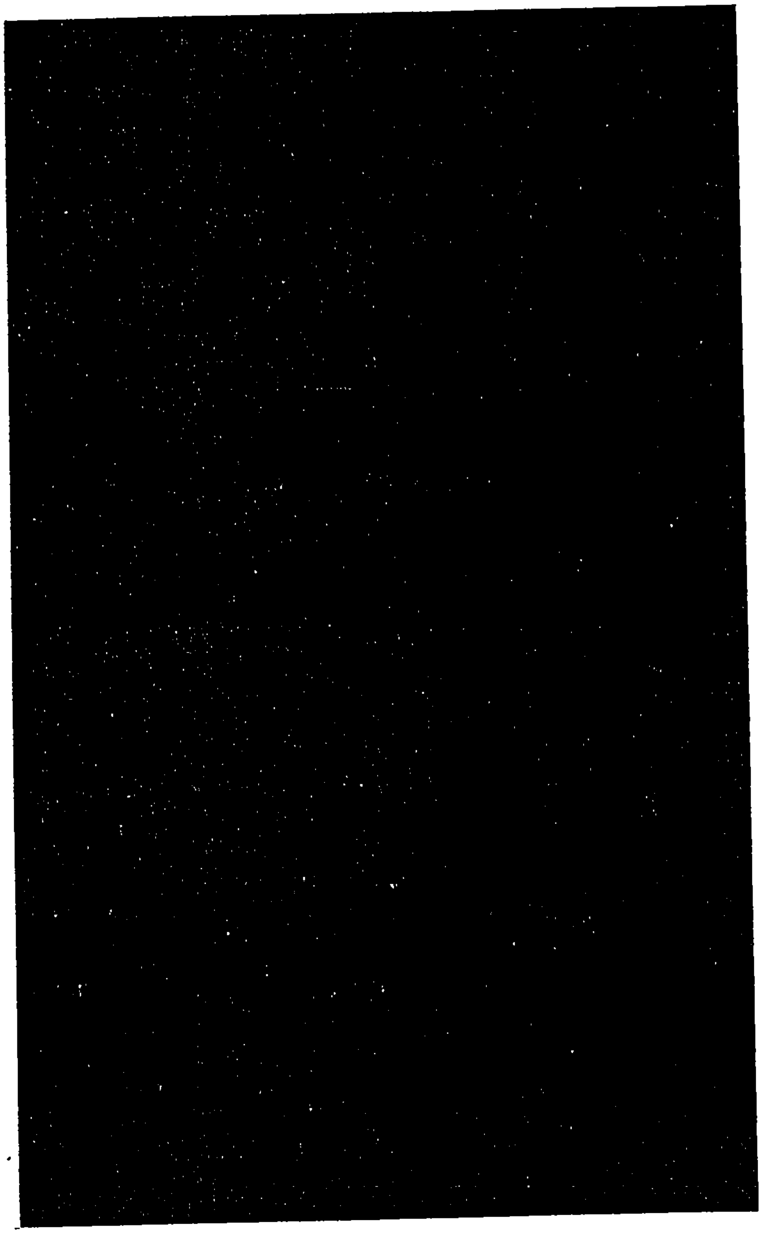
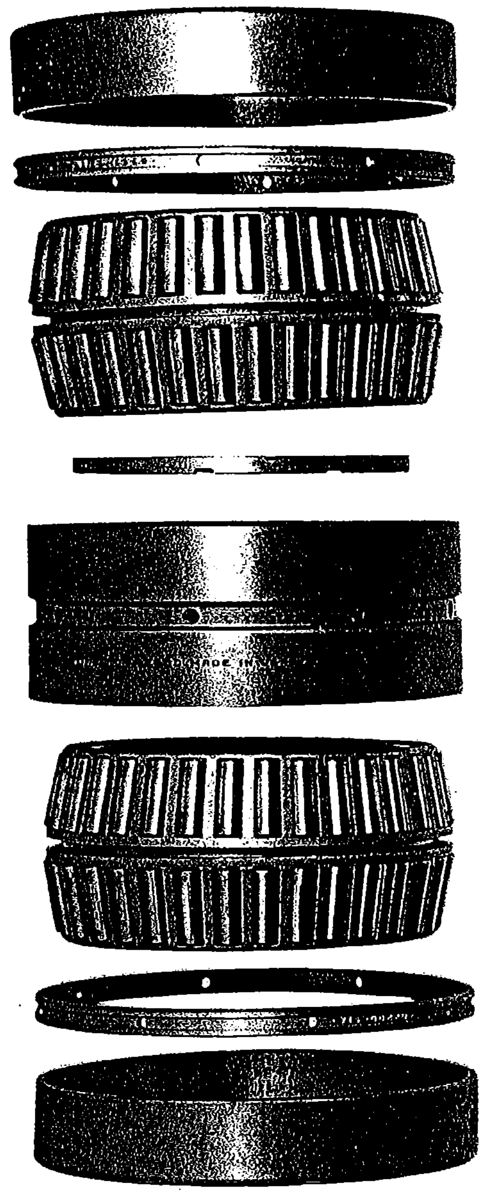
Maintaining Quality on Timken® TQO Bearings



