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LYC BEARING CORPORATION

■ LYC Import & Export Corp.
96 Jianshe Road, Jianxi District,
Luoyang, Henan, China 471039
Tel: +86-379-64984176
Fax: +86-379-64912225
Email: sales@lycbearing.com
Http://www.lycbearing.com

■ LYC North America Inc.
2600 Keslinger Road, Unit H
P.O.Box 150
Geneva, IL 60134, USA
Tel: 630-262-0601
Fax: 630-578-0712
Email: sales@lycbearings.com
Http://www.lycbearings.com

Roll Neck Bearings
Installation and Maintenance Manual

LYC BEARING CORPORATION

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LYC®

1. General information

LYC's continual research and development have led to improvements of their roll neck bearing technology, this has resulted in improved functionality and improved performance. This has also been enhanced by improved quality standards, resulting in a greater demand for LYC's roll neck bearings.

In order to meet this market demand LYC has a great R&D in the reliability of roll neck bearings, and makes significant progress. LYC's advanced concept design, improved materials and automated processing, enhance the bearings load capability, fatigue resistance, impact resistance and high temperature resistance, consequently, the bearings operating reliability has been improved considerably.

With respect to bearing application, if the mounting and maintenance are performed incorrectly then the aforementioned function of bearings will become worthless and will invariably lead to premature bearing failure.

In order to provide LYC's bearing users with a better understanding of the functionality of LYC's roll neck bearings, we have set forth in publishing this mounting instruction for roll neck bearings, this instruction is inclusive of the four-row cylindrical roller bearings, four-row taper roller bearings, sealed four-row taper roller bearings, double-row taper roller bearings, and the double direction thrust roller bearings, all of which are widely used in the steel Industry.

The useful life of any bearing depends to a great extent on the correct installation and proper maintenance it receives.

Please read these instructions carefully before starting the mounting procedure. Make sure that the assembly and mounting

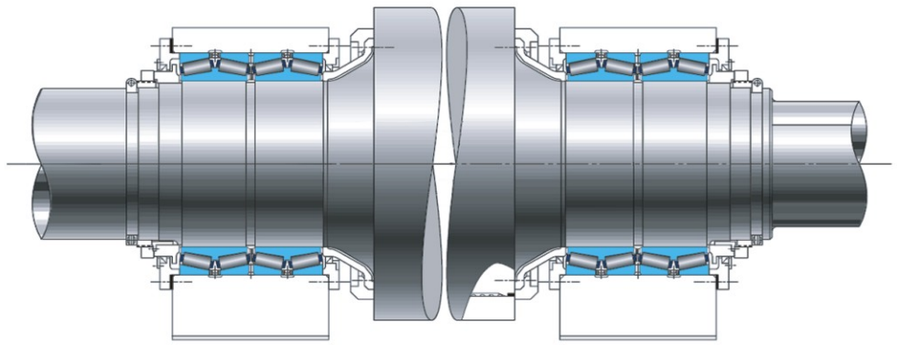

Fig. 1-1 : Roll neck bearings

2. Preparations for mounting

Confirm that the bearing to be mounted is the correct one for the application.

Prepare the assembly drawings of the roll neck and chock, and make the bearing assembly process and order.

Choose suitable inspection instruments, mounting tools and lifting devices based on the bearing design and type. These tools should include: Vernier caliper, feeler gauge, external micrometer, inside screw micrometer, infrared thermometer, vibration meter, electromagnetic induction heater etc.

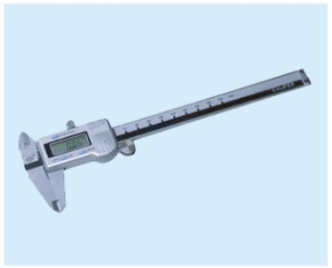

Fig. 2-1 : Vernier caliper

Fig. 2- 2 : Feeler gauge

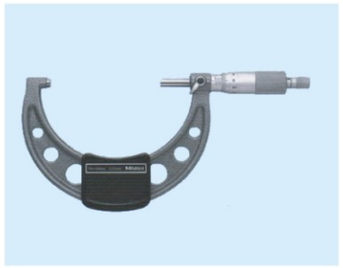

Fig. 2- 3 : External micrometer

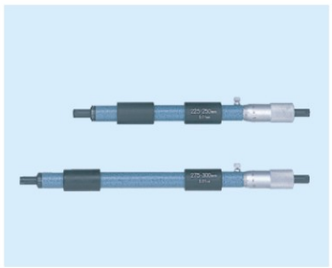

Fig. 2-4 : Internal screw micrometer

Fig. 2- 5 : Vibration meter

Fig. 2- 6 : Infrared Thermometer

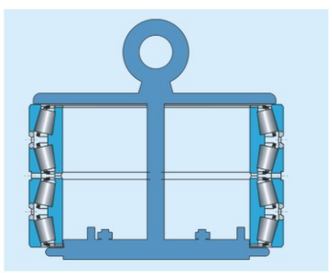

Fig. 2-7 : Lifting device for assembly bearing

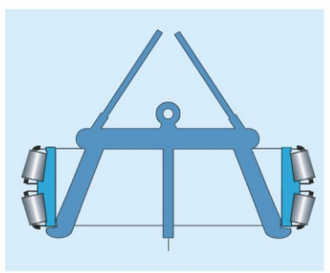

Fig. 2-8 : Lifting device for inner ring

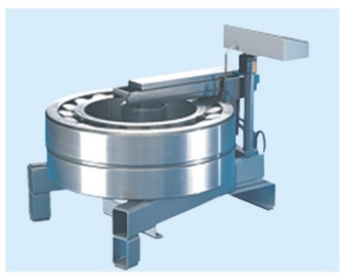

Fig. 2-9 : Electromagnetic induction heater

3. Installation precautions

Open the package and check the bearing's number carefully, one side of the inner ring or the outer ring is marked with the LYC brand name and part number.

Ensure that the bearing is kept clean at all times, contamination of the bearing's lubricant will result in a shortened service life. There is no need to remove the antirust oil of the new bearing. If the grease could not be compatible with the antrust oil, the bearing should be cleaned and dried to prevent the adverse chemical reaction. The bearings with shield or seal have no need to clean.

The mounting area should be clean and dry, ensure there is no scrap, dust or moisture which could enter the bearing.

Carefully clean and check the mating surface of chock and roll neck. Use kerosene or compressed air to clean out the lubricating hole and the oil gallery.

Check the related component dimensions and tolerance according to the drawing. Double check the dimensions and roundness of the roll neck and chock. During the assembly of bearing, it should prevent the bearing from early failure resulted from the over tight or over loose fit.

To obtain accurate dimensional and form measurement results, the following measurements must be conducted:

In the place of 10mm inward from the bearing end face (at the place of bearing mounting surface), the roll necks must be measured in three cross sections (along the bearing seat) and the chock bores must be measured in four cross sections. All measurements must be carried out on four diameters each (offset by 45°).

If there is small damage or wear on the mating surface, can sometimes be repaired carefully. Bearing should be installed if all components completely meet the requirements of the drawing. (Fig.3-1,3-2, Table1,2)

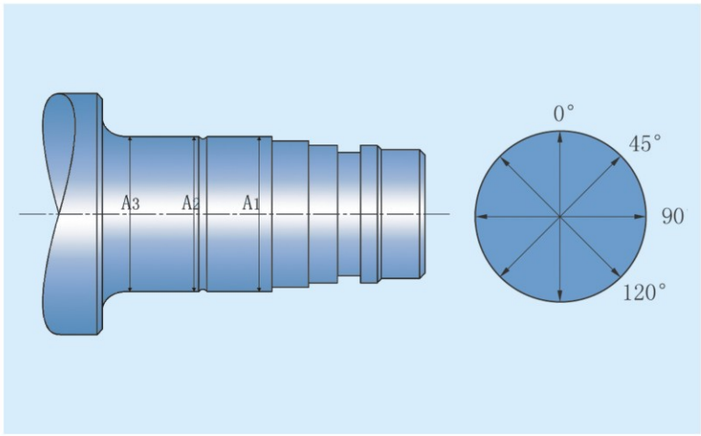

Fig. 3-1 : Measuring points for checking the roll neck

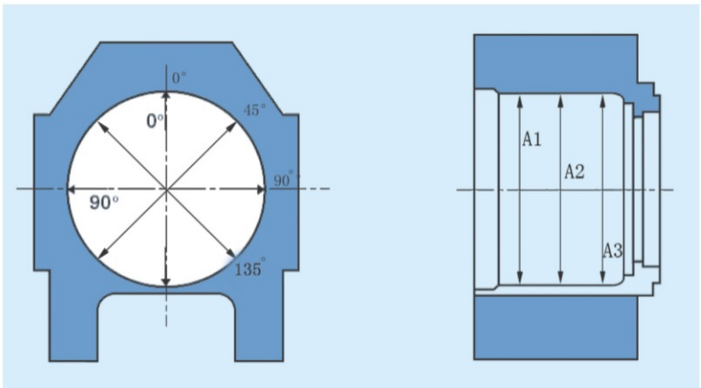

Fig. 3-2 : Measuring points for checking the chock

Table 1 : Roll neck check card Table No: Date:

Position	Drive end				Average value	Operate end				Average value
	0°	45°	90°	135°		0°	45°	90°	135°	
A1										
A2										
A3										

Table 2 : chock check card Table No. Date:

Position	0°	45°	90°	135°	Average value
A1					
A2					
A3					

Remove any burrs or sharp corners from any working surface. If there is serious damage then repairs must be made before assembly. The mounting surface of bearing need to be grinding, and the surface roughness could not be in excess of Ra1.6. If any surface cannot be ground then the roughness must be less than Ra 3.2 after fine turning. The two mating surfaces of bearing for the roll neck need to be processed in one time to ensure their concentricity with each other.

