14 Handling

14.1 Installation

14.1.1 Installation of setscrew units

When installing setscrew units, it is important to tighten the setscrews to the shaft with the specified torque.

When the clearance between the inner ring and the shaft is small, then grind the surface of the shaft where the setscrew contacts and make a flat base (**Fig. 14.1**). It helps you to take the shaft out of the inner ring.

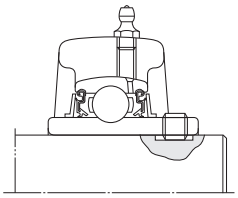

Fig. 14.1 Flat seat provided for shaft

If the unit is exposed to great load or excessive vibration, another option is to use a shouldered shaft and tighten the inner ring of the bearing with a shaft nut. (**Fig. 14.2**)

For dimensions of the shouldered shaft, see **"9 Design of shaft and base"**.

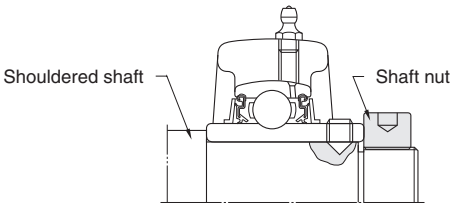

Fig. 14.2 Example of installation with a shouldered shaft and shaft nut

FYH Bearings are available with a variety of set screw options including **Double Point** and **Bullet Point** set screws which provide a secure fit to the shaft. Additional styles of setscrews are also available to meet a range of purposes and operating conditions (see **Table 14.1**).

Table 14.1 Set screws of ball bearings for units

Designations (code)	Details
Bullet Point 	The tip of the FYH Bullet Point setscrew has a ball shape, and it is designed to firmly grip the shaft by expanding its threads outward against the threads of the inner ring of the bearing as it is tightened. When shock or vibration are problems, the Bullet Point setscrew can remain affixed to the shaft longer than other set screw styles including double point, ball point, or others.
Double Point (**G7**) 	The cone point at the center of the screw, combined with the round point at the outer edge, provide excellent shaft contact and greatly reduced fitting error. This style is also available with a nylon film fused to the thread surface to prevent the screw from loosening during operation.
Cone Point (**G4**) 	The cone point setscrew has a 90º angle and fits a drilled cone seat in the shaft. It allows correct positioning on the shaft and prevents shaft movement in an axial direction. (**Fig14.3**)
Capped Full Dog Point (**G6**) 	The capped full dog point setscrew fits into the keyed groove in the shaft and allows for expansion and contraction of the shaft. It tightens to the inner ring of the bearing (not the shaft) to allow the shaft to float within the bore of the bearing.

When correct positioning is required, make a drilled cone base on the shaft, and tighten the shaft, using a cone point set screw (**Fig. 14.3**).

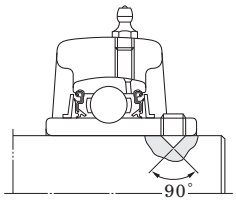

Fig. 14.3 Drilled seat provided for shaft

Contact FYH for additional set screw styles.

Shown below are installation procedures for bearing units with setscrews.

(1) Inspect the unit to ensure that the rigidity of the base, flatness of the mounting surface, and tolerance of the shaft meet the required standards. Check the shaft for bends, burrs, and other flaws.

(2) Make sure that the set screws are retracted far enough so that they do not contact the shaft as the bearing is installed.

(3) Fit the bearing unit onto the shaft and slide it to the specified position. In order to secure a tight fit, press-fit the bearing unit to the shaft with a press, cold-fit by cooling the shaft, or shrink-fit the bearing unit by warming it with an air bath (100 °C or less). Avoid striking the bearing with a hammer to press-fit the bearing to the shaft. If you give a strong impact to the side surface of the inner ring, the both slinger moves, and it may cause a problem.

(4) Align the bearing unit to the specified position on the base and affix it with washers and bolts. (**Fig. 14.4**). Use a torque wrench to tighten the bolts to the housing to the specified torque setting. For mounting bolt torque specifications, see **Appendix table 2** in the back of the catalog.

Fig. 14.4 Installation of setscrew units

(5) Tighten both of the setscrews on the inner ring to the specified torque setting (**Fig. 14.5**). For setscrew torque specifications, see **Appendix table 3** in the back of the catalog.

