Koyo

Installation and Handling Manual of KOYO Split type Cylindrical Roller Bearing Units for Continuous Casting, Drive Roll

JTEKT | JTEKT CORPORATION

CAT.NO. B3006E

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Koyo

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Contents

Information

1. Contact us if you have any questions about the installation and handling of these bearing units.
2. We accept orders for spare parts (not including commercially available spare parts).

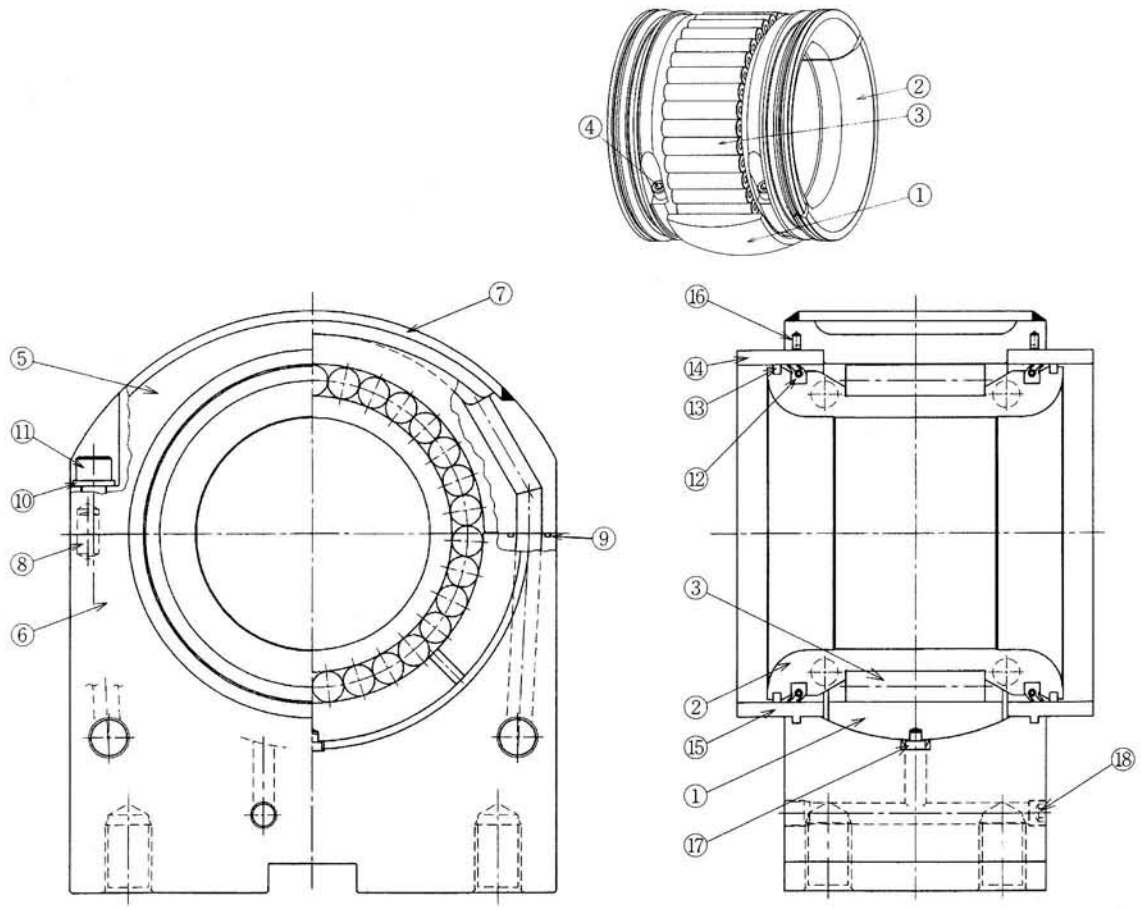
Koyo

1. Introduction

This document describes the installation and handling procedures for Koyo Split type Cylindrical Roller Bearing Units for Continuous Casting on Drive Roll. The bearing structure shown in this document is that of a typical split type roller bearing unit.

For installation and handling of bearing units of different structures, this instruction manual can still serve as a useful source of information.

Fig. 1 shows the structure and component parts of a typical split type roller bearing unit.



Code	Part name	Q'ty	Code	Part name	Q'ty
1	Outer ring (half ring)	1	10	Spring lock washer	4
2	Inner ring	1 set	11	Hexagon socket head cap screw (for fastening housing)	4
3	Roller	Note 1)	12	Oil seal	2
4	Hexagon socket head cap screw (for fastening inner ring)	4	13	Packing	2
5	Upper housing	1	14	Upper labyrinth ring	2
6	Lower housing	1	15	Lower labyrinth ring	2
7	Jacket plate	1	16	Parallel pin	2
8	Parallel pin	2	17	Dowel pin	1
9	O-ring	4	18	Plug	Note 1)

Note 1) Quantities of rollers and plugs differ with bearing numbers. Refer to JTEKT drawings.

Fig. 1 Structure of Split type Roller Bearing Unit and Names of Component Parts

2. Preparation for Installation

2.1 Preparation of Tools

Provide tools shown in Table 1 and industrial items shown in Table 2 before the installation of bearing units.