The shaft's shoulder and the bearings saddle bore shoulder contacting bearing should be vertical with the shaft, and the fillet of shoulders must be less than that of bearing end face. When being out of the vertical orientation it is possible that the loads could easily concentrate on some of bearing rolling elements, this can lead to creeping, too much stress on the raceways, which could result in deformation and reduce the bearings working life.

The internal clearance of rolling bearing when running can greatly affect the bearing performance such as fatigue life, vibration, noise, temperature rises etc.

Consequently, it is very important for bearing using correct original clearance, as well as the calculated mounting clearance and working clearance. Therefore, it is necessary to verify the bearing clearance during its assembly, and ensure that radial and axial clearance are correct, and guarantee the average loaded between each row of rolling elements and raceway of multi-row bearing to prevent from abnormal noise, heat and stuck.

For cold mounting, It should coat a thin layer of machine oil on the mating face of qualified roll neck and chock when mounting bearings, Remove oil or rust inhibitor from parts if heat mounting.

The installation method for each bearing is determined by its structure and matching requirement, the main objective being to avoid damage to any part of the bearing during installation. When multi-row bearings are being installed, additional attention must be paid to the installation order and position line of the loading zone. Don't install in wrong order. Otherwise, it will result in the non-uniform loading of rolling elements or shorten the bearing life.

Common installation methods: Pressure Method and Thermal Expansion Method.

When using the pressure method, strictly forbid to transfer the impact force through the rolling elements, in order to avoid the damage of rolling elements or raceway. If any additional impact force should be required (hammer) ,then a copper rod or other sleeve undamaged to the bearing should be used. Meanwhile, hitting power should be evenly distributed on the face of housing with interference fit. Bearing breakage or raceway damage resulted from excessively strong impacts should be avoided. (Fig.3-3)

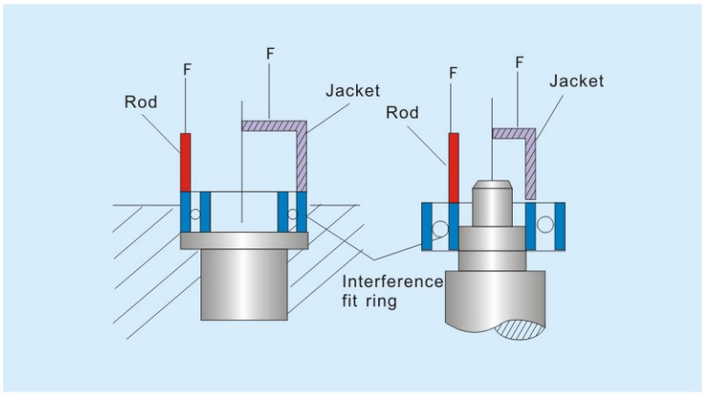

Fig. 3-3 : Pressure Method

When using the thermal expansion method, make the bearing expand in the oil with the temperature within 100℃, and pay attention that never make the temperature over 120℃. A 50-70 mm multi-hole iron plate should be placed under the bearing within the oil tank, this will prevent the bearing from touching the bottom of the oil tank. (Fig 3-4).

When using electromagnetic induction heating, it is important to apply demagnetization afterwards; this type of thermal expansion method should not be applied to bearings with integral seals, as damage will occur to the seal. When pre-heating to the desired temperature has been achieved then the bearing should be removed and installed to its axial location without delay and mounted. After installation the bearing should be allowed to cool naturally and completely, quenching is not allowed.

During the process of Installation, it should pay attention to the matching dimension and centering. If the bearing is inclined then beat lightly with a copper rod to revise its position. Don't force to inclined installation.

For the seals of bearings, no matter external seal or the internal seal, if any damages to seals occur then the seals must be replaced. Prevent water and any other impurities from entering the bearing .

For the bearing with grease lubrication, it should ingect1/2～2/3 of the internal space of bearing according to the bearing running speed. And please pay attention that excessive grease will result in high temperature.

When the same part is tightened by several screws or bolts, each screw (bolt)should be tightened cross symmetrically in clockwise. If a locating pin is used, the bolt which is closest to the locating pin should be first. (Fig 3-5)

Check whether the bearing is installed correctly. After installation, make the pilot running inspection under the condition of effective lubrication and seal in the following order.

- Under the position of no-load, run for 30 minutes at low-speed, examine the noise, vibration or any abnormal rise in temperature.
- Under the position of 30% load, run for 1 hour at low-speed, examine the noise, vibration or any abnormal rise in temperature.
- Under the position of 60% load, run for 2 hours at mid-speed, examine the noise, vibration or any abnormal rise in temperature.
- Run for 2 hours under the position of normal load, examine the noise, vibration or any abnormal rise in temperature.

During the process of trial running if the noise, vibration and temperature rising are all in order, the bearing could be put into use. Otherwise, it should be stopped running to check the reason of abnormal .

CAUTION:

Do not install bearings with steel rods or beat the bearing surface directly.

Do not heat bearings by gas welding torch directly. (Fig.3-6)

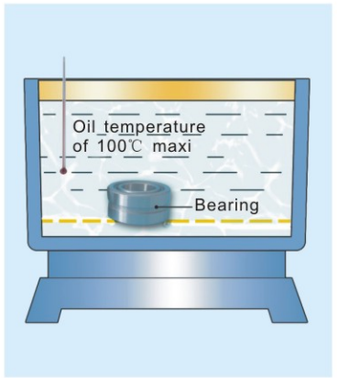

Fig. 3-4 :Thermal oil expansion method

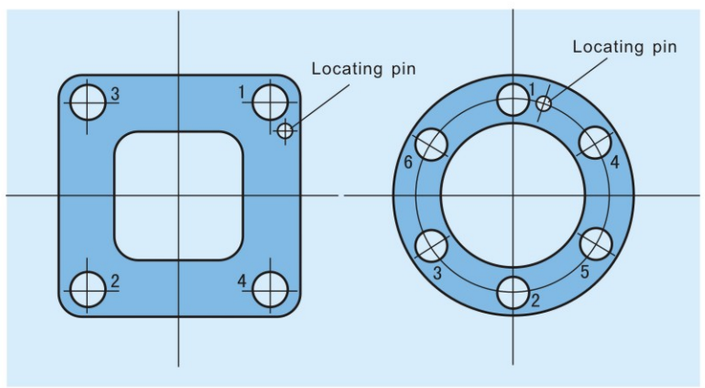

Fig. 3-5 Locating pin

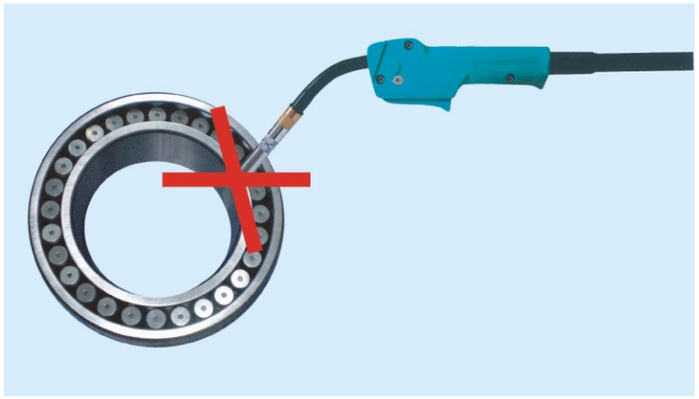

Fig. 3-6: ~~Failure to~~ heat bearings by gas welding torch directly

4. Mounting of four-row cylindrical roller bearings

These types of bearing are designed to carry only radial force; can't bear axial forces, consequently, the four-row cylindrical roller bearing must always be matched with an axial locating bearing. (matching with an angle contact ball bearings or tapered thrust roller bearings) (Fig 4-1)

The cage are usually either:
Brass solid cage
Pin-type cage.