Fig. 14.5 Tightening of set screws

(6) Turn the shaft by hand and tighten the setscrews of all other bearings on the same shaft to the specified torque setting.

(7) Finally, turn the shaft by hand and make sure that it rotates without any problems.

14.1.2 Installation of adapter style units

Adapter units, comprised of an adapter sleeve, locknut, and washer, can be installed into environments where they are exposed to excessive vibration and impact.

It is of great importance that these units are properly mounted. If the locknut is not properly tightened, the sleeve may be loose which could lead to slippage and wear on the shaft or bearing. Conversely, if the locknut is over-tightened, the inner ring of the bearing can expand and reduce internal ball clearance which could cause excessive heat and premature failure.

Installation procedures for adapter style bearings are shown below.

(1) Inspect the unit to ensure that the rigidity of the base, flatness of the mounting surface, and tolerance of the shaft meet the required standards. Check the shaft for bends, burrs, and other flaws.

(2) Slide the adapter sleeve onto the shaft where the bearing unit will be installed.

If the sleeve is too tight, place a screwdriver in the slotted portion of the sleeve and expand the slot to open the sleeve.

(3) Slide the bearing unit over the shaft and onto the adapter sleeve, then place a cylindrical reinforcing ring against the inner ring of the front side of the bearing. Seat the adapter sleeve by lightly tapping all around the backside of the sleeve (**Fig. 14.6**).

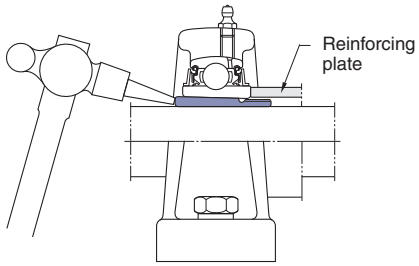

Fig. 14.6 Fitting adapter sleeve to bearing with tapered bore

(4) Attach the lock washer so that the tab fits into the slot in the sleeve, and, making sure the tapered side is facing the bearing, tighten the locknut on the sleeve by hand.

(5) Align the bearing unit to the specified position on the base and affix it with washers, and bolts. Use a torque wrench to tighten the bolts to the housing to the specified torque setting. For mounting bolt torque specifications, see **Appendix table 2** in the back of the catalog.

(6) Use a torque wrench to tighten the locknut to the correct specification (**Fig. 14.7**). For locknut torque specifications, see **Appendix table 4** in the back of the catalog.

Fig. 14.7 Tightening locknut

(7A) For pillow block housings, loosen the mounting bolts and adjust the unit axially while rotating the shaft by hand. Then re-tighten the mounting bolts to the correct specification.
(7B) For flange block housings, the position of the unit must be in the correct axial position in relation to the shaft, so take extra care to properly align them before completing installation.
(8) Bend one of the tabs on the washer so that it fits into one of the slots on the locknut (**Fig. 14.8**).

Fig. 14.8 Bending claw of washer
(Locking locknut)

(9) Finally, turn the shaft by hand and make sure that it rotates without any problems.

14.1.3 Installation of units with eccentric locking collars

Eccentric locking collar bearings provide another option for shaft locking. Since the rotating force of the shaft increases the tightening force of the eccentric ring to the shaft, this style of bearing allows a secure grip to the shaft.

Since the rotating force of the shaft increases the tightening force of the eccentric ring to the shaft, the unit with eccentric locking collar allows secure fixing of the bearing (**Fig. 14.9**).

Fig. 14.9 Ball bearing units with eccentric locking collar

Installation procedures for eccentric locking collar style bearings are shown below.
(1) Inspect the unit to ensure that the rigidity of the base, flatness of the mounting surface, and tolerance of the shaft meet the required standards. Check the shaft for bends, burrs, and other flaws.
(2) Slide the bearing unit onto the shaft, and place it at the specified mounting position.
(3) Align the bearing unit to the specified position on the base and affix it with washers, and bolts. (**Fig. 14.4**). Use a torque wrench to tighten the bolts to the housing to the specified torque setting. For mounting bolt torque specifications, see **Appendix table 2** in the back of this catalog.
(4A) Fit the eccentric section of the inner ring of the bearing to the eccentric recessed section of the eccentric locking collar, and rotate the collar in the direction of shaft rotation. Then, tighten the setscrew on the eccentric locking collar to the specified torque setting (**Fig. 14.10**).

