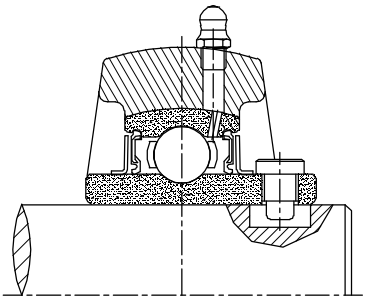
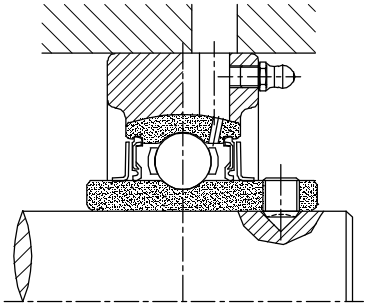
14. Use of heat resistant bearing (EN2)

Heat resistant bearing units operating at high temperatures receive thrust loading from the expansion of the shaft. In these types of situations, one bearing unit should by firmly fixed to the locking surface and the other bearing unit should be locked freely to absorb the expansion of the shaft as shown in Figure 14.1 (Heat resistant bearing unit should be used with a selection of proper quality grease and specially ordered C3 class large radial clearance bearing.)

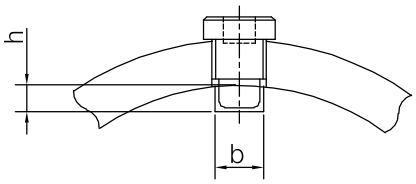


Machine a key slot on the shaft and use the locking bolt as the key so that the shaft and the bearing inner race can move against each other.



Use the rounded cartridge style bearing with the housing unit so that the outer surface of the cartridge housing can move. (UCC)

[FIGURE 14.1]



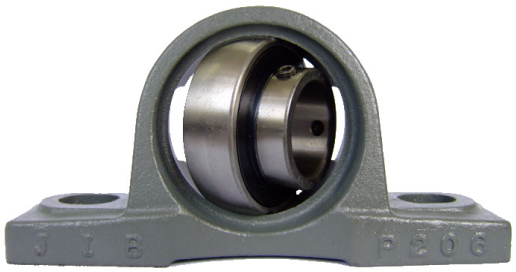
<TABLE 14.11> Groove dimensions for vertical hem bar style locking bolt

(unit : mm)

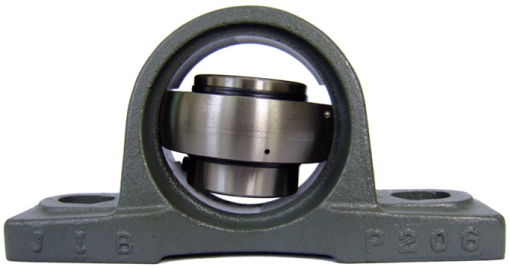
Bearing No.	Locking bolt No.	Depth, h	Minimum width, b
UC201 ~ UC206	M6 × 0.75	5	4
UC207 ~ UC209	M8 × 1.0	6	6
UC210 ~ UC213	M10 × 1.25	6.5	7
UC214 ~ UC218	M12 × 1.5	8	9
UCX05	M6 × 0.75	5	4
UCX06 ~ UCX08	M8 × 1.0	5	6
UCX09 ~ UCX12	M10 × 1.25	6.5	7
UCX13 ~ UCX17	M12 × 1.5	7	9
UCX18	M14 × 1.5	7	10
UCX20	M16 × 1.5	7	12
UC305 ~ UC306	M6 × 0.75	5	4
UC307	M8 × 1.0	6	6
UC308 ~ UC309	M10 × 1.25	6.5	7
UC310 ~ UC314	M12 × 1.5	8	9
UC315 ~ UC316	M14 × 1.5	8	10
UC317 ~ UC319	M16 × 1.5	8	12
UC320 ~ UC324	M18 × 1.5	8	13
UC326 ~ UC328	M20 × 1.5	8	15

15. Ball bearing unit interchangeability

JIB ball bearing unit bearings and housing are compatible for easy exchangeability. Therefore, if the bearing cannot be used for some reason such as abnormal heat generation or excess noise, the bearing can be changed while continuming to use the same housing. Conversely, the housing can be exchanged while keeping the same bearing if there is a problem with the housing. When the bearing is removed from the housing, the bearing locking pin should be rotated to face the front as shown in the Figure 15.1. Next, the bearing should be rotated to a position where the housing inside diameter assembly groove and the bearing width are equal as shown in the Figure 15.2. Then, the bearing can be simply removed by pulling towards the assembly groove. Assembly of the bearing unit is in opposite order of disassembly.