Bearing designation, series no., as well as balance mark , load position no. should be marked on the ring end face. Balance mark (A to D) indicates the assembling position for each component, the correct assembling position will ensure mutual consistency of each row clearance, perform an optimum performance with the largest load. If the components in a wrong assembling order, it will cause unequal clearance for each row, then the bearing will be led to over heating as unbalance loading or partial undersize clearance during bearing application. If the bearing

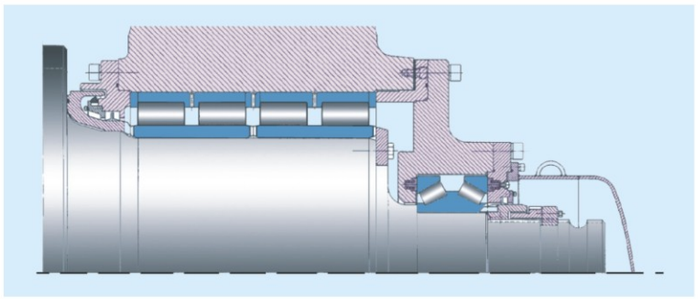

Fig. 4-1: Mounting of four-row cylindrical roller bearing

clearance is too large, then the bearing life will be shorten and appear fatigue spalling as the loading area of raceway is narrowed (Fig.4-2). Load zone nos. are equally marked on the end face of outer ring (if the outer ring is running ring, the nos. marked on the end face of inner ring). In order to extend the bearing service life, while each service bearing disassembly and cleaning, changing the load zone. (Fig.4-3).

Fig. 4-3 : Change the Load Zone

Before mounting, the bearing should be measured by gauge to identify the original radial clearance, then calculate the working clearance to ensure that this will meet the working requirement. It can avoid the appearance of the early fatigue spalling of the bearing, heating and damage caused by too small a clearance or overload on part of bearing raceway caused by an oversize clearance. (Fig 4-4)

Fig. 4-4 : Bearing clearance measurement

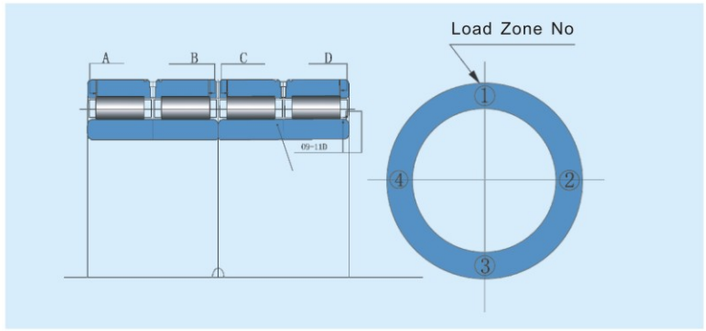

Fig. 4-2 : Mark for four row cylindrical roller bearing

The inner ring raceway of the four-row cylindrical roller bearing maintains a cylindrical surface, to provide for a better mount and dismount with the outer ring units. The bore of inner ring and roll neck adopt an interference fit, the outer ring's OD and the bearing housing adopt a loose fit. The bearings clearance usually adopts a C3. When assembling the bearing, the dimensions (Table 3) of the roll neck and chock are recommended to be used.

The preferred method to mount the inner ring on to the shaft is to use an induction heater and sleeve (its width is the same as the 2pcs inner rings). The OD of the sleeve provides a ladder action, which can push the inner ring on to the roll neck easily. Besides the sleeve with a larger OD this is usually used to mount the outer ring and the rolling elements.

- Mounting the inner ring. Firstly place the inner ring onto the sleeve, install them both onto the shaft after heating, then press close to the shaft shoulder until the assembly is cold. Then withdraw the tool, put in place the second inner ring after heating and push onto the shaft in the same manner. (Fig. 4-5)

Table 3. Normal roll and chock fit clearance as follows

Noninal bore diamerer and outside diameter (mm)		Roll neck diameter tolerance		Inside diameter tolerance of chock	
Over	Below	Max	Min	Max	Min
200	225	+109	+80 (r6)	+61	+15
225	250	+113	+84 (r6)	+61	+15
250	280	+126	+94 (r6)	+69	+17
280	305	+165	+130	+69	+17
315	355	+165	+130	+75	+18
355	400	+190	+150	+75	+18
400	450	+220	+170	+83	+20
450	500	+250	+190	+83	+20
500	560	+280	+210	+92	+22
560	630	+320	+250	+92	+22
630	710	+350	+270	+104	+24
710	800	+390	+310	+104	+24
800	900	+440	+350	+116	+26
900	1000	+480	+390	+116	+26
1000	1250	+530	+430	+133	+28

● When assembling the outer ring unit, lubricate the rollers and outer ring first, lubricate the fitting surface with oil, the fitting surface will be at the lowest point according to the mark on the cage A, lift the outer ring unit with the lifting hole on the cage A, aim at the load zone line between the bearing housing and the bearing, slowly insert this into the housing, if tilt occurs then gently tap the outer ring with a cooper bar to realign its direction, ensure that the bearing surfaces are in contact tightly with the rib of the bearing housing and that the assembly is moving into its correct position. Place the cage B , cage C and cage D in the same way, aim at the same load zone , place the roller unit and the outer ring assembly into the chock, the final step is the measurement, calculate the size of the end cap step, press the end cap tightly, (Fig. 4-6).

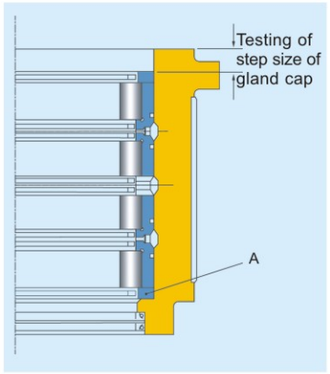

Fig. 4-6: assembly sequences of four-row cylindrical roller bearings

Finish the outer ring unit assembly, it is better to be equipped with a transition ring (the outer diameter of the transition ring should not larger than the outer diameter of the inner ring), place the inside rollers into the larger end of the mounting sleeve and put the sleeve on to the roll neck, horizontally arrange the sleeve when assembling, leveling the bearing housing, slightly dip the outer ring unit towards the outer diameter of the bearings inner ring with the transition ring. Do not deviate the unit with the outer diameter of the inner ring, deviation can cause roller damage to the raceway surfaces. Then mount the outer seal, and lock the bearing on to the roll neck.

For the roll neck bearings with a high requirement of plate thickness on steel plates, such as aluminum foil and cold mill sheet plate. In order to make the roll neck work in radial run-out to a minimum, the grinding allowance of the inner ring raceway surface should be kept in advance and grind the inner ring raceway surface and roll surfaces should simultaneously reach the required tolerance. Grinding process should be according to demand（drawing A, B, C, D.）

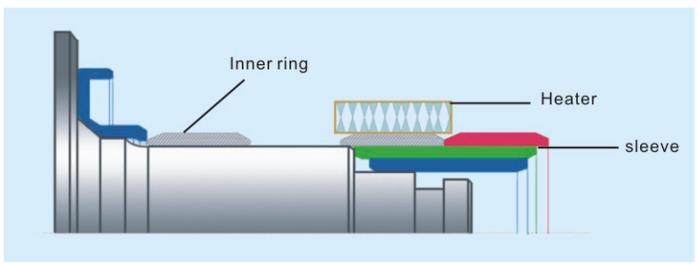

Fig. 4-5 : Mounting the bearing's outer ring & inner ring

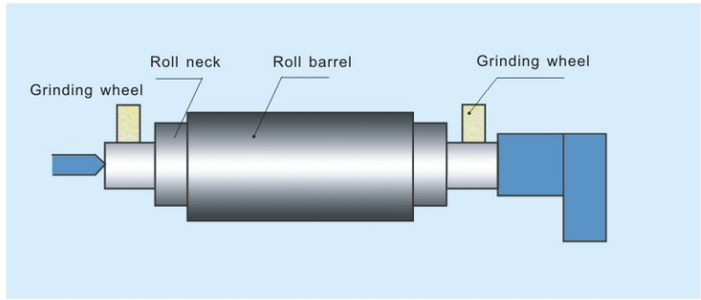

Fig. A: Grind the step of the roll neck as a reference surface, make sure that the roughness, radial run-out and concentricity are in compliance with the tolerance requirement after grinding.

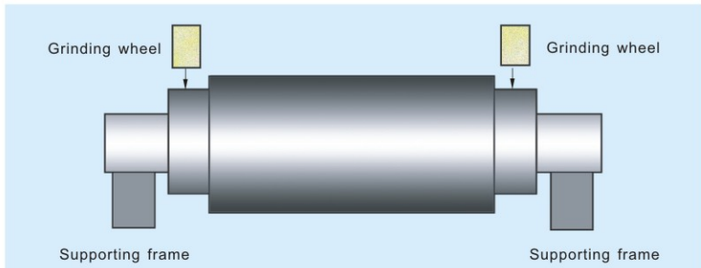

Fig. B: The step is now a reference surface, grinding the roll neck will allow you to mount the bearings, ensure that the roughness, radial run-out and concentricity are all in compliance with the tolerance requirements after grinding.

