Load Capacities & Life Calculations

Simple life/load estimations can be derived from the Radial Load chart shown on page 86. However, if a more specific estimation is desired, the life of a bearing can be calculated by the following formula:

$$L10h = \left(\frac{C}{P}\right)^3 \times \frac{16{,}667}{n}$$

Where:
L10h = Life hours
C = Basic Load Rating (lbf)
P = Equivalent Radial Load (lbf)
n = Speed (RPM)

See Page 86, or individual bearing pages for Basic Load Ratings.

L10h equals the number of hours that 90% of an identical sample group, operating under identical and ideal conditions, will operate without failure. Since actual field conditions seldom, if ever, match the ideal conditions used in the calculation of L10h, compensation for slip fit (most mounted bearings), dust, vibration, and shock loading must be considered. Since most **IPTCI** products are mounted units, it is helpful then to adjust the L10h number by .46 for slip fit applications and further reduce this number by 50-70% to compensate for other operating conditions.

Example:

Bearing: UCP205-16 – with slip fit on to ground shafting.
Application: Farm equipment experiencing variable shock loading.
L10h = 10,000 hours
Adjustment would be: 10,000 x .46 x .3 = 1,380 hours

Light and or infrequent vibration/shock loading may not require as much adjustment; however, **IPTCI** always recommends very generous safety factors for maximum bearing longevity. Additional adjustment may also be required if the bearing is directly exposed to heavy contaminants. The seal type will then influence the amount of this additional adjustment. It is assumed that the bearing will be operated within the confines of its published temperature limits, and that it will be relubricated properly.

Note: Caution is advised if in the use of the L10 formula, extremely high or low hours are derived.

Thrust

The above calculations assume that there is no consequential thrust load present; therefore, the actual radial load equals the Equivalent Radial Load. It is important to note, however, that thrust, or axial force can dramatically affect the life of a mounted ball bearing. It is also significant to note that, outside of ideal testing conditions, and without field experience, many thrust applications are difficult to realistically quantify. Therefore, as thrust exceeds approximately 25% of the Basic Load Rating, or there exists a combination of thrust and speed, please contact **IPTCI** for technical assistance.

Bearing Inserts • Radial Load Chart

Bearing Numbers						Basic Load Rating @ 33 1/3 RPM	Radial Load Rating in Pounds at Various RPM Based on 500 Hours Minimum Life											
Normal Duty			Light Duty		Medium Duty													
UC/UCW	NA/NAW	ER	SA	SB	UCX		50	100	200	300	500	900	1200	1500	1800	2400	3600	5000
UCW 201 201-8 UCW 202 202-10 UCW 203	NAW 201 201-8 NAW 202 202-10 NAW 203	–	SA 201 201-8 SA 202 202-10 SA 203	SB 201 201-8 SB 202 202-10 SB 203	–	2040	1780	1415	1120	980	830	680	620	575	540	490	425	380
UC 201 201-8 UC 202 202-10 UC 203 UC 204-12 204	NA 201 201-8 NA 202 202-10 NA 203 NA 204-12 204	ER 201 201-8 ER 202 202-10 ER 203 ER 204-12 204	SA 204-12 204	SB 204-12 204	–	2740	2390	1890	1510	1320	1110	910	835	770	725	655	575	505
UC 205-14 205-15 205 205-16	NA 205-14 205-15 205 205-16	ER 205-14 205-15 205 205-16	SA 205-14 205-15 205 205-16	SB 205-14 205-15 205 205-16	–	3010	2625	2085	1650	1450	1210	1000	915	845	800	725	630	555
UC 206-17 206-18 206 206-19 206-20	NA 206-17 206-18 206 206-19 206-20	ER 206-17 206-18 206 206-19 206-20	SA 206-17 206-18 206 206-19 206-20	SB 206-17 206-18 206 206-19 206-20	UC X05-14 X05-15 X05 X05-16	4200	3670	2910	2290	2010	1695	1390	1265	1170	1100	990	860	–
UC 207-20 207-21 207-22 207 207-23	NA 207-20 207-21 207-22 207 207-23	ER 207-20 207-21 207-22 207 207-23	SA 207-20 207-21 207-22 207 207-23	SB 207-20 207-21 207-22 207 207-23	UC X06-18 X06 X06-19 X06-20	5535	4820	3850	3050	2680	2250	1850	1680	1560	1420	1325	1155	–
UC 208-24 208-25 208	NA 208-24 208-25 208	ER 208-24 208-25 208	SA 208-24 208-25 208	SB 208-24 208-25 208	UC X07-22 X07 X07-23	6375	5560	4410	3490	3040	2550	2100	1895	1755	1655	1505	–	–
UC 209-26 209-27 209-28 209	NA 209-26 209-27 209-28 209	ER 209-26 209-27 209-28 209	SA 209-26 209-27 209-28 209	–	UC X08-24 X08	7110	6210	4915	3910	3400	2880	2355	2150	1990	1875	1700	–	–
UC 210-30 210-31 210 210-32	NA 210-30 210-31 210 210-32	ER 210-30 210-31 210 210-32	SA 210-30 210-31 210 210-32	–	UC X09-26 X09-27 X09-28 X09	7400	6465	5140	4075	3560	3000	2460	2240	2075	1970	1740	–	–
UC 211-32 211-34 211 211-35	NA 211-32 211-34 211 211-35	ER 211-32 211-34 211 211-35	SA 211-32 211-34 211 211-35	–	UC X10-30 X10-31 X10 X10-32	9490	8290	6575	5220	4560	3825	3140	2840	2635	2460	2240	–	–
UC 212-36 212 212-38 212-39	NA 212-36 212 212-38 212-39	ER 212-36 212 212-38 212-39	–	–	UC X11-34 X11 X11-35 X11-36	11,500	10,050	7965	6335	5525	4655	3775	3450	3200	3000	–	–	–
UC 213-40 213	NA 213-40 213	–	–	–	UC X12 X12-38 X12-39	12,400	10,810	8690	6860	6030	5030	4180	3780	3470	3260	–	–	–
UC 214-44 214	NA 214-44 214	–	–	–	UC X13-40 X13	13,530	11,820	9450	7480	6480	5520	4540	4110	3820	3510	–	–	–
UC 215-47 215 215-48	NA 215-47 215 215-48	ER 215-47 215 215-48	–	–	UC X14-44 X14	14,620	12,745	10,210	8100	7090	5980	4900	4400	4110	3860	–	–	–
UC 216	–	–	–	–	UC X15-47 X15 X15-48	15,970	13,950	11,070	8160	6470	5650	5150	4840	4490	4200	–	–	–
UC 218-56 218	–	–	–	–	UC X17 X17-55 X17-56	21,120	18,460	14,650	10,780	8560	7480	6800	6400	5940	–	–	–	–
–	–	–	–	–	UC X20 X20-63 X20-64	29,300	25,600	20,300	16100	14,100	11,900	9770	8870	–	–	–	–	–