Table 1 Tools

Tool	Nominal size or capacity	Remarks
Hexagonal wrench key	For M6 to M16	For fastening inner ring
	For M10 to M24	For fastening housing
Torque wrench	23 N to 280 N, nominal	For fastening inner ring
	90 N to 1 000 N, nominal	For fastening housing
Small jack	Minimum capacity: 2 kN	Jack with long stroke
Plastic hammer	—	—
Wiping rags	—	—
Compressed air	—	For cleaning

Table 2 Industrial Items

Product name	Memo	Recommended trade name
Molybdenum disulfide	Aerosol type	Three Bond 1910
Liquid packing	Heat-resistant silicone agent	Three Bond 1211 or 1209
Degreasing or cleaning solvent	Aerosol type	Eishin Kagaku R-1M (NT)
Instant adhesive	For plastics and rubber	Commercially available adhesive
Grease	Same grease as used in the bearing	—

2.2 Inspection of Installation Positions

Inspect dimensions and precision of the roll neck (especially, fitting portions for the bearing and housing) before the installation of a bearing unit. Inspect also fitting surfaces of the roll neck carefully to ensure that they are free of flaws, dents, or burrs.

2.3 Preparation of Bearing and Housing

Carry the bearing and housing to the installation work site. Avoid unpacking them until immediately before installation work in order to prevent any damage or the formation of rust.

(1) Unpacking of bearing

Unpack the bearing immediately before installation work. Cover the bearing with a plastic sheet or take other measures to keep the bearing free from dust or foreign matters.

Cautions

1. Exercise great care in handling all parts (especially, inner ring) to avoid dropping or causing a shock.
2. The serial number is marked at either one of the positions shown in Fig. 2. Make sure that the markings are the same serial number before installation work.

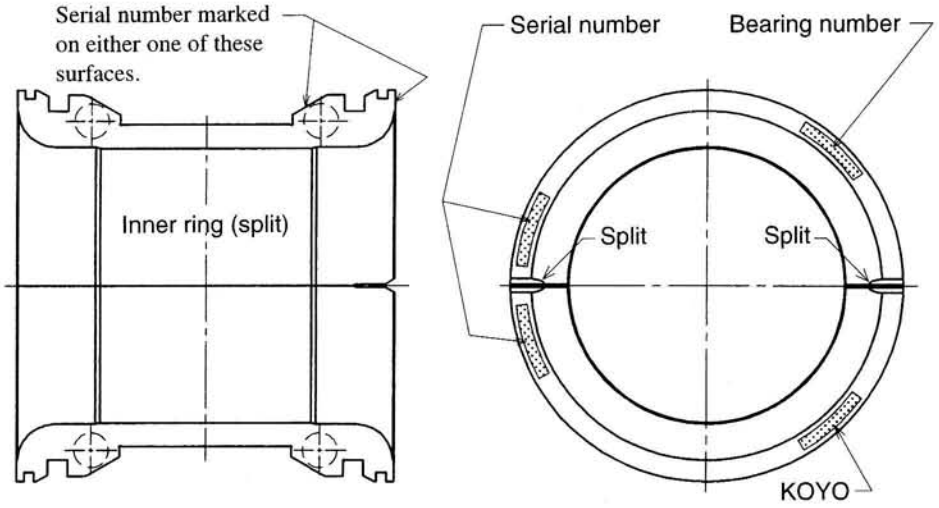


Fig. 2 Serial Number on Inner Ring

(2) Unpacking of housing

1) Unpack the housing. Remove fastening hexagon socket head cap screws on the upper and lower housings. Separate the upper housing from the lower one.
2) Clean the grease supply and drain holes and cooling water supply and drain holes using compressed air.
3) Clean the inner machined surfaces of the upper and lower housings with wiping rags (remove dust and foreign matters).
4) Look at the serial number and marked on the lower housing and matching mark on the upper and lower housing to ensure that they are the correct pair.
5) Look at the matching mark on the upper and lower labyrinth ring to ensure that it is made up of the correct pair, as with the housing.
6) Check the quantities of other parts.
   Clean them with wiping rags (remove dust and foreign matters).

Cautions

1. Split parts are vulnerable to deformation. Exercise great care in handling them to avoid dropping or causing a shock.
2. Split parts (including the housing) are interchangeable in pairs.
   When taken apart, discrete parts are not interchangeable.
   Accordingly, parts must be kept in pairs identified by the serial numbers and matching mark. Undivided, one-piece parts are interchangeable.
3. Serial numbers and matching mark on the housing and labyrinth ring at positions is shown in Figs. 3 and 4.
   Make sure that every pair of parts has the same serial number.

