.9986 | 0.0178 | 0.0178 |
| ER-28T, ER-209 | 3.3457 | 3.3465 | 3.3464 | 3.3470 | 0.0001 | 0.0013 | 3.3458 | 3.3464 | 0.0007 | 0.0007 |
| ER-30, ER-31 | 89.9795 | 89.9998 | 89.9973 | 90.0125 | 0.0025 | 0.0330 | 89.9820 | 89.9973 | 0.0178 | 0.0178 |
| ER-31T, ER-210 | 3.5425 | 3.5433 | 3.5432 | 3.5438 | 0.0001 | 0.0013 | 3.5426 | 3.5432 | 0.0007 | 0.0007 |
| ER-32 thru | 99.9795 | 99.9998 | 99.9973 | 100.0125 | 0.0025 | 0.0330 | 99.9820 | 99.9973 | 0.0178 | 0.0178 |
| ER-35T, ER-211 | 3.9362 | 3.9370 | 3.9369 | 3.9375 | 0.0001 | 0.0013 | 3.9363 | 3.9369 | 0.0007 | 0.0007 |
| ER-36 thru | 109.9795 | 109.9998 | 109.9972 | 110.0125 | 0.0025 | 0.0330 | 109.9820 | 109.9972 | 0.0178 | 0.0178 |
| ER-39T, ER-212 | 4.3299 | 4.3307 | 4.3306 | 4.3312 | 0.0001 | 0.0013 | 4.3300 | 4.3306 | 0.0007 | 0.0007 |
| ER-40 | 124.9756 | 125.0010 | 124.9959 | 125.0163 | 0.0051 | 0.0406 | 124.9782 | 124.9985 | 0.0229 | 0.0229 |
| ER-43, ER-214 | 4.9203 | 4.9213 | 4.9211 | 4.9219 | 0.0002 | 0.0016 | 4.9204 | 4.9212 | 0.0009 | 0.0009 |
| ER-46 | 129.9743 | 129.9997 | 129.9947 | 130.0150 | 0.0051 | 0.0406 | 129.9769 | 129.9972 | 0.0229 | 0.0229 |
| ER-47, ER-215 | 5.1171 | 5.1181 | 5.1179 | 5.1187 | 0.0002 | 0.0016 | 5.1172 | 5.1180 | 0.0009 | 0.0009 |
| ER-48 | 139.9743 | 139.9997 | 139.9946 | 140.0150 | 0.0051 | 0.0406 | 139.9769 | 139.9972 | 0.0229 | 0.0229 |
| ER-51, ER-216 | 5.5108 | 5.5118 | 5.5116 | 5.5124 | 0.0002 | 0.0016 | 5.5109 | 5.5117 | 0.0009 | 0.0009 |
| ER-52, ER-54 | 149.9743 | 149.9997 | 149.9946 | 150.0149 | 0.0051 | 0.0406 | 149.9768 | 149.9972 | 0.0229 | 0.0229 |
| ER-55 | 5.9045 | 5.9055 | 5.9053 | 5.9061 | 0.0002 | 0.0016 | 5.9046 | 5.9054 | 0.0009 | 0.0009 |
| ER-63, ER-64 | 189.9691 | 189.9996 | 189.9945 | 190.0301 | 0.0051 | 0.0610 | 189.9691 | 190.0047 | 0.0305 | 0.0356 |
| | 7.4791 | 7.4803 | 7.4801 | 7.4815 | 0.0002 | 0.0024 | 7.4791 | 7.4805 | 0.0012 | 0.0014 |

* To install an ER Type bearing into a housing, push ONLY on outer ring to avoid damaging balls and races.