Fig. 14.10 Installing eccentric locking collar

(4B) The NU-LOC collar is tightened by a hexagon head bolt to a specified torque setting in order to apply the correct amount of force to the inner ring o the bearing. (**Fig. 14.11**)

Regarding tightening torque for set screws or hexagon head bolts, see **Appendix Table 3** in the back of this catalog.

Fig 14.11 Installation of NU-LOC units

(5) Rotate the shaft by hand and then install the next eccentric locking collar unit to the shaft.
(6) Finally, turn the shaft by hand and make sure that it rotates without any problems.

14.1.4 Installing units with covers

Covers for ball bearing units are available in two types, steel plate and cast iron. Install both the covers at last after installation of the bearing and housing is complete.

Procedures for installation of the ball bearing units with covers are shown below.

(1) Apply grease all around the seal lip of the cover, and pack the internal space of the cover with grease (approximately 1/3 to 1/2 of the space capacity) (**Fig. 14.12**).

Fig. 14.12 Packing grease in internal space of seal lip of covers

(2) Make sure that the bearing unit is securely fixed to the shaft and mounting base.
(3) Slide the cover over the shaft to the grove in the housing and lightly press it into place.
(4A) For stamped steel covers, use a plastic mallet to prevent deformation, and evenly tap all around the periphery of the cover to install it to the housing (**Fig. 14.13**).

To remove the stamped steel cover, put a screwdriver into the groove on the periphery of the cover and slightly pry it.

Fig. 14.13 Installing steel plate covers

(4B) When installing a cast iron cover, fit the cover to the cover groove of the housing, and affix it with the supplied bolts.
For the tightening torque of the cast iron cover mounting bolts, see the **Appendix table 2** at the end of this catalog.
(5) Install another cover to the housing in a similar manner.
(6) Check for abnormality of the installed cover.
(7) Finally, turn the shaft by hand, and check for abnormality in the bearing.

14.2 Test Run Inspection

After installation of the ball bearing unit is complete, execute the test run inspection to ensure that it was done properly.

The test run inspection should be executed by following the procedures below.

(1) Turn the shaft by hand and make sure that the bearing rotates smoothly.
If there is any resistance, vibration, excessive rotational torque, or uneven rotation, the bearing is judged to be faulty.
(2) Execute a powered run with no load and at low speed, and check for abnormal noise and vibration.
(3) Execute a powered run under normal operating conditions and check for abnormal noise, vibration, and temperature increase.

Table 14.2 shows the main faults that may occur during the test run inspection of the ball bearing unit and causes.

Table 14.2 Main causes of bearing failure during test runs and their causes

Faults	Causes
Excessive torque, uneven rotating torque	(1) Faulty installation, causes preload on bearing (2) Inappropriate handling or installation, leading to interference of seal with slinger (3) Excessive tightening of locknut (adapter) causing too small internal clearance of bearing
Abnormal noise, abnormal vibration	(1) Improper tightening of set screws or of mounting bolts (2) Excessively large internal clearance of bearings (3) Bent shaft, or shouldered shaft may be machined eccentrically (4) Shaft tolerance chosen improperly (5) Mounting base not rigid or flat
Abnormal temperature increase	(1) Too small internal clearance of bearing (2) Faulty installation, causes preload on bearing (3) Load too great (4) Allowable rotational speed exceeded (5) Mounting base not rigid or flat (6) Inappropriate handling or installation, leading to interference of seal with slinger

14.3 Periodic Inspection

FYH Ball Bearing Units do not need to be inspected as frequently as lower quality bearings. However, it is good practice to set up an inspection schedule for even these high quality bearings.

Since a ball bearing unit cannot be disassembled for inspection of the internal status of components, the external appearance of the bearing must be inspected to give tell-tale signs of the status and expected life of the bearing. The following characteristics must be checked per the inspection schedule that is established for a particular application.

(1) Overall appearance
(2) Loose set screws or mounting bolts
(3) Noise from vibration
(4) Temperature of the bearing housing or the inner ring
(5) Grease supply interval and quantity of grease injected into the bearing (either too much or too little grease can be detrimental to the life of the bearing)

Table 14.3 shows the main faults that are usually found during periodic inspections and their causes.

If any fault is found in a ball bearing unit during an inspection, then immediate action must be taken to correct the situation and prevent deterioration of the bearing components. If serious damage has already occurred to the bearing unit, then the bearing unit must be replaced immediately to prevent damage to other machine components.