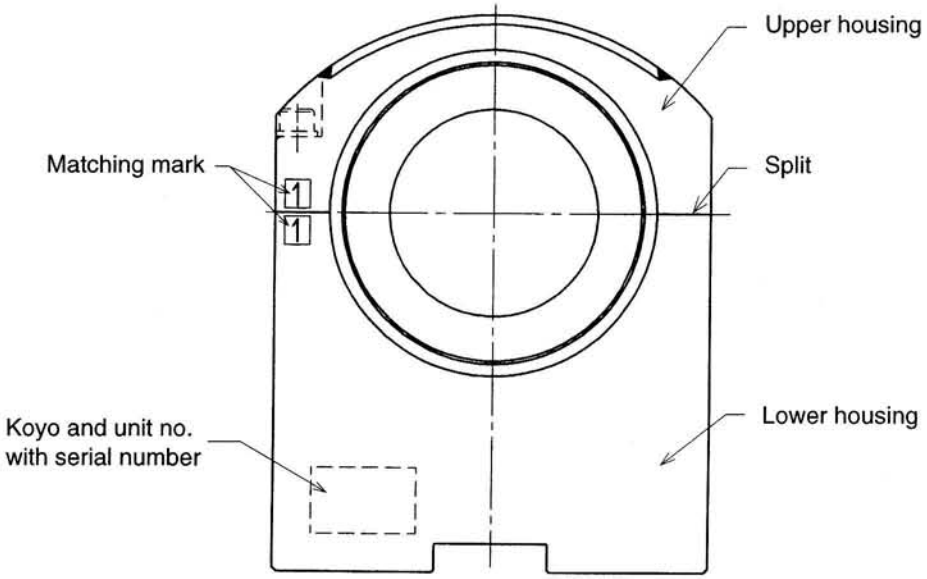


Fig. 3 Serial Number and Matching Mark on Housing

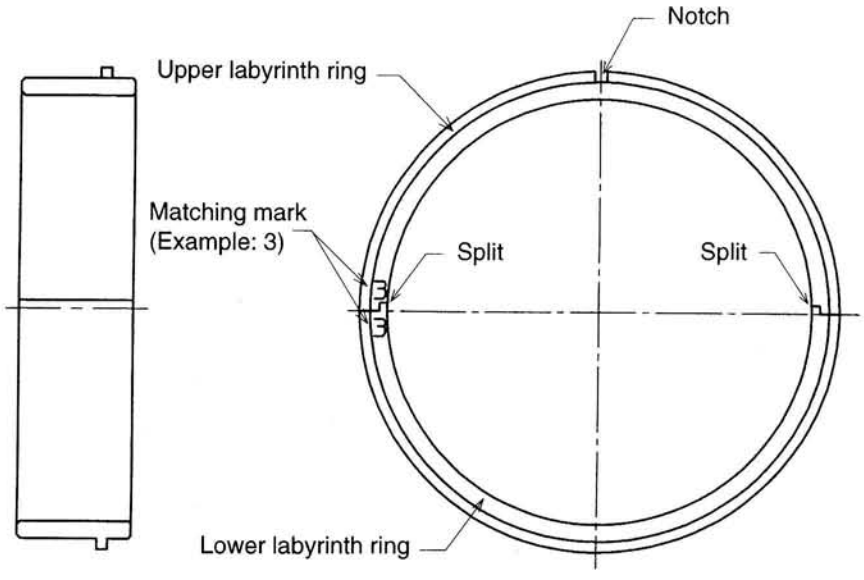


Fig. 4 Matching Mark on Labyrinth Ring

2.4 Checking Quantities of Parts

Check the quantities of bearings, housings, and other parts by referring to the JTEKT drawings.

3. Bearing and Housing Installation Procedure

3.1 Pretreatment of Roll Necks

Apply molybdenum disulfide lightly to the roll neck (shaded portion in Fig. 5).

Fill the labyrinth groove in the roll neck with grease.

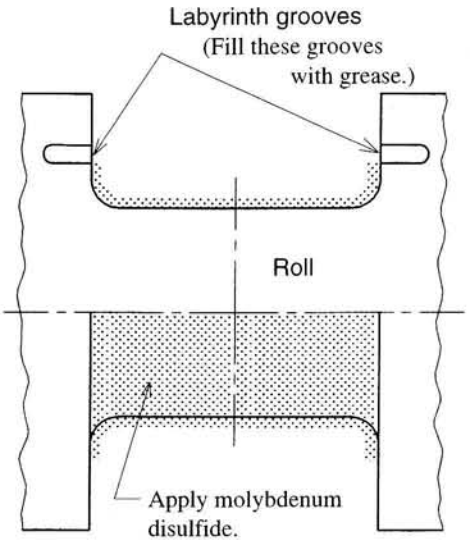


Fig. 5 Pretreatment of Roll Neck

3.2 Installation of Inner Ring

1) Remove four hexagon socket head cap screws fastening the inner ring.

   Take care that the removed hexagon socket head cap screws are not contaminated by oil or grease.

2) Apply molybdenum disulfide lightly to the inside surfaces of the inner ring.

   Take care to prevent molybdenum disulfide from being deposited on any threaded hole in the inner ring.

3) Degrease the split surfaces on the inner ring with cleaning solvent.

   Apply liquid packing on the split surfaces (shaded portion in Fig. 6).

   Air-dry the liquid packing after application (until it is touch-dry).

4) Install the half inner ring with threaded holes to the center of the roll neck from below. Fit the half inner ring with screw seats from above.

   Fasten temporarily the upper and lower halves of the inner ring with hexagon socket head cap screws (see Fig. 7).

   If the lower half of the inner ring is too heavy to support by hand, use the small jack.

5) Check the axial clearances between the roll neck and inner ring, which should be 0.5 mm on one side, to ensure that the inner ring is located at the center of the roll neck.

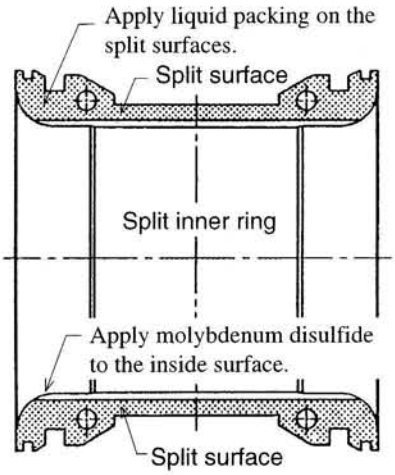
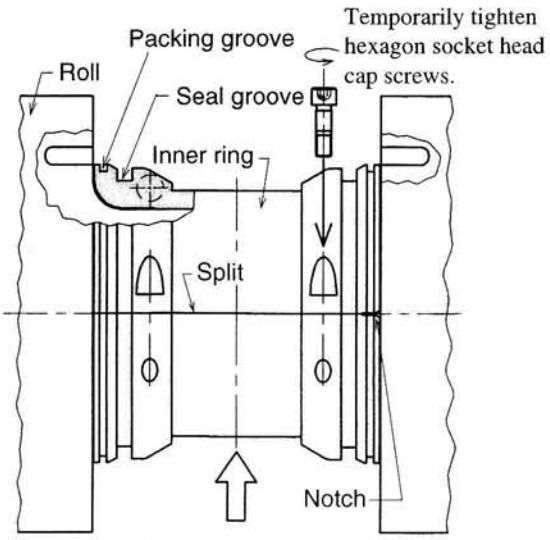


Fig. 6 Pretreatment of Inner Ring



Support the half inner ring with threaded holes until temporary tightening of screws is finished.