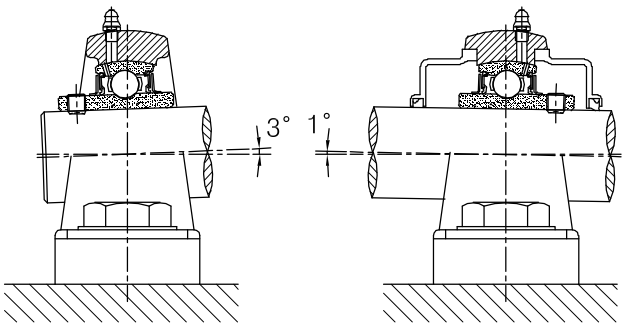
[FIGURE 15.1]



[FIGURE 15.2]

16. Ball bearing unit mounting

The bearing unit should be mounted within ±3° of the bearing locking angle. The operation of the bearing is not affected if the angle between the base of the unit and the shaft axis is greater than ±3° But, there is a possiblty that the bearing will not be properly lubricated by the trease. If the unit is also used with an additional cover, the cover will provide an irregular seal with the shaft. In this case, the locking angle should be ±1° for proper operation.



[FIGURE 16.1] Shaft mounting angle

17. Ball bearing unit's maximum rotation speed

Normally, high speed operation of the ball bearing is accompanied by increase in heat and noise because of the friction between the ball and the inside diameter of the outer race and the resistance of the grease. The ball bearing unit could be destroyed if the roation speed is too high. Therefore, the maximum rotation speed should be known for the bearing to ensure safe operation of the bearing unit. The most commonly used system is the dn and dmn values (d=shaft diameter, dm=ball pitch diameter, n=rpm) Additional limitation caused by the contact pressure of the seal for bearing units with seal and shield protection method should also be considered in determining the maximum speed. The maximum rotation speed for regular bearing, units with regular and simple seal methods are listed in Table 17.1.

<TABLE 17.1> Ball bearing unit maximum rotating speed

(unit : rpm)

호칭번호	회전수	호칭번호	회전수	호칭번호	회전수
UC201 ~UC204	6000				
UC205	5300	UCX05	4500	UC305	4800
UC206	4500	UCX06	3800	UC306	4000
UC207	3800	UCX07	3400	UC307	3600
UC208	3400	UCX08	3200	UC308	3200
UC209	3200	UCX09	2900	UC309	2800
UC210	2900	UCX10	2600	UC310	2500
UC211	2600	UCX11	2400	UC311	2400
UC212	2400	UCX12	2300	UC312	2200
UC213	2300	UCX13	2200	UC313	2000
UC214	2200	UCX14	2000	UC314	1900
UC215	2000	UCX15	1800	UC315	1700
UC216	1800	UCX16	1700	UC316	1600
UC217	1700	UCX17	1600	UC317	1500
UC218	1600	UCX18	1500	UC318	1400
		UCX20	1300	UC319	1350
				UC320	1300
				UC321	1200
				UC322	1150
				UC324	1100
				UC326	1000
				UC328	900

Remark : For triple seal method units, the maximum speed is about 25% of the numbers listed in the table.

18. Abnormal behavior of ball bearing unit and their cause

Improper behavior of bearing is usually caused by improper maintenance or installation. Therefore, care should be taken during maintenance machine and. Installation, depending on the operating and the operating condition. Also, in bearing operation, one cause can commonly be expressed as a secondary affect. The list in Table 18.1 which shows a relatively large number of causes for abnormally operating bearings should be used to prevent abnormal operation.