Materials of Bearings

Standard Bearing Inserts

Inner and outer rings, as well as balls, are made from vacuum degassed 52100 bearing steel. Composed of high carbon, chrome alloy, 52100 steel offers great longevity as it is very resistant to deformation and fatigue.

Stainless Steel & Hard Chrome Coated Bearing Inserts

See page 52 for component detail.

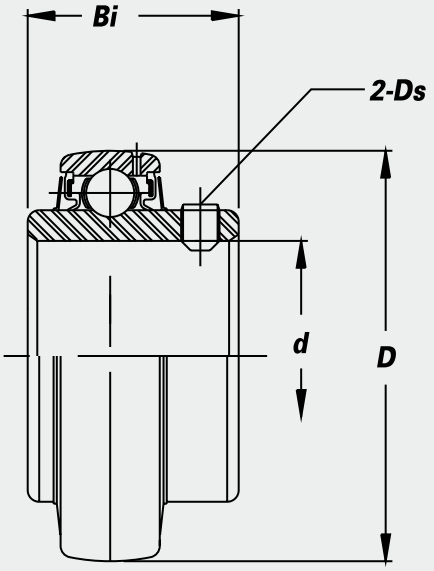
Tolerances of Rings

Outer Ring **Unit=.0001 in.**

Nominal Outside Diameter D				Outside Diameter		Radial Run-out (max.)
Over		Including		Tolerance of Diameter		
mm	in.	mm	in.	High	Low	
30	1.1811	50	1.9685	0	– 4	8
50	1.9685	80	3.1496	0	– 5	10
80	3.1496	120	4.7244	0	– 6	14
120	4.7244	150	5.9055	0	– 7	16
150	5.9055	180	7.0866	0	– 10	18
180	7.0866	250	9.8425	0	– 12	20
250	9.8425	315	12.4016	0	– 14	24

Inner Ring **Unit=.0001 in.**

Nominal Bore Diameter d				Bore Diameter				Inner Ring Width		Radial Run-outs (Max.)
Over		Including		dm		d		Bi		
mm	in.	mm	in.	max.	min.	max.	min.	max.	min.	
10	0.3937	18	0.7087	+ 7	0	+ 9	– 2	0	– 47	6
18	0.7087	30	1.1811	+ 8	0	+10	– 2	0	– 47	7
30	1.1811	50	1.9685	+10	0	+12	– 2	0	– 47	8
50	1.9685	80	3.1496	+12	0	+14	– 2	0	– 59	10
80	3.1496	120	4.7244	+14	0	+17	– 3	0	– 79	12
120	4.7244	180	7.0866	+16	0	+19	– 3	0	– 98	14