Table 14.3 Main faults found during periodic inspection and their causes

Faults	Causes
Excessive torque	(1) Degraded grease (2) Interference of seal with slinger due to excessive supply of grease (3) Deformation of slinger causing interference with seal (4) High load due to shaft expansion
Abnormal noise, abnormal vibration	(1) Improper tightening of set screws locknut (adapter) or of mounting bolts (2) Wear on inner ring of bearing or shaft due to creep or fretting (3) Ingress of foreign matter (dirt) into bearing (4) Damage to cage or ball surfaces due to rolling fatigue (5) Indentation on raceway surface or ball surface due to excessive load (6) Warped or bent shaft
Abnormal temperature increase	(1) Degraded grease (2) Interference of seal with slinger due to excessive supply of grease (3) Deformation of slinger causing interference with seal (4) Looseness of setscrew, eccentric locking collar or adapter lock nut for tapered bore bearings (5) Load due to shaft expansion (6) Damage to cage or ball surfaces due to rolling fatigue

14.4 Supply of Grease

FYH Ball Bearing units are supplied with high quality FYH Lithium Bearing grease and seals. Therefore, under clean operating conditions, light loads, low speeds, and low temperatures the bearing may be used with no further lubrication.

However, under harsher operating conditions and environments, the grease will deteriorate much more rapidly.

This would include environments exposed to dust, moisture, or higher operating temperatures.

In such cases, a re-greasing schedule must be established to prevent premature failure of the bearing. The life of the bearing can be greatly extended by proper attention to the re-greasing schedule and by supplying the proper amount of grease. Please note that too much grease can be detrimental as well as too little grease.

14.4.1 Grease life and supply intervals

The grease life of a bearing unit can be found using **Formula (4.7)** in page 27.

The re-greasing schedule should be set at 1/4 to 1/3 of the grease life found by the calculation shown above; however this may be adjusted for particularly demanding environments or conditions.

In addition, some environments may be unusually dirty or wet, and these conditions may be exacerbated by higher temperatures. Under such harsh conditions, a more frequent re-greasing schedule will extend the life of the bearing.

Under normal operating conditions, adhere to the guidelines outlined in **Table 2.2** in page 10.

14.4.2 Amount of grease

The amount of grease initially supplied in a new FYH Ball Bearing Unit is approximately 30 to 35% of the internal space capacity of the bearing. If the bearing is over greased, the agitation of the grease causes internal friction and heating of the bearing. The first sign of failure will be excessive grease finding its way to the outside of the bearing. DO NOT exceed the initial greasing amount.

Table 14.4 shows the recommended amount of grease to be used for re-greasing FYH bearings.

In a severely dusty or wet environments, the amount of grease may be as much as doubled if operating speeds are low.

Note:

1. **Table 14.4** applies to UK units as well.
2. For greasing triple-lip (L3) type bearings, use 1 1/2 times the amount of grease recommended in the table.
3. Values shown in the table are applicable to standard grease (density: 0.9 g/ml). If a compatible grease of another specific gravity is used, then the proper conversion must be made to insure that the recommended volume is put into the bearing.

Table 14.4 Amount of recommended grease for ball bearing units

Bore dia. code	Greasing amount, g		
	Diameter Series[1)]		
	UC200	UCX00	UC300
01	0.7		
02	0.7		
03	0.7		
04	0.7		
05	0.8	1.3	1.8
06	1.3	1.8	2.5
07	1.8	2.3	3.4
08	2.3	2.8	4.6
09	2.8	3.2	6.3
10	3.2	4.3	8.1
11	4.3	5.5	11
12	5.5	6.8	14
13	6.8	7.7	17
14	7.7	9	21
15	9	11	25
16	11	14	29
17	14	17	34
18	17	21	40
19	–	–	47
20	–	29	61
21	–	–	69
22	–	–	84
24	–	–	98
26	–	–	126
28	–	–	151

The basic bearing size number consists of the duty code (2, X, or 3) followed by the inner ring size code (07, 10, 24, etc.)

14.4.3 Types of grease supplied

Many different types of grease are available for use in ball bearings. However, if a non-compatible grease is used, particularly a non-lithium based grease, then performance may be drastically reduced.

Only use the grease recommended in **Table 2.1** (page 10) to assure optimum performance of your bearings.

If another grease is used in an emergency situation, for instance, please assure that this grease is compatible, with a lithium base, at the minimum.