Fig. 7 Installation of Inner Ring

After checking that the inner ring is correctly positioned, tighten the four hexagon socket head cap screws in a diagonal sequence in two to three cycles.

Finally, tighten them with the torque wrench to the specified torque.

See Table 4 at the end of this document for the tightening torque for hexagon socket head cap screws.

6) After the hexagon socket head cap screws have been tightened, remove excess liquid packing squeezed out from the split of the inner ring.
7) Make sure that the inner ring has been properly installed on the roll, by rolling a greased roller or sliding a finger on the raceway surface.

There should be no step at the split of the inner ring (see Fig. 8).

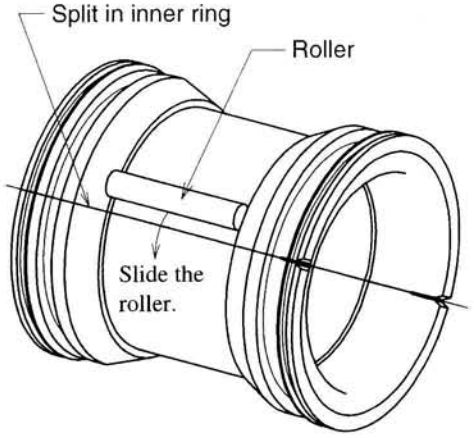


Fig. 8 Inspection of Inner Ring Installation Condition

Warning

Lightly touch the inner ring to check it with a finger. Do not slide your finger in the direction of the split (axial direction).

Doing so may cause injury.

8) If there is a step at the split of the inner ring, examine its serial number again.

Check the inner ring to see if the upper half or lower half is installed in the wrong direction or there is a disparity in the serial number.

Other possible causes include foreign matters caught between split surfaces of the inner ring.

Consult Koyo if the step is not caused by any of the above factors.

3.3 Packing Installation

1) Fill packing grooves (side grooves) in the inner ring with the grease used for the bearing.
2) Fit the packing to the groove so that the cut in the packing is at a 90° position from the split in the inner ring (see Fig. 9).

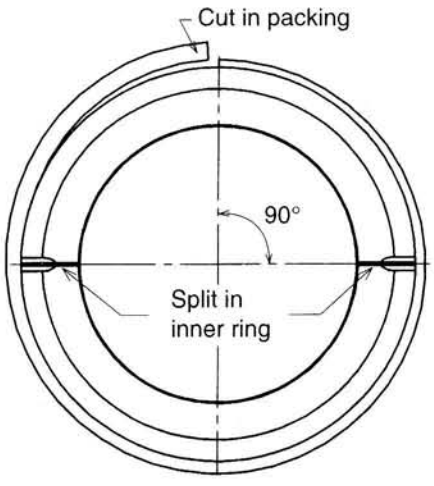


Fig. 9 Packing Installation

3) Finally, bond the surfaces on the cut of the packing together, with instant adhesive.

3.4 Oil Seal Installation

1) Clean the seal groove.
   Ensure that the seal groove is free of grease or oil.
2) Open the cut in the oil seal. Fit the oil seal in the seal groove in the inner ring ensuring the correct direction of the lips.
   In the installation, the cut should be at a 90° position from the split in the inner ring, as with the packing (see Fig. 10).
3) Press the oil seal into the seal groove bit by bit.
   When installed, the oil seal should be free of looseness or clearance at its cut.
4) Fit the spring around the oil seal.
   Hooks are provided at both ends of the spring. Use these hooks to fit the spring on the oil seal (see Fig. 11).
5) Check that the lips are directed as specified in Koyo drawing.
6) Apply grease to the circumferences of the packing and seal (shaded area in Fig. 10).

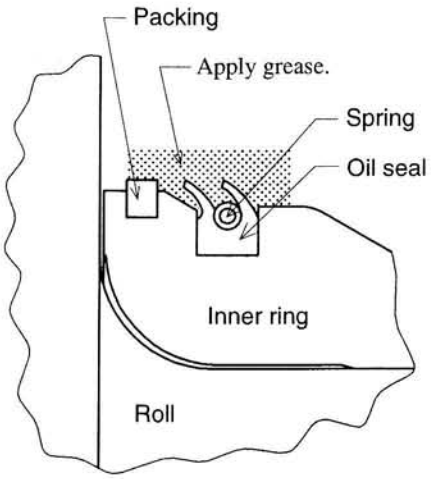
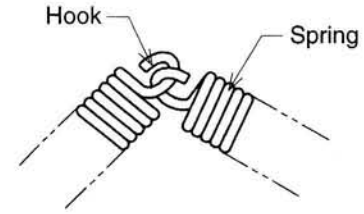


Fig. 10 Oil Seal Installation



Hooked into each other.

Fig. 11 Spring Installation

3.5 Installation of Bearing Outer Ring on Lower Housing

1) Apply molybdenum disulfide to the outer ring seating face (spherical seat) of the lower housing.
2) Fill the grease supply hole and grease groove in the lower housing.
3) Insert a dowel pin in the oval dowel hole in the bottom of the spherical seat of the lower housing.
4) Apply a suitable quantity of grease all over the outer ring (half ring). Place the outer ring (half ring) softly on the spherical seat of the lower housing.
   Place the outer ring in a direction perpendicular to the spherical seat of the lower housing (see Fig. 12, left). Then, turn the outer ring by 90°.
   This should allow the outer ring to fit into the lower housing smoothly.