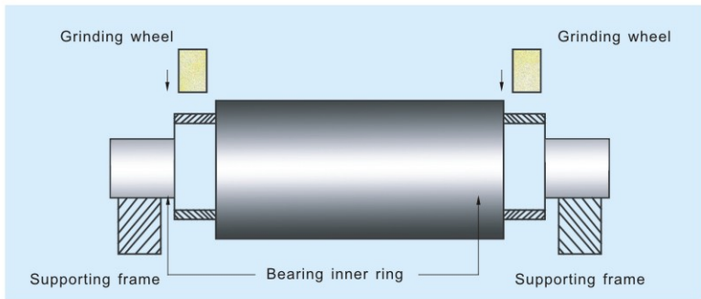

Fig. C: After grinding the roller neck surface to match the bearing, hot charging the bearing inner ring (generally use the induction heating method), grind the outer diameter of bearing inner ring after it has cooled completely. Make sure that the roughness, radial run-out and concentricity are in compliance with the tolerance requirements after grinding.

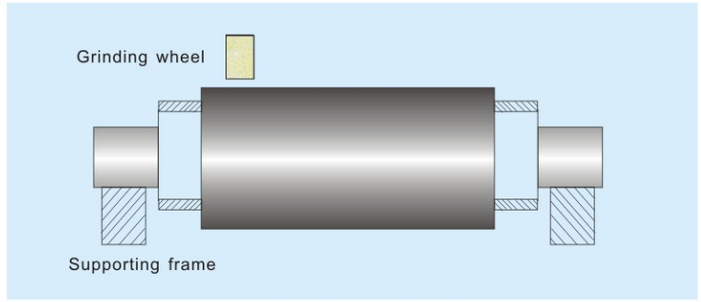

Fig. D: Finally, grind the roll neck surface, the dimension should conform to The tolerance requirements concentricity of outer diameter between Roller neck and the two bearing inner rings should comply with tolerance requirements.

If the interchangeability of the bearings inner ring required, then offer the diameter under the roller and the outer diameter of the inner ring dimension. This should be specified when the customer places the order.

CAUTION:

Ensure the mounting sequence is in the order as detailed above.

If bearings are to be interchanged, please unify the outer diameter of the inner ring.

5. Mounting of double-row tapered roller bearings

These types of bearing are primarily use where heavy axial forces are applied, there should be enough clearance between the bearing and the bearing housing so as to keep the bearing from experiencing radial load during assembly, the axial position provides the axial force to the roll neck when in the working condition.

General structure: Double-row tapered roller bearings with an outer spacer and two-row tapered roller bearings without an outer spacer. (Fig.5-1,5-2)

For the bearing with an outer spacer, the end cap should be pressed tightly with the bearing face when mounting, the bearing without an outer spacer should be provided with a pre-load spring between the shoulder of the chock and the outer ring face, this provides the bearing with a pre-load during its working condition. It should be applied with a loose fit of 0.3mm to 1.0mm between the inner ring and shaft, in order to avoid the inner ring from creeping on the shaft. generally open a locating slot on the inner ring face. (Fig 5-3)

Clearance adjustment of the bearing with the spring on the end face.

In general the condition of the bearing without out a spacer pre-loaded by a spring. Assembly of the bearing should be in accordance with the following diagram. Do not assemble the spring first, lock the nut of end cap, temporarily measure the clearance in the four points within the circle equally; the spaced values should be averaged. Disconnect the end cup, mount the spring, place the bearing in with the spring and maintain an allowance: Washer

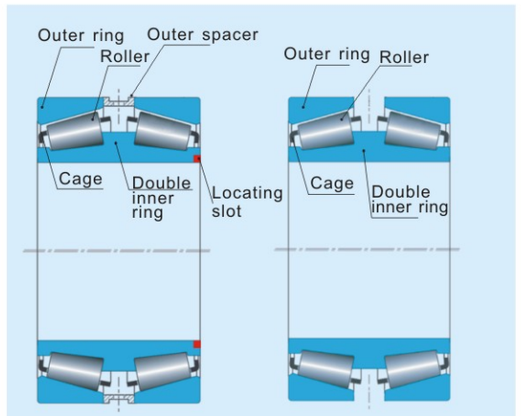

Fig. 5-1 Fig. 5-2

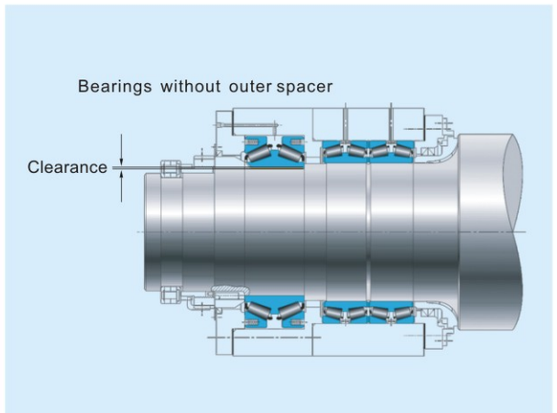

Fig. 5-3 : Locating bearing loose fit

thickness. If the washer used is not metallic, then take into account the washer shrinkage calculation, as detailed below. (Fig. 5-4 Fig5-5)

Spring allowance:
△a =0.4-0.6 mm,
Washer thickness:
T = △a +△h

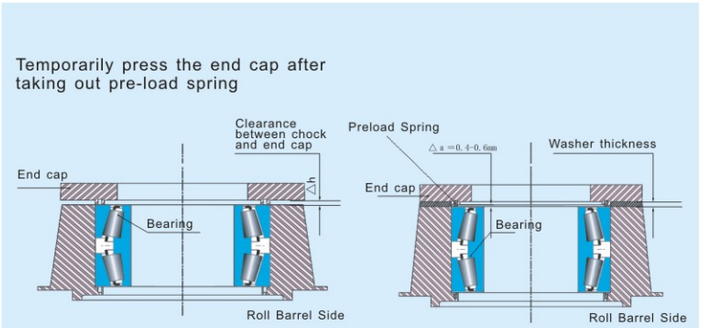

Fig. 5-4 Fig5-5 :The clearance adjustment for pre-load spring

6. Mounting of double-row thrust tapered roller bearings

The bearings of these type can carry pure axial forces from two directions, and offer a higher axial load capacity over two-row tapered roller bearings with a larger contact angle. Under the condition of high load and impact load, then springs between the chock shoulder and the cup face are provided, these provide the bearing with a pre-load in its working condition, and are able to locate during working.（(Fig. 6-1)

For assembly of bearings without pre-load springs to locate, the end cap of chock is tightly pressed on the bearing face when assembling. (Fig.6-2)

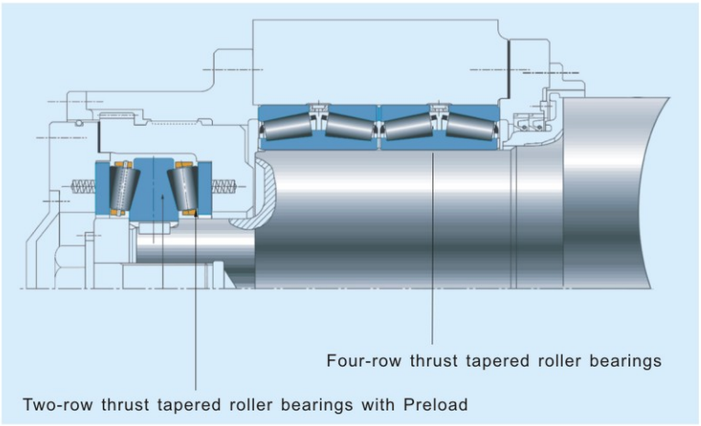

Fig. 6-1 Assembly diagram for thrust roller bearings

Clearance adjustment of the bearing with the spring on the end face

In general condition, bearings without outer spacer is pre-loaded by the springs. Assemble the bearing in accordance with the following diagram, do not assemble the spring first, you should however lock the end cap nut. Measure the clearance in four points in the circle equally spaced and take the average value △H, then you may disconnect the end cap and mount the springs, and put the bearing into the chock, the washer thickness see the △T calculation below.

Generally if the washer is none metallic then take the washer shrinkage calculation into account.