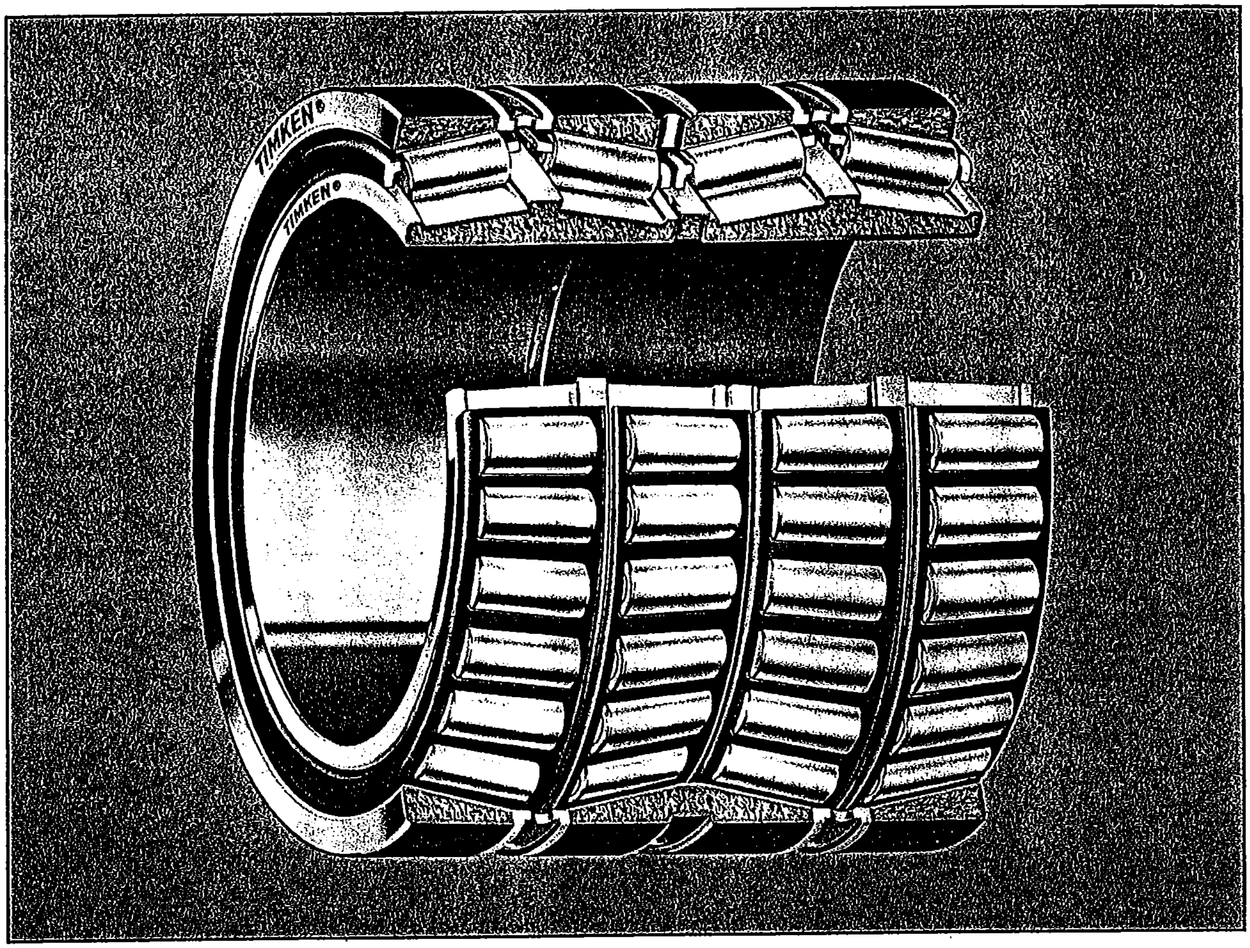


TIMKEN®

REGISTERED TRADEMARK

TAPERED ROLLER BEARINGS

Timken® TQO Bearing Maintenance Manual for Mill Operators



Today, steel mills run at higher speeds than ever before, and roll wider material to closer tolerances. Under these increasingly demanding conditions, the mill equipment must be equipped with high quality bearings and those bearings must be properly maintained.