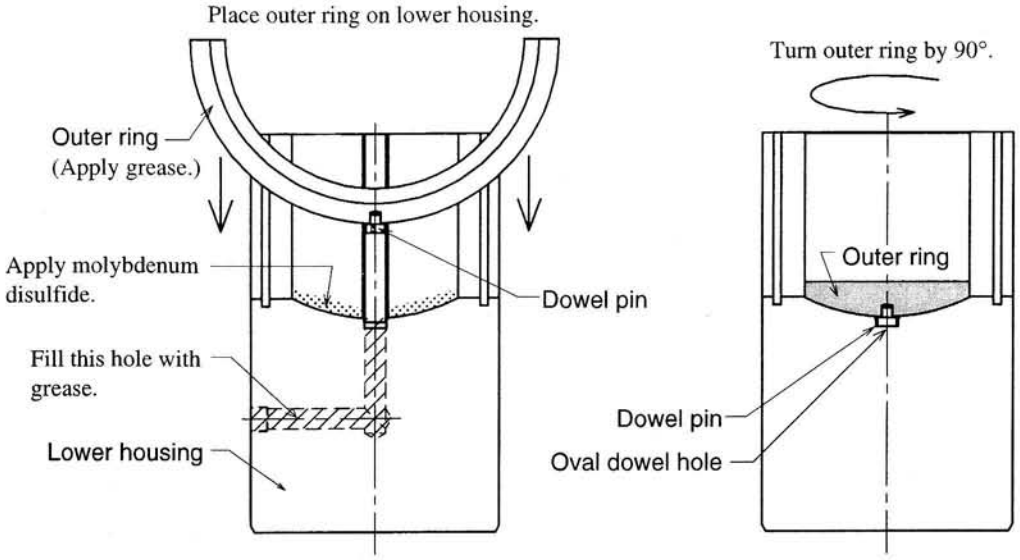


Fig. 12 Installation of Bearing Outer Ring to Lower Housing

3.6 Installation of Lower Housing and Lower Labyrinth Ringn

1) The labyrinth ring consists of two types of parts: upper half with notch and lower half without notch.

   Before installation, check the condition of the supplied labyrinth ring and the matching mark (see Fig. 13).

2) Degrease all surfaces of the upper labyrinth ring (with notch) with cleaning solvent.

   Apply liquid packing to the shaded area shown in Fig. 14.

   Air-dry the liquid packing after application (until it is touch-dry).

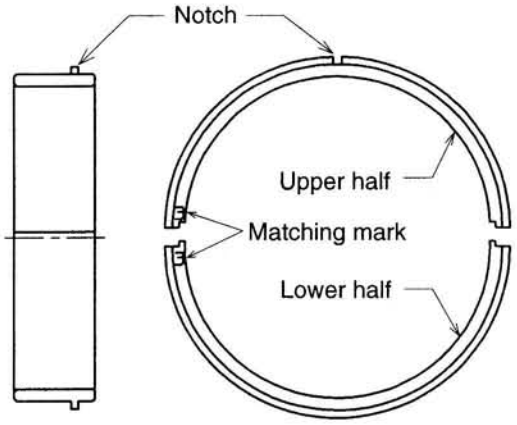


Fig. 13 Shape of Labyrinth Ring (Upper and Lower Halves)

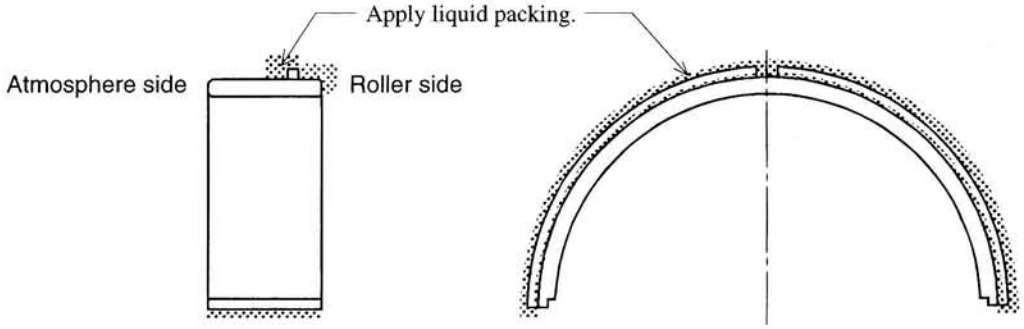


Fig. 14 Application of Liquid Packing to Upper Labyrinth Ring

3) In the case of equipment intended to collect used grease completely, so called 'Seal In Type', it is recommended to apply liquid packing additionally to the lower half of the labyrinth ring (see Fig. 15).

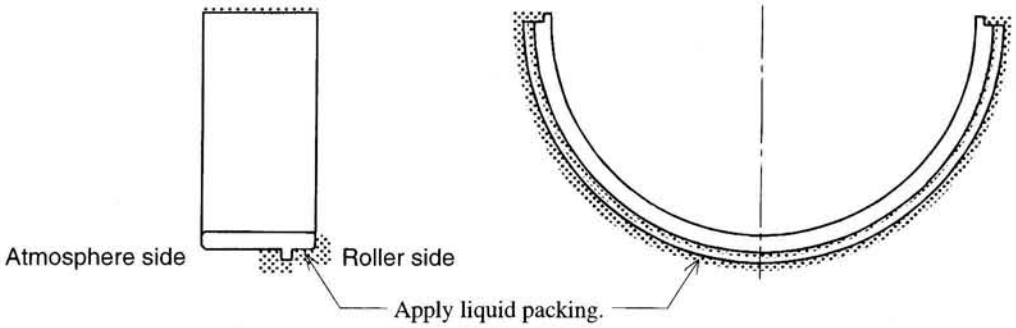


Fig. 15 Application of Liquid Packing to Lower Labyrinth Ring

4) Insert the lower labyrinth ring in the labyrinth groove in the roll.
   Exercise care to avoid dropping the labyrinth ring.
5) Jack up the lower housing gradually with the jack. Stop the jack when the lower housing comes in contact with the lower labyrinth ring (see Fig. 16).