The spring allowance is
CL1+CL2=0.5mm
The washer thickness is
△T =△h + 0.5mm.
（Fig. 6-3）

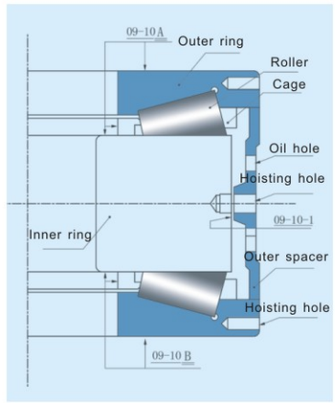

Fig. 6-2 : Assembly of bearing without a pre-load spring

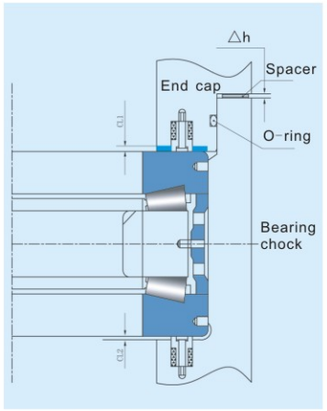

Fig. 6-3: Assembly of the bearings with pre-load springs

CAUTION:

The bearings can not sustain radial load in location application.

7. Mounting of four-row tapered roller bearings

Four-row tapered roller bearings can stand large radial force and axial load, general configurations are TQO , TQI design etc. (Fig 7-1,7-2).

TQO design: These are comprised of 2 cones, 3 cups and 2 outer spacers.

TQI design: These are comprised of 3 cones, 2 cups and 1 outer spacer.

The cage are usually either:
Window-type pressed cage
Pin-type cage

In order to facilitate mounting and dismounting, usually loose fit will be used between bearings and roll necks. Therefore, to prevent the damage caused by creeping of the roll neck and the Inner ring bore during operation, there is a helical groove for lubrication in the fitting surface .To prevent the damage caused by the friction of inner ring and inner spacer, there are lubrication grooves which equally placed in one side faces of the inner rings and both side facers of inner spacers.

Checking of roll necks and chocks

After an extended operating period, the rough operating conditions and impact load change the form of the chocks. The operating conditions, and a relative movement between cone and roll neck cause wear of the roll neck. In tables 4 and table 5 , the permissible dimensional and form deviations are listed as well. If deviations exceed these limits, there is a requirement to overhaul/rework of the fitting surface dimension.

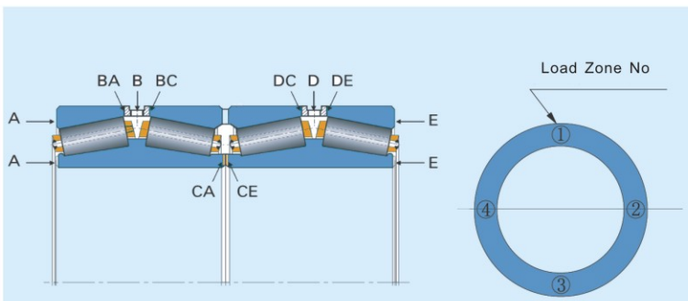

Fig. 7-1: TQO four- row tapered roller bearings

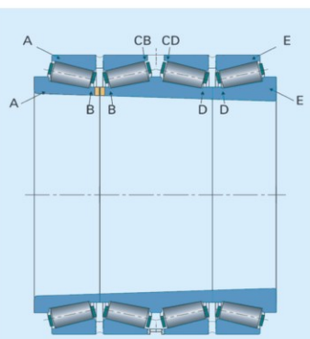

Fig. 7-2:TQI four- row tapered roller bearings

Table 4: Permissible dimensional deviations of the roll neck for metriic -size tapered roller bearings.

Bearing bore (mm) Over Incl.	Tolerance New roll neck (mm)	Max. permissible dimensional deviation (mm)
180··· 250	-0.180··· -0.200	-0.400
250··· 315	-0.210··· -0.250	-0.500
315··· 400	-0.240··· -0.300	-0.600
400··· 500	-0.250··· -0.300	-0.600
500··· 630	-0.250··· -0.300	-0.600
630··· 800	-0.330··· -0.400	-0.800
800··· 1000	-0.380··· -0.450	-0.900

Table 5: Permissible dimensional and form deviations of the chock for metriic-size tapered roller bearings.

Bearing outside diameter (mm) Over Incl.	Tolerance New chock bore (mm)	Max. permissible dimensional deviation (mm)	Deviation from cylindricality (mm)
315··· 400	+0.000··· +0.036 (H6)	+0.200	+0.150
400··· 500	+0.000··· +0.040 (H6)	+0.240	+0.170
500··· 630	+0.000··· +0.044 (H6)	+0.290	+0.200
630··· 800	+0.000··· +0.050 (H6)	+0.360	+0.240
800··· 1000	+0.000··· +0.090 (H6)	+0.450	+0.300
1000··· 1250	+0.000··· +0.105 (H6)	+0.560	+0.390
1250··· 1600	+0.000··· +0.125 (H6)	+0.690	+0.520

As the four-row tapered roller bearing is working under heavy radial force and axial impact load , the surface hardness of roll neck should not be less than HRC35, the hardness of shaft shoulder should not be less than HRC45.

To ensure that the bearing works properly, make sure that the bearing set is complete, check the markings on the ring faces, the Bearing code and serial number must be identical on all parts. All parts of the bearing set must be assembled and mounted in the order of the letters A to E on the faces of the rings and on the outside diameters of the spacers. The bearing parts must not be interchanged to avoid moving clearance of each row, which would have the effect of shortening the bearing life.

With the four-row tapered roller bearing there is a serial number on each component, the two adjacent faces have the same letter code, the letter code of the spacer is the same as the letter codes of its adjacent ring. For example BB spacer and CC spacer are used to adjust bearings axial clearance, and should not be out of sequence. The axial clearance has been adjusted at the factory, and should not need to be adjusted again, the installation should be followed the correct mounting order.

To increase the bearings life, 4 load zones are marked on the faces of the cups with the figures from 1 to 4, offset by 90° each. (if the outer ring rotates, load zone should be marked on the inner ring).

When assembling the bearing set, make sure that the load zone markings are aligned in a row. The outer rings should be turned after each cleaning and remounting of the bearing so that a new zone comes under load, this will increase the bearings life, (Fig 7-3)

Fig. 7-3: The load zones of TQO four-row tapered roller bearings

The TQO four-row taper roller bearing have a loose fit between the inner ring and the roll neck. A lock nut is used to adjust the clearance when installation is carried out, There must remain a total clearance between the bearing cones and roll abutments of 0.5 to 1.2mm. It is necessary to tighten first then loosen a little, and then secure by nut lock to ensure its final position. (Fig.7-4)

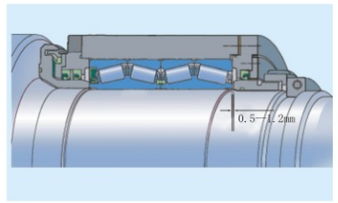

Fig. 7-4: Adjustment of the axial clearance of inner ring

Mounting instructions of TQO four-row taper roller bearings

- Prepare the clean bearing and the bearing assembly drawing.
- Provide a lubrication grease film on the matching surfaces of the roll neck and the chock.
- Screw the roll-side cover on to the chock (Fig 7-5)
- Turn the chock on the horizontal position with the open side up, then install the oil seal and cup D-E with side E down and DD spacer; the lines indicating load zone of cup are in alignment, Each component should be installed in line with correct series number. Spacers are used to determine the clearance, these must not be mixed up. Cones should to be turned when assembling, so as to put every parts in its exact target location on the shaft. (Fig 7-6)

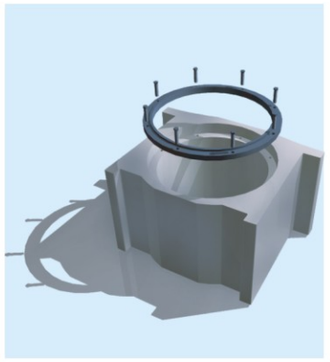

Fig.7-5 : Fastening the end cap on the roll body side

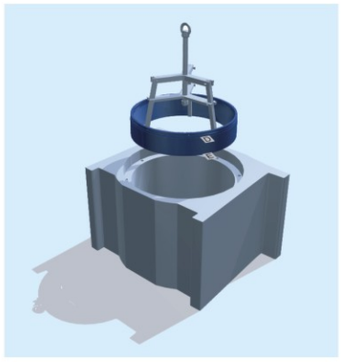

Fig.7-6 : Mounting the cup D-E and spacer D

- Mounting of the four-row taper roller bearing with pressed cage.

Use the lifting device to lift the complete bearing sets E-A , then follow the assembly sequence in order E, D, C, B, A into the chock bore, make the position of load zone 1 in alignment, if misalignment, then realignment can be applied by the use of a copper rod, by gently knocking in the direction to gain alignment. (Fig.7-7)

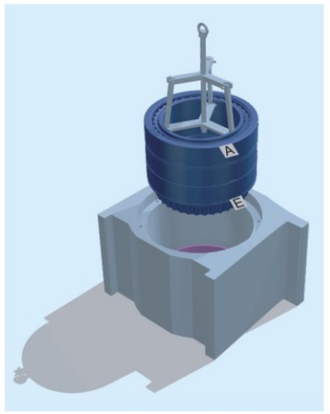

Fig.7-7 : Mounting the complete bearing sets

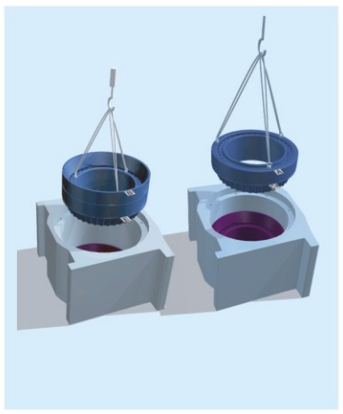

Fig. 7-8 : Mounting of the cone E-C and spacer CC
Mounting of the cup A-B

- Mounting of the four-row taper roller bearing with pin cage.