<Taable 18.1> Abnormal behavior and their cause

Behavior	Cause
Excess torque	Tight assembly, overtightening of adapter causing reduced clearance, overlap of shield and seal due to physical shock during installation, inaccurate alignment of bearings when more than 2 bearing units are installed on a single axis
Noise and vibration	Breakdown of the orbital race surface due to improper handling or installation, not enough clearance for operation, early stage of flaking or breakdown on the orbital race surface or groove or ghe ball, expansion of bearing mounting bolt or housing mounting bolt, too much bearing clearance, bent shaft, unbalanced load acting on the axis of the rotating machine, more than 3 units mounted on a single axis, bad mounting surface angle, vibration of shft axis, too much clearance between the shaft and the bearing inside diameter, not enough strength on the mounting surface, breakdown of sealing method causing entrance of foreing contaminants into the bearing
Temperature increase	Not enough bearing clearance during operation, operating above the maximum rotation speed, improper grease supply, overlap between shield and seal due to installation shock, notenough free play for shaft expansion on the free mounted side bearing, early stage of breakdown for some bearing parts

19. Ball bearing unit maintenance procedure

The maintenance of ball bearing should follow carefully planned practices adopted to match the precision of the ball bearing parts. No matter how good the quality and the capability of the bearing is, the expected life time of a bearing can not be achieved without good maintenance practices. The maintenance procedure described below are essentially basic practices. The maintenance procedure described below are essentially basic practices for all bearing maintenance. Still, any careless handling will not allow the bearing to be used as an integral mechanical part. Therefore, the user must pay special attention to the proper maintenance practices.

1) Maintain a clean assembly and disassembly area and use clean tools.
2) Handle the ball bearing with clean and dry hands.
3) Assembly bar can break easily so do not use tools that can create dusty particles.
4) Use a clean dry cloth to wipe the bearing once the wrapping on the bearing is removed.
5) The proper type and amount of grease should be used.
6) Grease supply should be protected from entrance of foreign particles and the grease container should be kept closed when not in use.
7) The rotation stop locking pin should not be removed unless a special reason exists.(Steel plate housing use)
8) Forced assembly should be avoided to maintain the housing and bearing assembly clearance unless it is a high speed situation.
9) Use JIB's housing if possible and try to aboid using other company's housing that do not use he rotation stopping locking pin with JIB bearings. Housing without the rotation stopping locking pin have low assembly grooves which can allow the locking pin to slide in between the housing and the outer race. This can often reduce the internal radial clearnace and thus reduce the bearing life.

20. Table of relationships between load and rotating speed based on 500 hr minimum life ball bearing unit

In the table below (Table 20.1), the load and speed for each ball bearing style are outlined and summarized for easy reference.

The load and speed listed in the table was based on load calculation previously described in scetion 9.

(Example)

Bearing load = Calculated load × Load factor(fw) × Belt factor(fb,fc,fg)

<TABLE 20.1> Relationship between rotation speed and load

Bearing No.							Rotaing speed and load												
UC200	UK200	UCX00	SER200	HC200	SA200	SB200	33 1/3	50	100	250	500	750	1000	1200	1500	2000	2400	3600	5000	RPM
-	-	-	-	-	201-203	201-203	960	840	670	490	390	340	310	290	270	250	230	200	180	
201-204	-	-	201-204	204	204	204	1280	1120	890	650	520	450	410	390	360	330	310	270	240	
205	205	-	205	205	205	205	1400	1220	970	720	570	500	450	420	390	360	340	290	260	
206	206	X05	206	206	206	206	1950	1700	1350	1000	790	690	630	590	550	500	470	410	370	L
207	207	X06	207	207	207	207	2570	2250	1780	1310	1040	910	830	780	720	660	620	540	-	
208	208	X07	208	208	208	208	2910	2540	2020	1490	1180	1030	940	880	820	740	700	610	-	O
209	209	X08	209	209	209	209	3200	2800	2220	1630	1300	1130	1030	970	900	820	770	-	-	
210	210	X09	210	210	210	210	3510	3070	2430	1790	1420	1240	1130	1060	990	900	840	-	-	A
211	211	X10	211	211	211	211	4330	3780	3000	2210	1760	1530	1390	1310	1220	1110	1040	-	-	
212	212	X11	-	212	212	212	5240	4580	3630	2680	2120	1860	1690	1590	1470	1340	1260	-	-	D
213	213	X12	-	-	-	-	5720	5000	3970	2920	2320	2030	1840	1730	1610	1460	-	-	-	
214	-	X13	-	-	-	-	6220	5430	4310	3180	2520	2200	2000	1880	1750	1590	-	-	-	
215	215	X14	-	-	-	-	6740	5890	4670	3440	2730	2390	2170	2040	1890	1720	-	-	-	
216	216	X15	-	-	-	-	7260	6340	5030	3710	2940	2570	2340	2200	2040	-	-	-	-	
217	217	X16	-	-	-	-	8390	7330	5820	4290	3400	2970	2700	2540	2360	-	-	-	-	(Kg)
218	218	X17	-	-	-	-	9600	8390	6660	4900	3890	3400	3090	2910	2700	-	-	-	-	
-	-	X18	-	-	-	-	10900	9520	7560	5560	4420	3860	3500	3300	3060	-	-	-	-	
-	-	X20	-	-	-	-	13300	11600	9220	6780	5390	4710	4280	4030	-	-	-	-	-	