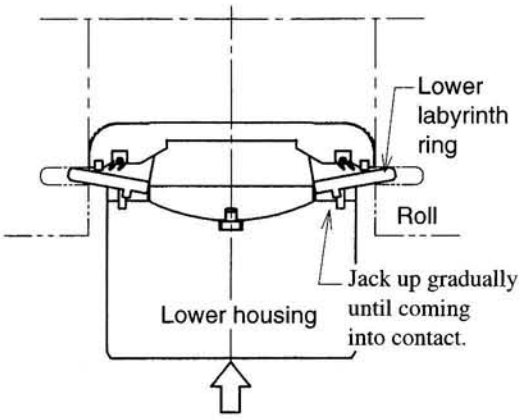


Fig. 16 Jacking Up Lower Housing

Warning

Carefully jack up the lower housing.
Excessive jacking up may cause damage to the labyrinth ring or the labyrinth groove in the housing.

6) Fit the labyrinth ring into the groove in the lower housing (at both ends) with hands.
   This fitting is carried out easily by looking at the parts from below.
7) Jack up the lower housing further by 3 to 5 mm.
   Ideally, there should be a clearance of the roller diameter 1 to 2 mm between the lower half of the inner ring and the raceway surface of the outer ring (see Fig. 17).

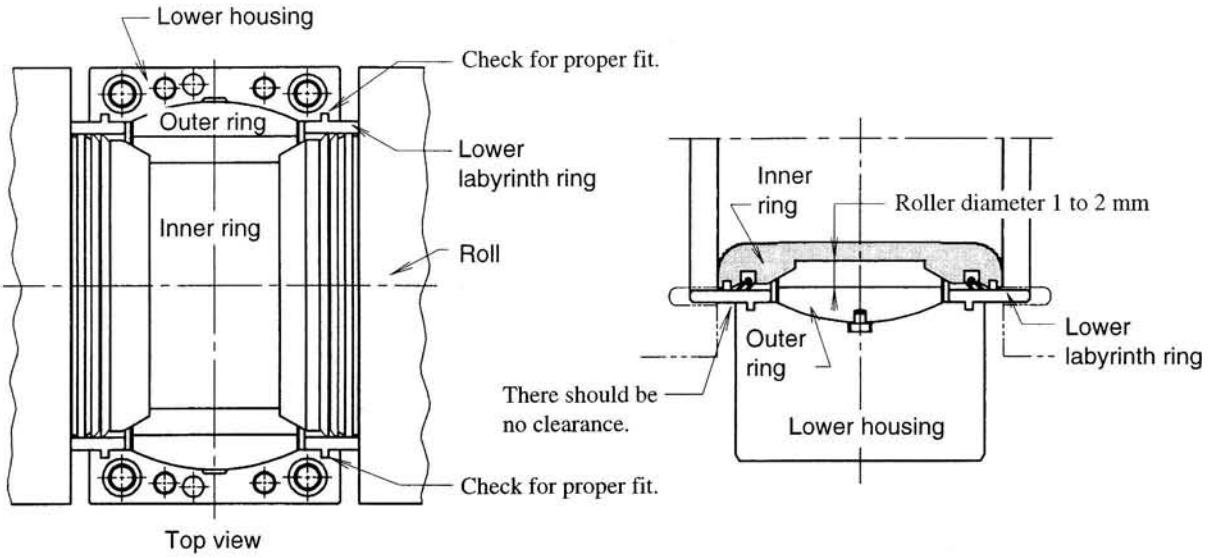


Fig. 17 Installation of Lower Housing and Lower Labyrinth Ring

3.7 Placement of Rollers

1) After the lower half of the housing has been set, place rollers between the raceway surfaces of the inner and outer rings.

Apply as much grease as possible to rollers. Fit in rollers one by one between the raceway surfaces of the inner and outer rings.

Insert them while sliding the raceway surfaces (see Fig. 18).

Caution

Rollers can slip off from the ribs of the inner ring if the lower housing has not been fully jacked up. Exercise great care in the placement of rollers.

2) After rollers have been inserted for the lower half of the bearing, press the rollers on both ends to make sure that the rollers move lightly (see Fig. 19).

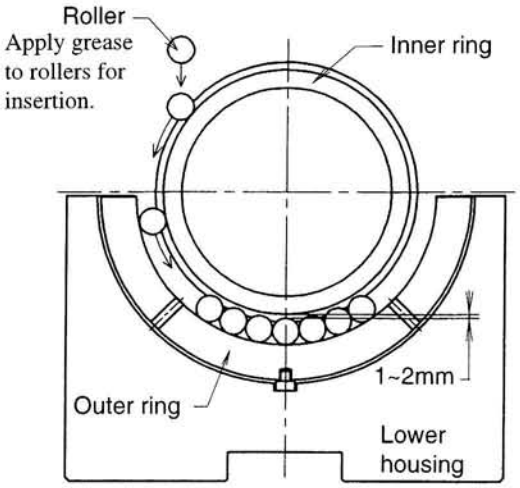


Fig. 18 Placement of Rollers for Lower Half of Bearing

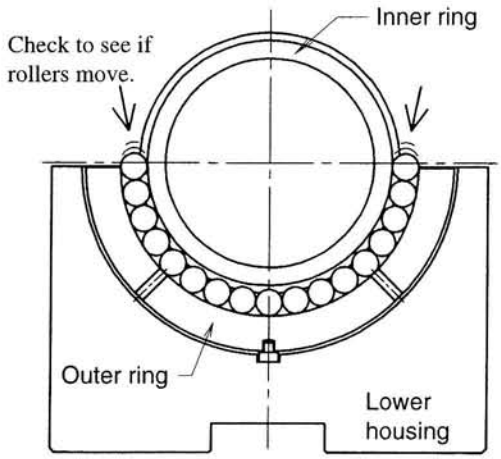


Fig. 19 Roller Movement Check

3) After checking that the rollers move smoothly, jack up the lower housing until the rollers do not move.