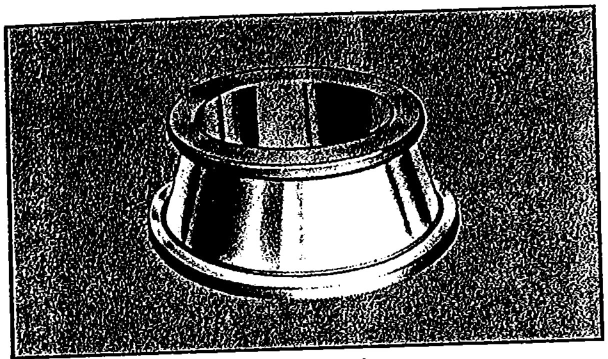


Figure 1

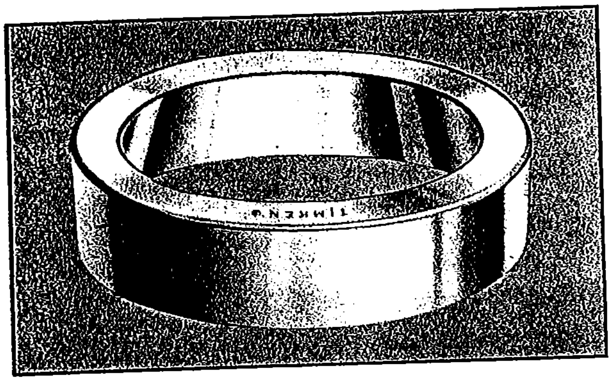


Figure 2

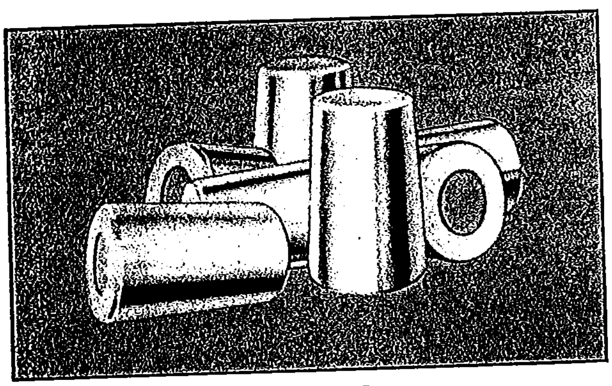


Figure 3

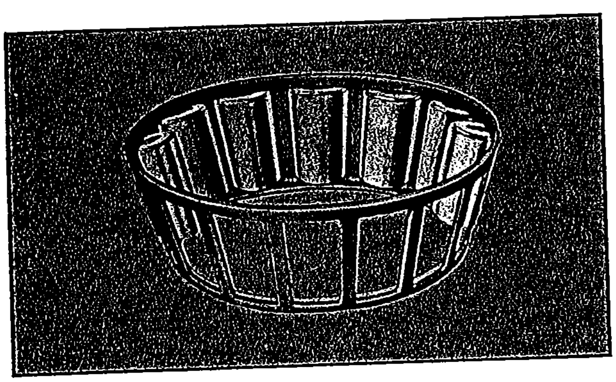


Figure 4

BEARING DESIGN & GENERAL INFORMATION

The Timken® tapered roller bearing is a precision product, and, therefore, should be handled with care.

Basically, there are four parts to a Timken tapered roller bearing - the cone or inner race (Figure 1), the cup, or outer race (Figure 2), the tapered rollers, which roll freely between the cup and cone (Figure 3), and the cage (Figure 4), which serves as a retainer to maintain the proper spacing between the tapered rollers grouped around the cone.

Figure 5 shows a standard single row Timken bearing type TS. By single row, we mean there is a single row of rollers. Design modifications of the standard single row bearing make possible many variations in types of tapered roller bearings. While there are many different types of Timken tapered roller bearings as shown in Figure 6, we will discuss only the four row type TQO, which is the most commonly used anti-friction roll neck bearing in the metal rolling industry.