Lift cone E-C with side E down, the inner spacer CC with the retaining lip down, (Fig7-7), the double-row cover B-D and the outer spacer BB into the chock, Finally, Lift cone A-C and the single-row cover A-B into the chock ,make the position of load zone 1 in alignment, (Fig.7-8)

Bearings with a pin-type cage can be mounted, like bearings with a pressed cage, with the help of a lifting device as shown in (Fig.7-7)

- Mounting of Sealed four-row tapered roller bearings

Characters of this type of bearing:
a. Reduced grease consumption.
b. Extended maintenance intervals.
c. Prevent impurities entering the bearing.

Integrated Installation method

Use the lifting device to lift the assembled components, lubricate with grease, then follow the assembly sequence in order E, D, C, B, A into the chock bore, (fig 7-9), make the position of load zone in alignment, if misalignment, then realignment can be applied by the use of a copper rod, by gently knocking in the direction to gain alignment. During assembly take care that the load zone 1 markings line up.

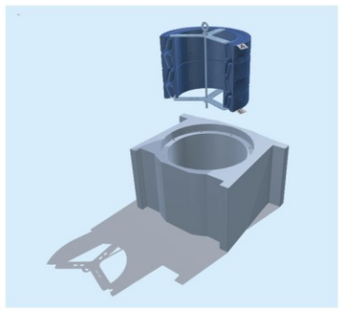

Fig7-9 : Mounting a sealed four-row tapered roller bearings

- Pre-load on the end cap, turn in the bearing, and inspect the bearing assembling quality

1. Slightly bolt the second end cap of chock to the chock using four diametrically opposed bolts.

2. Brace the clamping fixture on the cone faces with the tie rods, slightly at first. The clamping fixture must touch only the cone faces. The cage must not get jammed (Fig 7-9). For sealed bearings, the lifting device also serves as clamping fixture. (Fig 7-10)

3. After the bearing is completely packed into the chock, tighten the tie rod nuts and the cover bolts gradually and evenly, also constantly turning the cones. Allow the inner ring and the inner spacer, the outer ring and outer spacer to touch closely in the axial orientation until the cones abut the inner spacer C over their entire circumference without clearance, ensure to that free rotation is applied when carrying out this operation and when completed. During this assembly keep checking this with a feeler gauge. Measure the width of gap “S” between end cap and chock with a feeler gauge.

4.Loosen the end cap bolts and remove the end cap again. Insert an inflexible material seal of the required thickness T=S- (0.05~0.10mm) into the end cap. Bolt the cover tightly to the chock, tightening the bolts crosswise. Remove the clamping fixture and coat the cone bore with grease.

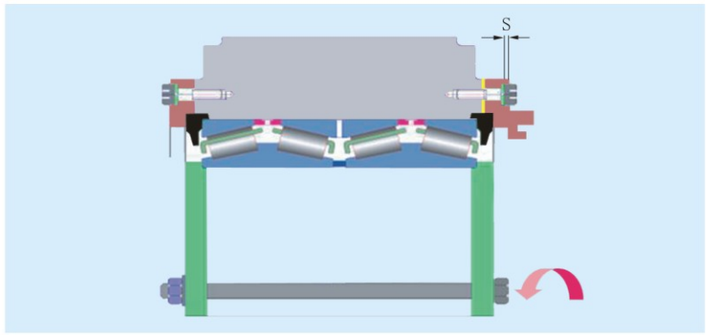

Fig 7-10 : Turning in with the clamping fixture

- Finish Installation

1. Push the labyrinth ring you have heated in an oil bath onto the roll neck together with the O-ring. While the labyrinth ring cools down, it must be pressed tightly against the roll body face. Push the assembled chock onto the roll neck . (Fig.7-11)

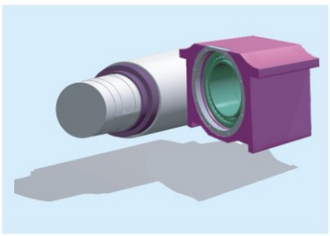

Fig. 7-11 : Mounting the labyrinth ring, pushing the assembled chock onto the roll neck

2. If the bearing mounting is secured axially by means of a split groove ring (position 1) and a locknut (position 2), push the spacer ring and the locknut onto the roll neck one by one. Fix the split groove ring in the roll neck groove. Tighten the locknut only moderately at first while moving the chock constantly to the right and to the left so that the cones abut the mating parts and the bearing is aligned. Tighten the locknut securely against the groove ring. Loosen the locknut until a clearance of 0.5 to 1.2 mm is obtained. Secure by nut lock to prevent it from accidentally being turned. (Fig. 7-12)

If the unit is to be lubricated with grease, make sure that the labyrinth and bearing are packed with grease before use.

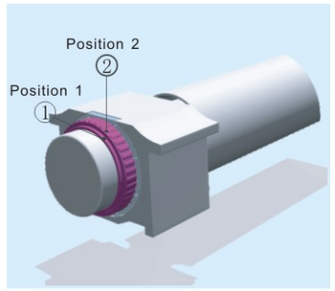

Fig. 7-12 : Axle fixation bearing with locking bolt.

CAUTION :
Sealed parts no damage.

The bearing parts must not be interchanged! including load line , DD, BB,CC spacers.

Do not repair the spacers in your own way.

8. Lubrication

The purpose of the lubricant is to build a load-carrying film separating the bearing components in rolling and sliding contact in order to minimize friction and wear. The lubricant should also protect the bearing against corrosion, has a favorable influence on the bearing service life.. Additionally, the lubricant provides the function of providing a medium for heat dissipation from the bearing and partially avoid dirt and contaminants from entering the bearing.

It is critical that the correct lubrication is selected in order to enhance the bearings performance and attain life expectancy. So, It is important to select the right lubricant,, in right amount, with the right lubrication system, and guarantee the rib and roller end face, raceway and the roller outer surface was separated by the lubricant film.

The bearings fatigue life is directly related with speed, load, lubricating, moisture, sealing and alignment.

The thickness of lubrication oil film depends on the following working condition :

- Speed
- Load
- Lubricant viscosity

Rolling mill bearings are required to meet high speed, heavy load, be impact resistive, and resist high temperatures. Besides selecting a good design, manufacture and excellent material properties, it is also very important to ensure that the bearings lubricant can also meet the aforementioned demands.

Grease lubrication

We recommend to lubricate the roll bearings with a lithium soap base grease with EP (high-pressure) additives and a high level of corrosion protection. Low viscosity lubricant is suitable for high speed or light load, high viscosity lubricant is suitable for moderate speed or heavy load. There are many lubrication brands in the market today, due the large variety available please refer to the LYC Technical Department for a recommendation.

Unsealed bearings should be greased as soon as installation is complete. Press grease into the bearing by means of a grease gun until excess grease escapes on both sides of the bearing over the entire circumference. If no grease gun is available, the roller-cage assemblies must be greased manually before being inserted into the chock. otherwise, the bearing could sustain the potential of being infected by pollutants.

Lubrication Period

a. There is no general standard for the lubrication period, general considerations should be for an individual application, parameters should be: ambient humidity, oil humidity, effect of sealing, pollution, and experience. Injection time/period is generally according to the loss of lubricant during the bearings working condition. Grease should be injected at intervals of approximately every 100~200h.

b. The Lubricant Quantity is mainly in accordance with the working condition of the bearing, in a low speed condition the injection ratio is 2/3; in moderate speed, the injection ratio is 1/2~2/3; in high speed condition, the injection ratio is1/2~ 1/3. For special applications with respect to lubrication periods, please refer to LYC technical department.

Oil lubrication

Depending on the operating and environmental conditions, four-row tapered roller bearings can be operated using the following oil lubrication methods:

- Oil bath lubrication :

This is an efficient method, this allows the bearing to be partially submersed in the oil lubrication, the use of oil spraying on to the bearing is another method. (Fig 8-1)

- Oil mist lubrication:

This is often used for high speed applications. The oil mist maker includes a nozzle within the lubrication system. (Fig 8-2)

- Oil-air lubrication :

This method is suitable for medium and high speed applications.
The oil is not injected into the bearing as in the oil mist application. The speed and pressure of the application are much higher in the Oil-air lubrication system. The oil does not coagulate before entering into the bearing. In the design of these systems it is important to ensure that the oil should be effectively dispersed at different lubrication points within the bearing housing. Oil mist lubrication requires a nozzle. In an Oil-air lubrication the nozzle is not required.