This eliminates the clearance for the lower half of the bearing.

4) As the next step, pile up the remaining rollers for the upper half of the bearing on the raceway surface of the inner ring (see Fig. 20).

Caution

Apply grease sparingly to the two or three rollers above the split surface of the housing so as to prevent contamination of the split surfaces with grease.

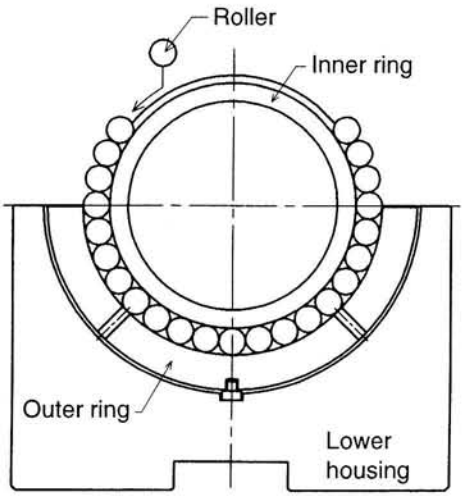


Fig. 20 Placement of Rollers for Upper Half of Bearing

3.8 Installation of Upper Labyrinth Ring

Insert the upper half of the labyrinth ring (with notch and application of liquid packing) into the labyrinth groove in the roll.

Install the upper half of the labyrinth ring so that the split surfaces of the upper and lower labyrinth ring mate with each other (see Fig. 21).

Caution

Make sure that the matching mark on the upper labyrinth ring is the same as that on the lower labyrinth ring and that the notch in the upper labyrinth ring is at the top.

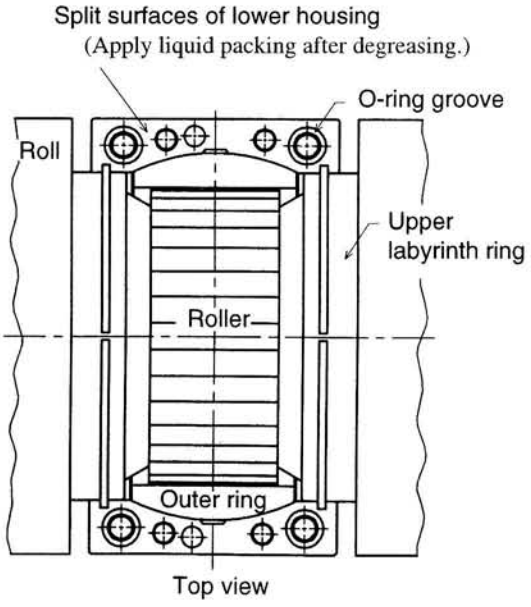


Fig. 21 Installation of Upper Labyrinth Ring

3.9 Installation of Upper Housing

1) Degrease the split surfaces of the lower half of the housing. Apply liquid packing lightly and evenly.

   Spread the liquid packing equally with fingertips with care. Exercise care to avoid entry of the liquid packing into the O-ring groove or a screw hole during this process.
2) After it has been ensured that the liquid packing is touch-dry, fit an O-ring into the O-ring groove in the lower half of the housing.
3) Degrease the split surfaces of the upper half of the housing. Then, apply grease to the center of the inside surface (raceway surface of the bearing).
4) Check the following at this time.
   a. O-ring fitting condition
   b. Notch position of the labyrinth ring
   c. Installation condition of the upper and lower labyrinth ring
   d. Presence or absence of parallel pins at the center of the labyrinth groove in the upper housing
5) While paying attention to the installation conditions of the labyrinth ring and oil seal, place the upper housing over the lower housing (see Fig. 22).
6) Press the upper housing lightly from above to check that the clearance decreases at the split between the upper and the lower housing. If this clearance does not decrease, improper fitting of the labyrinth ring into the labyrinth groove is a probable cause.

   Remove the upper housing. Fit the labyrinth ring properly into the labyrinth groove and reinstall.
7) Fasten the upper and lower housing with hexagon socket head cap screws.

   Tighten the four hexagon socket head cap screws equally in a diagonal sequence in two to three cycles. Finally, use the torque wrench to tighten the hexagon socket head cap screws to the specified torque.

   See Table 4 at the end of this document for the tightening torque for the hexagon socket head cap screws.