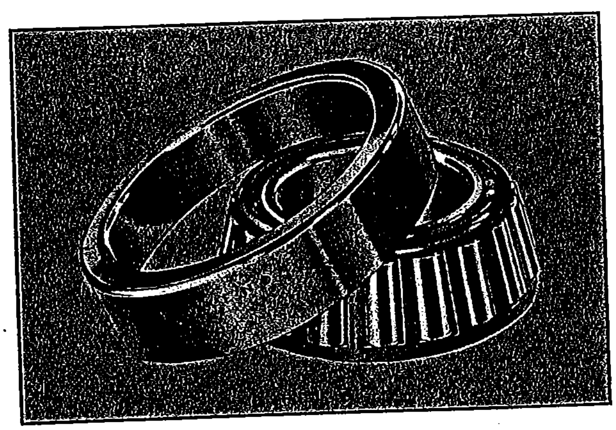


Figure 5

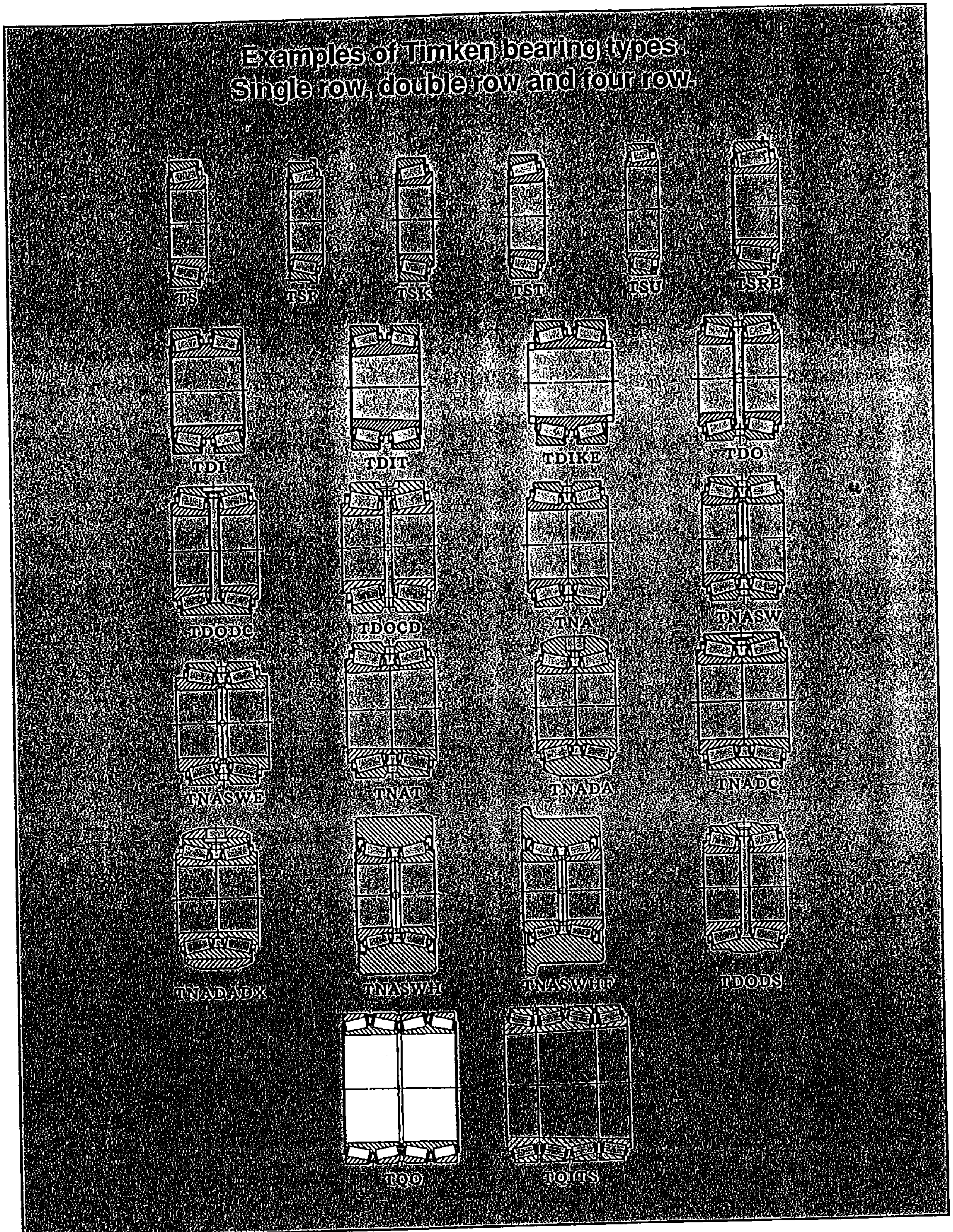

Examples of Timken bearing types:
Single row, double row and four row.
TS
TSF
TSK
TST
TSU
TSRB
TDI
TDIT
TDIKE
TDO
TDODC
TDOCD
TNA
TNASW
TNASWE
TNAT
TNADA
TNADC
TNADADX
TNASWH
TNASWHF
TDODS
TQO
TQITS