- Oil circulation lubrication:

This method circulates lubrication within the bearings. (Fig 8-3)

Lubrication Period

The lubrication period depends on working conditions, oil status, oil quantity, and the types of lubrication oil. For oil bath lubrication, if the operating condition of the oil temperature is below 50℃, then the replacement interval should be within half a year, if the oil temperature is between 80℃to 100℃, then the lubrication interval should be less than 2 months. The lubrication period for some key equipment should be decided by supervising the oil properties and cleanliness.

Labyrinth Lubrication

The grease should be filled in the Labyrinth seal at the first mounting, then lubricated again according to the specified lubrication intervals for the bearing or when replacing the roll neck. The bearings by oil lubrication are handled in same way.

Measures to be taken with sealed bearings

With sealed bearings, the roll neck must be lubricated at least every 8 hours if no automatic roll neck lubrication is provided.

Drain holes and spill valves must be provided in the underside of the chocks. (Fig 8-4). The drain holes prevent excessive pressure in front of the bearing seal, and permit water to drain from the chock cavities, it must be kept free from grease and contaminants.

CAUTION:

Avoid oil or grease pollution.

Different lubricants cannot be mix-used.

Seals cannot be damaged.

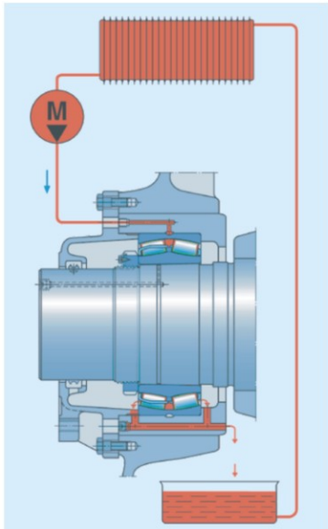

Fig 8-3 : oil circulation lubrication

Lubrication oil or grease selection

Oil lubricant selection is incredibly important due to the particular working and environmental conditions of roll neck bearings.

High temperature resistant :
The tapping temperature of a steel billet is over 1,200℃, the temperature of the working roller bearing housing will be over 100℃ due to the radiant and conductive heat caused during the rolling process. Consequently, a good mechanical stability provide satisfactory consistency along with lower softening trend under high temperature, and provide excellent thermal reversibility, with a dropping point of over 250℃.

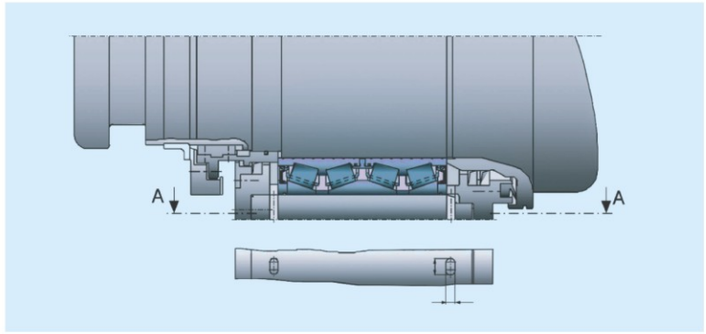

Fig 8-4: Drain hole in the chock

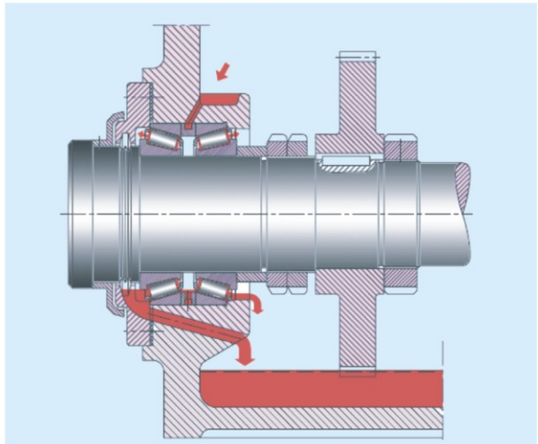

Fig 8-1 : Oil bath lubrication

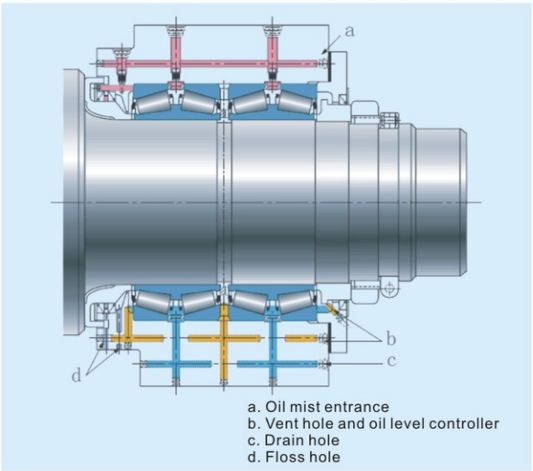

Fig 8-2 : Oil mist lubrication

Heavy load carrying capability:
The grease for these applications should have a good extreme pressure and anti-wear properties, due to the fact that the roll neck bearings will be under heavy rolling strength and impact load, especially for CVC rolling mills, the grease should maintain a good film thickness as it is subject to the combined acting force from shift roll and bending roll.

Abundant water resistant performance :
Generally there are large quantity of cooling water spray within the working conditions of the roll neck bearing, the sprayed water from these cooling systems can easily flow within the bearings environment, especially the bottom work roll. Consequently, the grease being applied should have excellent water resistant performance. Its viscosity should not reduce when the grease is in contact with water or co-mixed with water; meanwhile, it should maintain a good protective property so as to avoid lubricant loss.

High speed protection : Finishing rolling mills generally maintain a high rolling speed.

Good anti-rust and anti-corrosion properties :
The rolling mills bearing grease application needs to provide good anti-corrosion and have lubricity properties that can resist water vapor and dust in order to prolong the bearings life.

The grease produced by SINOPEC Group is recommended according to the above-mentioned work conditions and working environment of roll neck bearings.

a) Great Wall No. 2 EP lithium base grease : A general application for hot rolling mill applications.

b) Great Wall MEP grease : This is applied to cold rolling mill equipment, this grease provides good lubricity, extreme load carrying capability, pumping and anti-media properties. (The environment of work roll bearings could be immersed in rolling fluid) Another alternative would be the Great Wall polyurea-based grease, it also can be applied to cold rolling mill bearings.

c) Great Wall 9301EP grease : This is generally applied to a roll conveyor, meets the lubrication requirement under high temperature(the tapping temperature of steel billet is over 1200℃.),heavy load, abundant water (especially for a layer flow channel), and centralized grease lubrication.

Optional lubricant oil for steel rolling

1. Hydraulic system : Great Wall Zhuoli anti-wear hydraulic oil.

2. Servo system : Great Wall high cleanness hydraulic oil.

3. Gear box : Great Wall Dewei CKD gear oil (with good moisture properties)

4. Back-up roll bearings : Great Wall oil film bearing oil.

5. Oil-gas lubrication system : Great Wall oil-gas lubrication oil

Optional lubricant grease for continuous casting machines

The working conditions are high temperature, dust, water contamination, low speed, heavy load, etc, then the bearings outside temperature is generally between 180-260℃,grease can't occur coking and hardening under these high temperature environments, to prevent greases from clogging within the pipeline and the bearing seizure from poor lubrication, the grease must maintain its extreme pressure properties in order to qualify in this category.

Common use of greases :

1. Great Wall JZEP polyurea-based grease. This grease is suitable for the bearings used in continuous casting operations, such as mould, Arc-Shaped Roller conveyor, bending roller conveyor in steel mills. The dropping point can be over 300℃.

2. Great Wall FPNR grease has an excellent high temperature performance, the dropping point can be over 250℃, with good water resistant properties and its hydrophobic nature, this grease has shown that water cannot be dissolved within this grease. The oil film thickness and oil resistance properties are good and can form a lubrication film under any rubbing pair. A fine mechanical stability is maintained (grease consistency will be unchanged under shearing).

Optional lubricant oil for steel-making

1. Hydraulic system :
Great Wall Zhuoli HM anti-wear hydraulic oil.

2. Servo system:
Great Wall high cleanness hydraulic oil. For Straightener hydraulic station, Great Wall fire-resistant hydraulic oil maintains resistance to fire in the event that a leak occurs, excellent fire-retardant properties.

3. Crystallizer :
Great Wall crystallizer oil.

4. Roller conveyor reducer : Great Wall CKC gear oil.

5. Oil-gas lubrication system : Great Wall oil-gas lubrication oil.

9. Inspection and Maintenance

Check the lubrication system regularly, ensure continuity of the oil supply.