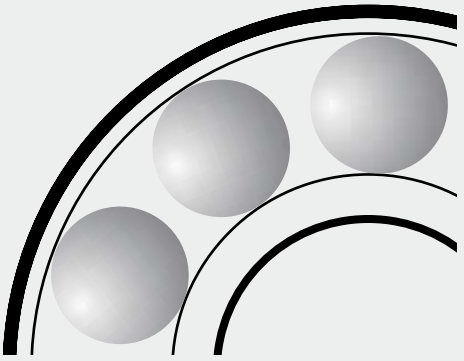


Internal Clearances

The Normal or Cø fit is generally accepted as an industry standard, and is, therefore, adopted as our standard clearance. However, other fits are available to accommodate extreme temperatures or low tolerance applications where slow r.p.m.s allow for a tighter fit.

Unit=.0001 in.

Bore Diameter				C_2		Normal		C_3		C_4	
Over		Including									
mm	in.	mm	in.	min.	max.	min.	max.	min.	max.	min.	max.
10	0.3937	18	0.7087	0	3	2	6	5	9	8	12
18	0.7087	24	0.9449	0	3.5	3	7	6	10	9	13
24	0.9449	30	1.1811	0	4	3	7	6	10	10	15
30	1.1811	40	1.5748	0	4	3	7	7	12	12	17
40	1.5748	50	1.9685	0	4	3	8	8	13	13	19
50	1.9685	65	2.5591	0	5	4	10	10	16	16	23
65	2.5591	80	3.1496	0	5	5	11	11	19	19	27
80	3.1496	100	3.9370	0	6	6	13	13	22	22	32
100	3.9370	120	4.7244	0	7	7	15	15	25	25	37



Shaft Tolerances

Shaft Diameter	Shaft Tolerance
1/2" - 1 15/16"	Nominal to - .0005"
2" - 3 3/16"	Nominal to - .0010"
3 1/4" - Up	Nominal to - .0015"

For maximum life, **IPTCI** recommends a fit as close to nominal as possible. Turned and ground shafting is also beneficial as it tends to be rounder, straighter and free of burrs or other flaws.

Mounting Instructions

When mounting, always clean shafting and bearing bore. Then, having coated the shaft with a light oil, slide the bearing unit on the shaft to its correct position. It may be necessary to use a soft mallet and/or pipe, on the inner ring only, to reach the correct position. Never pound on, or apply pressure to, the outside ring! Once the bearing unit is in position, precise alignment can be achieved by first fixing the housing in place, then simultaneously rotating and tapping the shaft with a soft mallet. This should be accomplished before any locking collar or set screw is tightened.

When mounting a locking collar bearing, use a spanner wrench or punch to lock the collar in place — always in the direction of shaft rotation. Then tighten set screw. Do not use locking collar bearings for bi-directional applications.

When mounting set screw locking bearings we recommend the following torque settings:

Mild steel set screws - for standard bearing inserts

Set Screw Size	Max. Recommended Torque (in./lbs.)
10-32	28
1/4 - 28	66
5/16 - 24	126
3/8 - 24	228
7/16 - 20	306
1/2 - 20	330

300 series stainless set screws - for SUC & CUC bearing Inserts

Set Screw Size	Max. Recommended Torque (in./lbs.)
1/4 -28	54
5/16 - 24	110
3/8 - 24	205

Lubrication

All IPTCI bearing units are factory prelubricated and, therefore, do not require supplemental grease before service life begins. Relubrication, when administered correctly, can increase the life of a bearing substantially. IPTCI recommends the following general guidelines to maximize your bearing life:

RPM	Temperature	Environmental Condition	Interval
100	32° F -120° F	Clean	6-12 months
500	32° F -150° F	Clean	2-6 months
1,000	32° F - 210° F	Clean	2 weeks to 2 months
1,500	Over 210° F	Clean	Daily to weekly
Any	32°F -150° F	Dirty	Weekly to monthly
Any	Over 150° F	Dirty	Daily to 2 weeks
Any	Any Temp.	Very Dirty	Daily to weekly
Any	Any Temp.	Extremely Dirty	Daily to weekly

NOTE:
Overlubrication is a major cause of bearing failures. Please relubricate conservatively when unsure of bearing requirements.

When selecting a bearing lubricant, **IPTCI** suggests any lithium-based NLGI #2 grease. For operating temperatures higher than 210° F, please consult **IPTCI**.