Figure 6

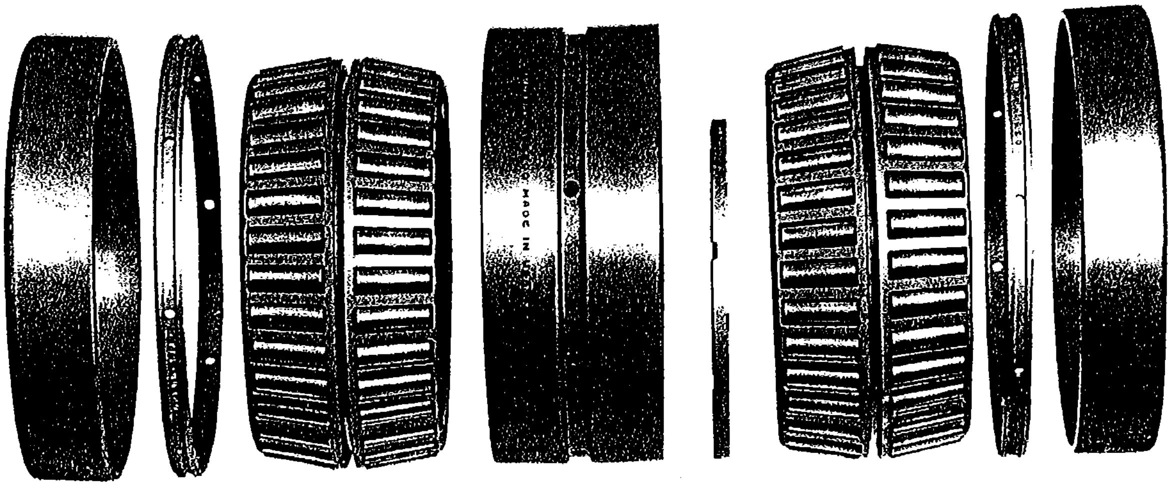


Figure 7

TIMKEN TQO BEARINGS

The TQO bearing consists of two double cones, one double cup and two single cups, together with two cup spacers and one cone spacer (Figure 7).

TQO bearings have been made in a range of sizes from 83.337 millimeters (3.281 inches) outside diameter up to 1915 millimeters (75.3937 inches) outside diameter. The basic construction is the same in all sizes.

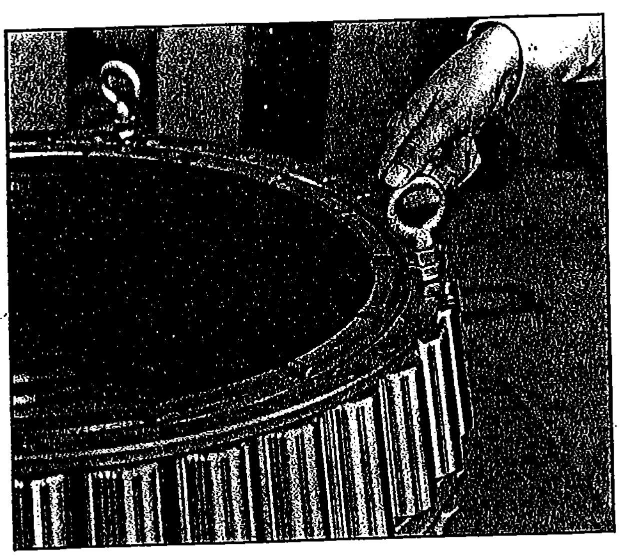


Figure 8

On the smaller size TQO bearings, a stamped steel cage is used. On larger sizes or where maximum capacity is needed in a limited space, a pin type cage is used and lifting holes are provided in the cage rings (Figure 8).

Purpose and frequency of inspections

The useful life of any bearing depends to a great extent on the care and maintenance given to the bearing. This is especially true in the metal rolling industry where the operating conditions are harsh, loads are heavy, and contamination by dirt, scale and rolling solution is common.

Bearings must be removed from the mill and inspected regularly to assure maximum roll neck bearing life. The frequency of the inspections will vary with the operating conditions and could be at 3 month, 6 month or even 12 month intervals. These inspections give you a chance to spot developing trouble areas before they become serious.

After removing the bearing and chock assembly from the mill, proper care and maintenance can be accomplished by following several steps:

1. Record the bearing position in the mill.
2. Remove the bearing from the chock.
3. Clean the bearing.
4. Thoroughly inspect the bearing.
5. Check the bearing for wear.
6. Inspect and repair the chock.
7. Assemble the bearing into the chock.
8. Inspect the roll neck.
9. Install the chock onto the roll neck.

All of these steps play an important role in good bearing performance.