Check the effectiveness of the chock seals and the temperature of the bearing regularly. If the bearing works properly, its temperature increases slowly to operating temperature and then remains constant. If you detect even the slightest damage, the seal must be replaced. Avoid the ingress of water, scale or other foreign material entering the bearing.

After a certain time, LYC recommends cleaning and washing of the bearing, shifting to the next load zone. The cups should be turned inside the chock by 180° when changing load zones the first time. If, for example, load zone 1 was aligned in load direction before dismounting, align the cups in such a way that the load zone 3 markings are now aligned in load direction. The next times, turn to load zone 2 and then 4. This will extend the bearings life, and prevent part of the raceway from fatigue stripping.

To clean the bearings components you should use oil or kerosene, then immediately re-grease the components with anti-rust oil. When cleaning the bearing you should remove all scales, water marks, old lubrication and other pollutants which can cause bearing wear.

Check the raceway and rollers for damage or hard spots, Consult LYC's Technical Department in providing you with an answer.

The bearing seal must be checked carefully and replaced if even the slightest damage is found.

With sealed tapered roller bearings, we recommend to perform additional inspections after a certain operating hours, proceeding as follows:
Withdraw the chock and remove the cover. Check the grease quantity and the condition of the grease in the bearing and in the labyrinths. If the grease is discoloured or contaminated, we recommend to pack bearing and labyrinths with fresh grease

Always disassemble the bearing according to the reverse order of assembly.

Enter the records of the roll bearings running time, the checks and maintenance work in the rolling bearing inspection card.

Check the bearings clearance, if the clearance is too large, then the bearing should not be used, investigate, and repair or replace with a new bearing. For the four-row cylindrical roller bearing, clearance can be measured directly by the feeler gauge. For the four-row tapered roller bearing, there are two axial clearance measuring methods, direct measuring method and indirect measuring method.

Bearings with outside diameters of up to 450 mm

This would use the direct measuring method to inspect the axial clearance. (Fig.9-1)

Measuring arrangement 1: blac

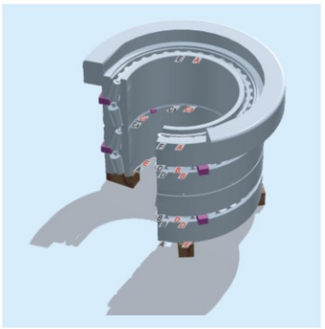

Fig 9-1
Measuring arrangement 1: black
Measuring arrangement 2: red

Place the single-row cup A-B on level supports. Place the other bearing parts, without spacers, on top of it in the specified order (the bearing cage must not be supported). Load the bearing via the upper cone with about half the bearing weight. Turn the cups until all roller rows abut the guiding lips. Measure the distance D-D and the distance B-B between the cups and the distance C-C of the cones at four points each.
Enter the results into the measuring report.

Measuring arrangement 2: red
To obtain more precise measurement results, we recommend to arrange the bearing parts in reverse order and conduct a second measurement. Start with cup E-D. Carry out the steps described under measuring arrangement 1.
Enter the results into the measuring report.

The Initial clearance value will be marked on the spacer, after running for a period then the axial clearance can become twice that of the initial clearance, if this is the case then the spacer must be ground again to the calculated value. The final axial clearance should not be over 1.2 times of the initial axial clearance value.

The value of the original clearance is marked on the spacers. When the amount of axial clearance has doubled in the course of operation, the spacers must be reground. The spacer are reground to the calculated values. The target axial clearance correspond to 1.2 times the original axial clearance.

Bearings with outside diameters larger than 450 mm

This would use the indirect measuring method to inspect the axial clearance.

Step 1: Width of spacer C
(Fig. 9-2)
Measuring arrangement 1: black
Place cone A-Ca level on supports and put cup B-D on top (the cage must not be supported). Turn the cup until all rollers in the upper row abut the guiding lip. Measure as shown in the picture the distance M at four points around the circumference using a micrometer and a rail. Measure the width of the double-row cup K. Enter the results into the measuring report
Measuring arrangement 2: red
Place cone E-Ce level onto supports and put cup D-B on top (the cage must not be supported). Turn the outer ring until the rollers in the upper row abut the guiding lip. Measure the distance N at four points around the circumference. Enter the results into the measuring report.

Step 2: Width of the outer spacers D and B (Fig. 9-3)

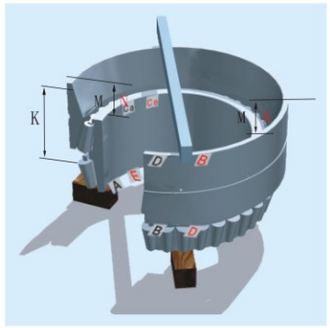

Fig 9-2
Measuring arrangement 1: black
Measuring arrangement 2: red

Measuring arrangement 1: gap B-B red, Place cone E-Ce level onto supports and put the other bearing parts, with a reworked or new inner spacer C, on top in the specified order (the bearing cage must not be supported).
Omit the outer spacers. Place cup D-E onto cup A-B as a measuring load.

Turn the cups until the first (upper) and the third roller row abut the guiding lips. Measure the gap B-B at four points around the circumference using a parallel end block. Enter the results into the measuring report.

Measuring arrangement 2: gap D-D black arrange the bearing parts in the reverse order, starting with cone A-Ca. Carry out the steps described under measuring arrangement 1. Measure as shown in the picture the gap D-D at four points around the circumference using parallel end blocks. Enter the results into the measuring report .

The outer spacers must be ground to the calculated values (corresponding to 1.2 times the amount of original axial clearance).

The value of the original clearance is marked on the spacers.
When the amount of axial clearance has doubled in the course of operation, the spacers must be reground.

Spacer is either reground or a new one must be provided. The target axial clearance correspond to 1.2 times the original axial clearance.

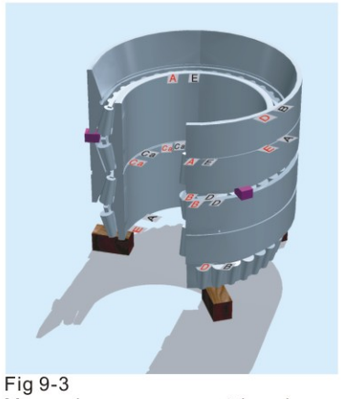

Fig 9-3
Measuring arrangement 1: red
Measuring arrangement 2: black

Measurement Report

		Measurement of gap B-B		Measurement of gap D-D		Measurement of gap C-C	
		Measurement 1	Measurement 2	Measurement 1	Measurement 2	Measurement 1	Measurement 2
Measurement value 1	W1						
Measurement value 2	W2						
Measurement value 3	W3						
Measurement value 4	W4						
Mean value Sm from(B-B), (D-D) and (C-C) e. g. Sm(B-B)=(W11+W12… W24) /4	Sm						
Original axial clearance A	A						
Target axial clearance L=A*1. 3	L						
Spacer width Sm(B-B)+L	B						
Spacer width Sm(D-D)+L	D						
Spacer width Sm(C-C)+L	C						

Measured value
reading
calculated value

LYC®

Measuring report for spacer C

		Double-row cup width K	Measurement of distance M	Measurement of distance N
Measurement value 1	W1			
Measurement value 2	W2			
Measurement value 3	W3			
Measurement value 4	W4			
Mean value Sm from K, M and N e. g. Smk=(W1+W2+W3+W4) /4	Sm			
Original axial clearance A	A			
Target axial clearance L=A*1. 3	L			
C=SmM+SmN-Smk+L	C			

Measuring report for spacer B and D

		Measurement of gap B-B	Measurement of gap D-D
Measurement value 1	W1		
Measurement value 2	W2		
Measurement value 3	W3		
Measurement value 4	W4		
Mean values Sm for (BB) and (DD)	Sm		

Measured value
Reading
Calculated value

CAUTION:

Bearings placed in a vertical position or leaning at an angle should not be allowed.

Bearings should not be allowed to be in contact with the ground directly.

10. Storage

Spare bearings should be stored in their original packing. To avoid any distortion the outer ring & inner ring of the bearing need to be supported over their entire circumference and placed at least 30mm above the ground.

All spare parts for the bearing should be coated with the anti-rust oil before storage and placed on an approved storage rack. Any used bearing parts or bearings that have been opened should be cleaned and oiled again and wrapped in oiled paper to protect the bearings inside from moisture and dirt.

Storage temperature :
The storage temperature should be controlled in the range 0-25℃. If the temperature is too high or too low then this will lead to the anti-rust oil deteriorating and becoming ineffective.

Storage humidity :
The bearing parts storage humidity should be kept between 45% and 60%. If the humidity should be too high then this could lead to component corrosion.

Storage environment : Bearings components are best stored separately; they should not be stored with chemicals, such as acids, alkalis, salts or in a corrosive environment.

Periodic inspection :
According to the bearings anti-rust specification, the stored bearing components should be checked once every 10-12 months.

The bearing components packaging should be changed and re-oiled if the bearings packaging has been damaged or there are signs of rust.