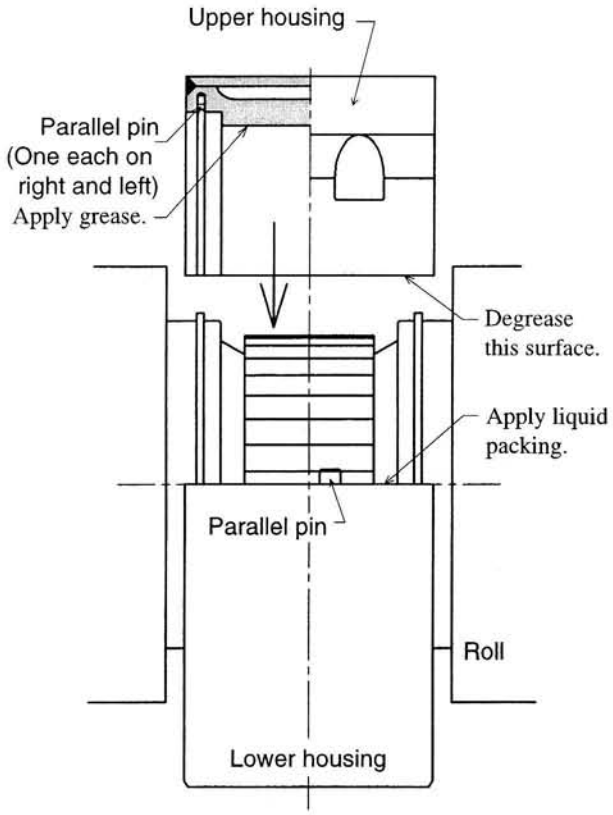


Fig. 22 Installation of Upper Housing

3.10 Final Inspection

1) Remove the jack supporting the housing. Roll the entire housing lightly to check that the bearing rotates smoothly and there is not any unusual condition in the torque.
2) Finally, check that no parts remain for the one set of the bearing unit provided at the beginning.

Caution

If the housing is not placed at the center of the roll neck, the deviation should be corrected.

To do so, make adjustments while rotating the bearing (this is intended to run in the bearing).

4. Initial Quantity of Grease Filling and Cooling Water Quantity

1) Comply with the JTEKT drawings with regard to the initial quantity of grease filling and the minimum required quantity of cooling water for one bearing unit set.
2) If the initial quantity of grease filling is not shown on the drawing, calculate the quantity of the grease filling by the following equation.

$$G = 0.43B\,(R^2 - d^2) + 0.22b\,(D^2 - R^2) - 0.07W$$

where,

G : initial quantity of grease filling (g)
B : inner ring width (cm)
R : inner ring outside diameter (cm)
d : inner ring bore diameter (cm)
b : outer ring width (cm)
D : outer ring outside diameter (cm)
W : bearing mass (g)

5. Spare Parts

It is recommended to replace the parts shown in Table 3 with new parts at every periodic inspection.

Table 3 Periodic Replacement Parts

Part	Material	Manufacturer name
O-ring	Fluoro rubber	Commercially available
Oil seal	H-NBR	JTEKT CORPORATION
Packing	PTFE + fluoro rubber	JTEKT CORPORATION
Labyrinth ring	Mild carbon steel + chrome plating	JTEKT CORPORATION

6. Miscellaneous Notes

(1) Notes on grease supply

1) Supplying grease immediately after assembly

A reduced quantity of grease may be filled during the assembly of the bearing unit for improved workability. Grease can be supplemented immediately after the assembly, but this may cause an unusual increase in the internal pressure of the housing.

Therefore, if grease is supplemented immediately after the assembly, release the internal pressure to the following acceptable level.

Acceptable internal pressure in housing at rest.

A) $\leqq$ 3 MPa {30 kgf/cm^2}, if used grease is not be collected (So called 'Seal Out Type').
B) $\leqq$ 1 MPa {10 kgf/cm^2}, if used grease is collected (So called 'Seal In Type').

Follow the procedure below to supplement grease.

① If used grease is not to be collected, Seal Out Type, and the bearing has a grease drain plug:

Remove the grease drain plug and supplement grease only when grease is supplemented immediately after assembly.

After grease has been supplemented and the grease draining from the drain hole has stopped completely, reinstall the grease drain plug.

② If used grease is not to be collected, Seal Out Type, and the bearing does not has a grease drain plug:

Fill a specified quantity of grease during assembly work for this type of bearing structure. Supplement grease immediately after assembly is prohibited.

③ If used grease is to be collected, Seal In Type:

Follow the same procedure as in ①. If grease is supplemented with the grease drain connected with pipe, however, supplement grease while referring to the pressure gauge on the grease drain piping. Confirm the internal pressure in the housing taking into account of loss of the pressure in the pipe.

2) Supplementing grease to bearing in operation

① Supplement grease to the bearing type in which used grease is not to be collected, Seal Out Type, at a rate of 1.6 cc/10 min to 3 cc/20 min, as a standard.

② If the bearing type is such that used grease is to be collected, Seal In Type, and the seal lips are directed inward, supplement a small quantity of grease in short intervals, since the internal pressure of the housing increases during the grease supplement.

Supplement grease to the bearing type in which used grease is to be collected, Seal In Type, at a rate of 0.8 cc/10 min to 1.5 cc/20 min, as a standard.

③ Determine the optimum quantity and period for supplementing grease so that the internal pressure of the housing in operation meets the requirement of acceptable internal pressure $\leqq$ 0.3 MPa {3 kgf/cm^2}.

If the internal pressure of the housing is continuously high during operation, the grease may leak through the split of the bearing unit or the oil seal may be broken early.

(2) Notes on the roll coming to a standstill

If the roll comes to a standstill while the machine is in operation, continue to supply grease and cooling water to the bearing unit as long as a slab is present.

(3) Notes on maintenance of segments

Bearings and housings removed at a maintenance worksite during maintenance of segments should be cleaned, greased, and reassembled as promptly as possible.

Store reassembled bearings and housings in a suitable location.

Table 4 Tightening Torques for Hexagon Socket Head Cap Screws

Nominal size of screw	Tightening torque, N · m	
	For fastening inner ring	For fastening housing
M 6	7.85 ~ 9.81	—
M 8	20.6 ~ 24.5	—
M 10	39.2 ~ 49.0	53.9 ~ 63.7
M 12	73.5 ~ 83.4	93.2 ~ 103
M 16	157 ~ 196	226 ~ 265
M 20	—	451 ~ 510
M 24	—	775 ~ 873

MEMO

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CAT.NO. B3006E
Issue Date 2006. 4