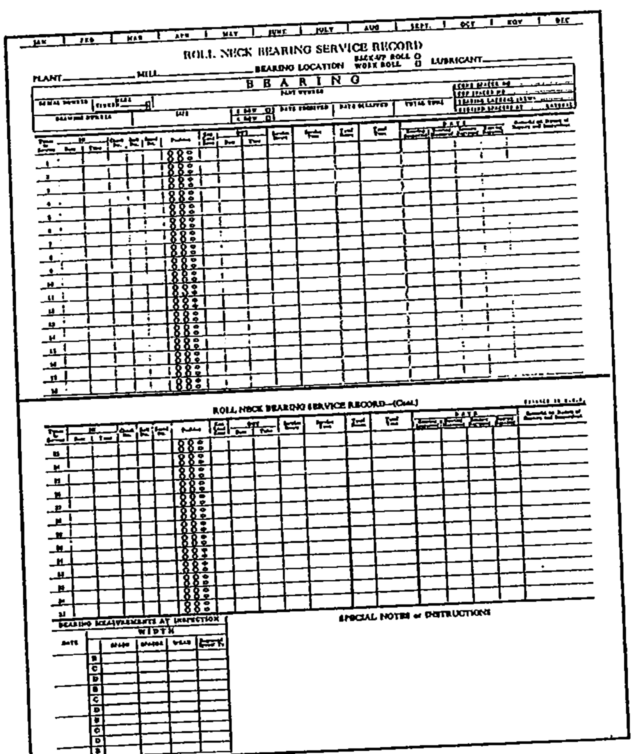


Figure 9

RECORD THE BEARING POSITION IN THE MILL

Roll Neck Bearing Service Record cards, as shown in Figure 9, are available from The Timken Company. These cards offer a good means of keeping records of the chock number, roll number, stand number, position in the mill, cup load zones that have been used, and tonnages or hours used. These cards should be kept up to date and readily available to the maintenance personnel. The back side of the record card (lower half of Figure 9) provides space for bearing measurement data and other inspection details.

REMOVE THE BEARING FROM THE CHOCK

Special lifting methods and handling tools are used to remove the bearing from the chock and handle the bearing during inspection. The handling tools and special lifting methods are shown in Figure 10.

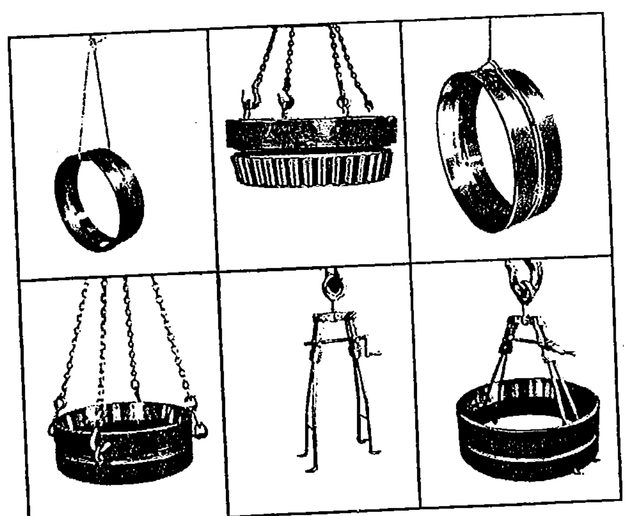


Figure 10

Bearing removal from the chock is usually done in 3 lifts.

The first lift (Figure 11) removes the top single cup and top double cone. Four, equally spaced, eye bolts and locking nuts are put into the lifting holes of the double cone to remove these parts. The locking nut should be tightened against the cage, prior to lifting.

The second lift (Figure 12) removes the double cup, bottom double cone along with the cone spacer and top cup spacer. Again, the lifting holes in the bottom double cone are used to remove these parts.

The final lift (Figure 13) removes the bottom single cup and the bottom cup spacer. The bearing hook is used in the removal of these parts.