Table No. 35

| SC HOUSING DIMENSION RECOMMENDATIONS (INCHES) | | | | | | | | |
|--|-----------------|--------------|--------------|-----------|-----------|-------------------|--------|--|
| SHAFT SIZES | | OUTSIDE DIA. | OF CARTRIDGE | STATIONAF | Y HOUSING | REVOLVING HOUSING | | |
| STANDARD | MEDIUM DUTY | DIAME | ETERS | DIAM | ETERS | DIAMETERS | | |
| DUTY | | MAX. | MIN. | MAX. | MIN. | MAX. | MIN. | |
| 1/2 - 11/16 | - | 2.6885 | 2.6865 | 2.6905 | 2.6885 | 2.6875 | 2.6855 | |
| 3/4 | - | 2.9385 | 2.9365 | 2.9405 | 2.9385 | 2.9375 | 2.9355 | |
| 13/16 - 1 | - | 3.1260 | 3.1240 | 3.1280 | 3.1260 | 3.1250 | 3.1230 | |
| 1 1/16 - 1 1/4 | 15/16 - 1 | 3.5010 | 3.4990 | 3.5030 | 3.5010 | 3.5000 | 3.4980 | |
| 1 1/4 - 1 7/16 | 1 3/16 - 1 1/4 | 3.8760 | 3.8740 | 3.8780 | 3.8760 | 3.8750 | 3.8730 | |
| 1 1/2 - 1 9/16 | 1 7/16 | 4.1885 | 4.1865 | 4.1905 | 4.1885 | 4.1875 | 4.1855 | |
| 1 5/8 - 1 3/4 | 1 1/2 | 4.3760 | 4.3740 | 4.3780 | 4.3760 | 4.3750 | 4.3730 | |
| 1 13/16 - 2 | 1 11/16 - 1 3/4 | 4.5635 | 4.5615 | 4.5655 | 4.5635 | 4.5625 | 4.5605 | |
| 2 - 2 3/16 | 1 15/16 - 2 | 4.9385 | 4.9365 | 4.9405 | 4.9385 | 4.9375 | 4.9355 | |
| 2 1/4 - 2 7/16 | 2 3/16 - 2 1/4 | 5.8760 | 5.8740 | 5.8780 | 5.8760 | 5.8750 | 5.8730 | |
| 2 1/2 - 2 11/16 | 2 7/16 - 2 1/2 | 6.2510 | 6.2490 | 6.2530 | 6.2510 | 6.2500 | 6.2480 | |
| 2 7/8 - 2 15/16 | 2 11/16 | 6.6260 | 6.6240 | 6.6280 | 6.6260 | 6.6250 | 6.6230 | |
| - | 2 15/16 - 3 | 7.0010 | 6.9990 | 7.0030 | 7.0010 | 7.0000 | 6.9980 | |
| - | 3 3/16 - 3 1/4 | 7.4385 | 7.4365 | 7.4405 | 7.4385 | 7.4375 | 7.4355 | |
| - | 3 7/16 - 3 1/2 | 8.1885 | 8.1865 | 8.1905 | 8.1885 | 8.1875 | 8.1855 | |
| - | 3 15/16 - 4 | 9.5010 | 9.4990 | 9.5030 | 9.5010 | 9.5000 | 9.4980 | |

*Avoid excessive tightening of anchor bolts on SC casting.

ERCI Bearings - see page 119 for typical housing.

For ER fits - see page 206 (table 34).

Refer to page 182 for relevant disclaimer.

SEAL MASTER®

EMERSON POWER TRANSMISSION

EPT MOUNTED BEARING DIVISION

Mail To: SEALMASTER Bearings - Application Engineering 1901 Bilter Rd. Aurora IL 60507

Fax to: Application Engineering 630-898-6064

| Distributor Information | Customer Information | | | | | |
|---|--|--|--|--|--|--|
| Distributor Name | Company Name | | | | | |
| Contact Name | Contact Name | | | | | |
| Street Address | Street Address | | | | | |
| City/State/Zip | City/State/Zip | | | | | |
| | | | | | | |
| Phone | Phone | | | | | |
| Fax | Fax | | | | | |
| Internet E-Mail | Internet E-Mail | | | | | |
| Is the Customer an: OEM or End User | Industry | | | | | |
| | | | | | | |
| Application Ir | formation | | | | | |
| Is this a new application Yes or No | Complete Climate Description | | | | | |
| Speed: | EXPLAIN: Climate Conditions: Wet | | | | | |
| (rpm) Service Life Required: | Washdown □ Dry □ | | | | | |
| (hours): | Dry Clean C | | | | | |
| | - Dirty 🗅 | | | | | |
| Shaft Diameter: | Chemicals 🗆 | | | | | |
| Load Information (Ibs.): Load Conditions: Steady | Operating Temperature (°F): | | | | | |
| Radial (lbs.): Shock | Is the bearing in the elevated temp? Yes / No | | | | | |
| Axial / Thrust (lbs.): Thrust | Is the heat coming through the shaft? Yes / No | | | | | |
| Oscillation | | | | | | |
| If loads unknown attach detailed sketch*** Other \Box | Can the bearings be re-lubricated? Yes D No D | | | | | |
| Complete Application Description: Horsepower (bhp): | Motor | | | | | |
| | Driven Pulley Diameter (in.): | | | | | |
| | Distance Between Bearings: | | | | | |
| | ED SKETCH OF APPLICATION. | | | | | |
| | AND SYSTEM LOAD LOCATIONS | | | | | |
| | | | | | | |