<TABLE 20.1> Relationship between rotation speed and load

Bearing No.		Rotating speed and load													
UC300	UK300	33 1/3	50	100	250	500	750	1000	1200	1500	2000	2400	3600	5000	RPM
305	305	2100	1830	1460	1070	850	740	680	640	590	540	500	440	400	
306	306	2660	2320	1840	1360	1080	940	860	810	750	680	640	560	500	
307	307	3330	2910	2310	1700	1350	1180	1070	1010	940	850	800	700	-	
308	308	4070	3560	2820	2080	1650	1440	1310	1230	1140	1040	980	850	-	
309	309	3890	4270	3390	2500	1980	1730	1570	1480	1370	1250	1180	-	-	L
310	310	6200	5420	4300	3170	2510	2200	2000	1880	1740	1580	1490	-	-	
311	311	7160	6250	4960	3660	2900	2540	2300	2170	2010	1830	1720	-	-	O
312	312	8180	7150	5670	4180	3320	2900	2630	2480	2300	2090	1970	-	-	
313	313	9270	8100	6430	4740	3760	3280	2980	2810	2610	2370	-	-	-	
314	-	10400	9090	7210	5310	4220	3680	3350	3150	2920	2660	-	-	-	A
315	315	11300	9870	7830	5770	4580	4000	3640	3420	3180	2890	-	-	-	
316	316	12300	10750	8530	6280	4990	4360	3960	3730	3460	-	-	-	-	D
317	317	13300	11620	9220	6790	5390	4710	4280	4030	-	-	-	-	-	
318	318	14300	12490	9920	7310	5800	5070	4600	4330	-	-	-	-	-	
319	319	15300	13370	10610	7820	6200	5420	4920	4630	-	-	-	-	-	
320	320	17300	15110	12000	8840	7010	6130	5570	5240	-	-	-	-	-	
321	-	18400	16070	12760	9400	7460	6520	5920	-	-	-	-	-	-	(Kg)
322	322	20500	17190	14210	10470	8310	7260	6600	-	-	-	-	-	-	
324	324	20700	18080	14350	10580	8390	7330	6660	-	-	-	-	-	-	
326	326	22900	20000	15880	11700	9290	8110	-	-	-	-	-	-	-	
328	328	25300	22100	17540	12930	10260	8960	-	-	-	-	-	-	-	

Proof of 500hr life((bearing life $= \frac{10^6}{60 \times n} \times \left(\frac{C}{P}\right)^3$)

n : Rotation speed(rpm)
C : Dynamic radial load rating(kg)
P : Load(kg)

Example1) For UC205, when=50 and p=1220 Kg (equibalent static load rating for 205 bearing is listed in the catalog as 1400Kg)

Therefore, $\frac{10^6}{60 \times 50} \times \left(\frac{1400}{1220}\right)^3 \fallingdotseq 500\text{hr}$

Example 2) For UC315, When n=1500, p=3180Kg, C=11300Kg

Therefore, $\frac{10^6}{60 \times 1500} \times \left(\frac{11300}{3180}\right)^3 \fallingdotseq 500\text{hr}$