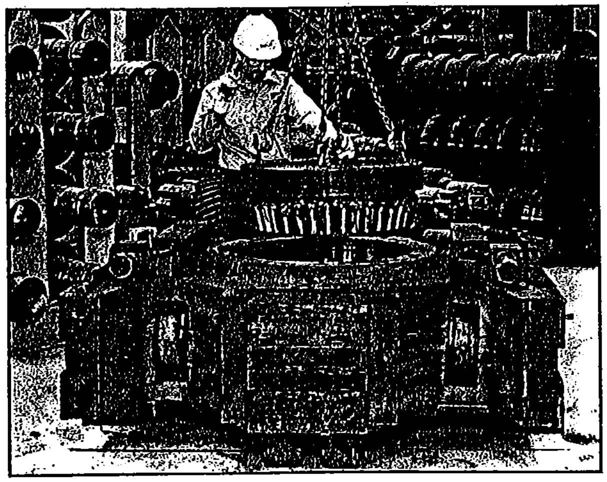


Figure 11

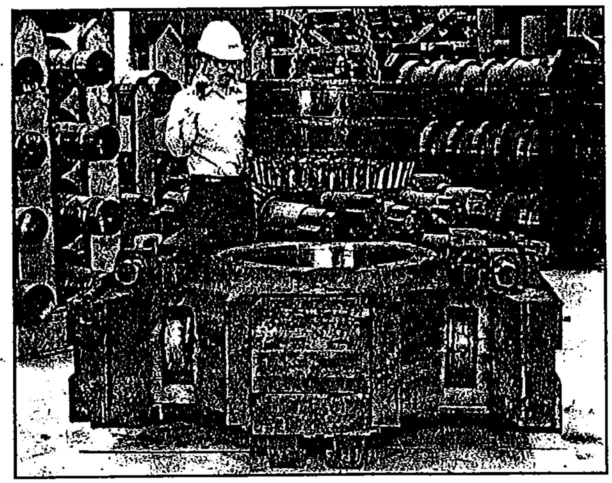


Figure 12

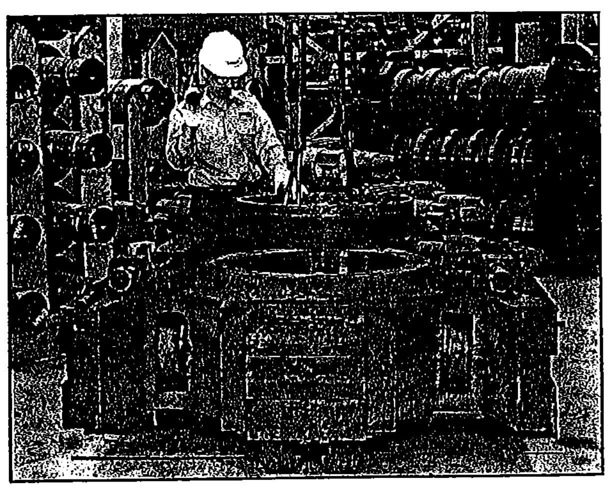


Figure 13

CLEAN THE BEARING

Cleaning of the bearing removes any accumulation of scale, water, old lubricant, or any other contaminants which can cause excessive wear in the bearings. There are different cleaning methods and solutions available, depending on the size or number of bearings you will be cleaning. Small bearings or small quantities of bearings may be cleaned with kerosene, mineral seal, or other commercial solvents. For large bearings or large quantities of bearings, a neutral oil with a viscosity of 22 centistokes at 40° Celsius or 100 SUS at 100° Fahrenheit heated to 300° Fahrenheit can be used in cleaning tanks.

Alkali cleaners such as Trisodium Phosphate, soda ash, or metasilicate mixed two to three ounces per gallon of hot water may also be used. These hot water solutions are often used as a final cleaning or rinse after the initial cleaning in a hot oil tank. The cleaning tank should have provisions for heating the oil or water solution as well as for agitating or recirculating the cleaner. Figure 14 shows details of a typical rectangular cleaning tank.

After cleaning, the bearings should be covered with a coating of light oil to protect against rusting, if they are not to be inspected immediately.