14.4.4 Relubricating the unit at the specified interval

Note **Fig. 14.14** which shows the grease fitting, grease groove and grease holes for relubrication of the unit.

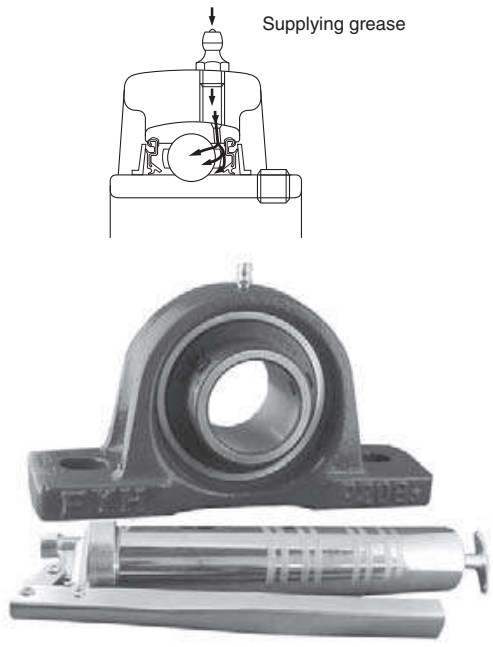

Fig. 14.14 Supplying grease to ball bearing units

(1) Clean the grease fitting and the area around it to prevent dirt and foreign material from entering the unit.
(2) Clean the grease gun and pack clean grease.
(3) Grease the unit with the recommended amount of grease.

When lubricating the ball bearing unit, slowly turn the shaft with your hand. This allows the fresh grease to be uniformly distributed inside the unit.

If it is difficult to access the standard straight type grease fitting with a grease gun, 67.5º and 90º angled fittings are available as an option. See the images below of these grease fittings. Contact FYH for more information.

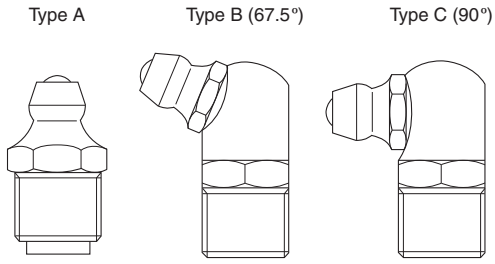

Fig. 14.15 Types of grease fittings for ball bearing units

When using a centralized automatic lubrication system, with ball bearings, it is important to use softer grease than normal. The grease should be specified with a "worked penetration number" between 300 and 380. This is NLGI grade "0" or "1". Piping from the lubricating system must be sized so that the specified volume of grease is supplied.

Piping must be connected to the threaded hole on the ball bearing unit. This is either 1/4-28 tapered threads for units up to and including 210 ring size, or 1/8 PT (BSPT) for ball bearing units with a 211 ring size and larger. If the piping size used is larger than the threaded hole in the ball bearing unit, then the appropriate reducing coupling (or street elbow) must be used to fit the threaded hole.

Fig. 14.16 shows the body of a pipe reducer.

When using an automatic centralized lubrication system, it is imperative to assure that the correct volume of grease is supplied to each individual bearing as specified in **Table 14.4**. The total amount of grease is a multiple of the number of bearings being supplied by the central lubrication system.

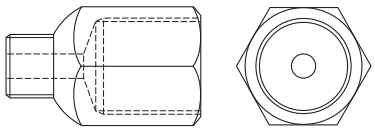

Fig. 14.16 Reducing coupling for centralized lubrication systems

14 Handling

14.5 Replacing Bearings

If a bearing insert needs to be replaced, it is not always necessary to replace the housing if the housing is intact.

After carefully inspecting the housing to ensure that it is not damaged, simply insert a new bearing into the old housing.

Replacement procedures for a bearing insert are listed below.

(1) Remove the complete bearing unit from the shaft and mounting base.
(2) Screw in the set screws so that the head of each set screw does not protrude outside the outer diameter of the inner ring. Otherwise, the head of the set screw may damage the bearing seat inside the housing.
(3) Use a bar or pipe to rotate the bearing 90° until the bearing is horizontal.
(4) Remove the bearing insert from the housing via the loading slot in the back of the housing.

Reverse the above procedure to put in a new bearing insert. Ensure that the set screws are screwed in before proceeding with the replacement.