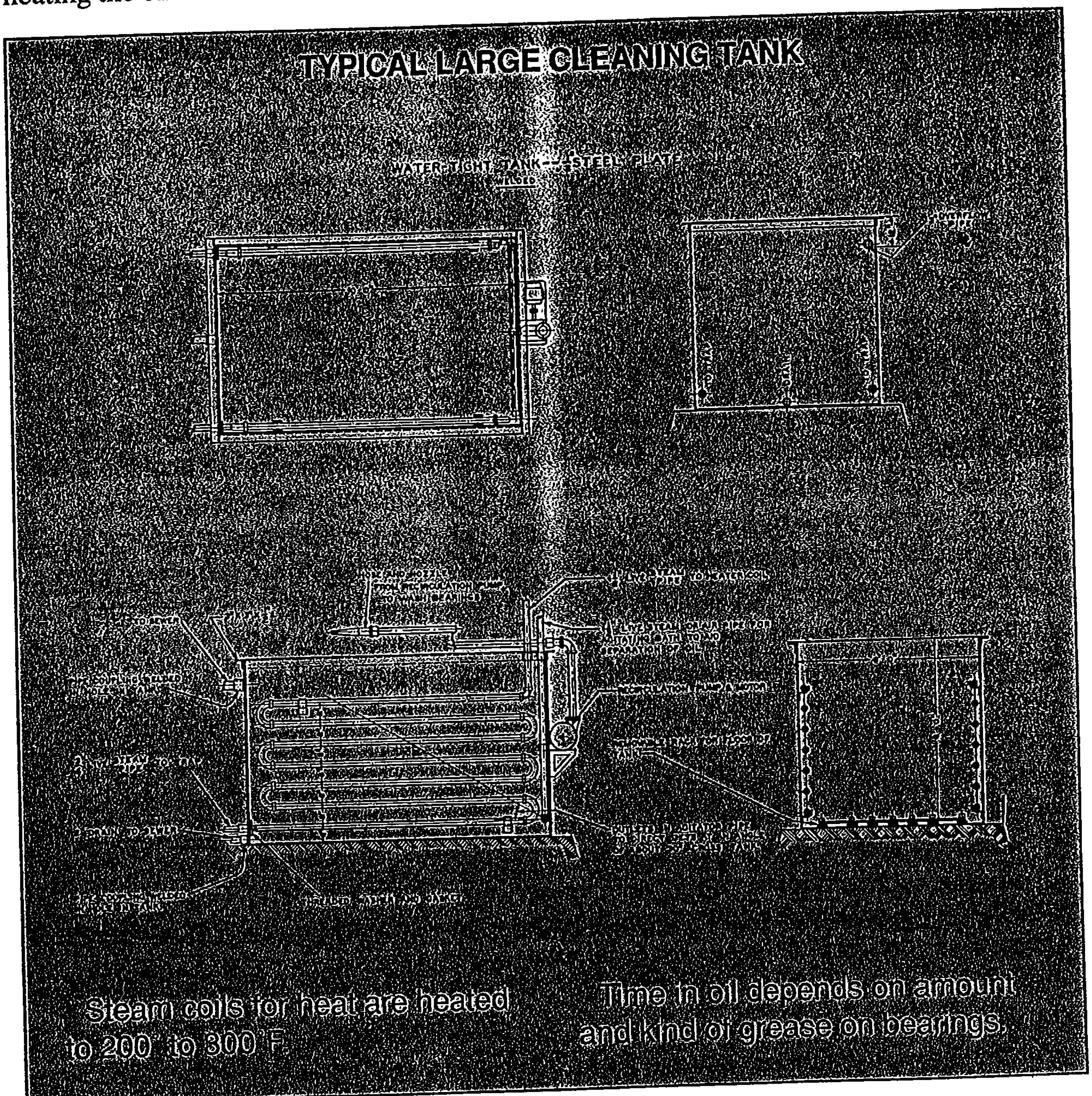


Figure 14

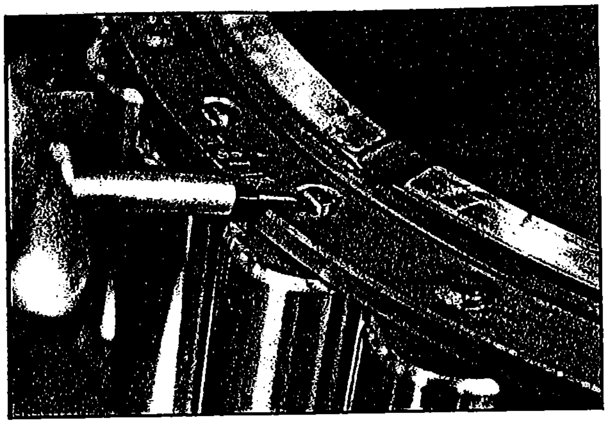


FIGURE 15

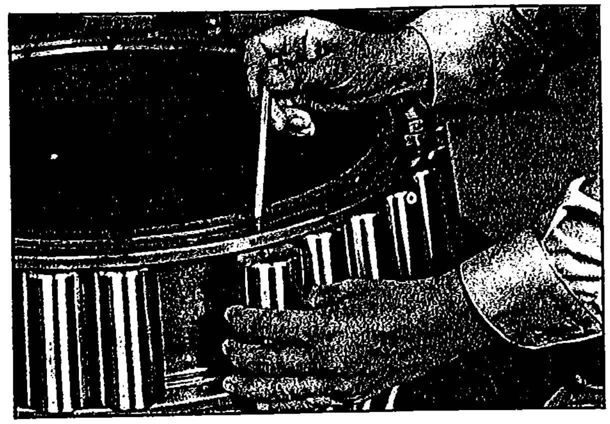


FIGURE 16

THOROUGHLY INSPECT THE BEARING

After cleaning the bearing visually inspect it for areas that may require repair. The rollers can be inspected by rotating the cage or by turning the individual rollers.

The pin type cages on most of the large bearing cones have one or two pins which are not welded in place. These threaded pins can be removed by prying out the locking wire and screwing the pin out (Figure 15). Drawings of the socket to be used to remove the pin are available from your Timken Company Representative. Now the roller can be removed in order to inspect the cone outside diameter or rolling surface (Figure 16). Removing rollers permits access to the cone outside diameter for minor repair.

On the smaller cones with stamped type cages there is no removable roller. Repair work on these smaller cones is usually too costly in relation to a new cone assembly which can be used in the repair of the four-row bearing.

On cones with removable rollers, if small spalls or surface breakouts are found on the cone outside diameter or rollers, minor repairs can often be made by grinding out the loose metal (Figure 17) and smoothing out the edges of the spalled area.

The cone and rollers are the rotating bearing parts in a roll neck application and all areas of their outside diameters will carry part of the rolling load sometime during. each revolution of the bearing. Large spalled areas on the cone outside diameter will not be able to support the rollers under load, consequently, repair of these large areas is questionable. Spalls that might develop from long life or abnormal service which exceed 25-30% of the width of the cone raceway are usually not considered repairable.

To complete the cone inspection, reinstall the inspection rollers, retighten the threaded pins and replace the locking wires.

Bearing cups should be wiped clean and

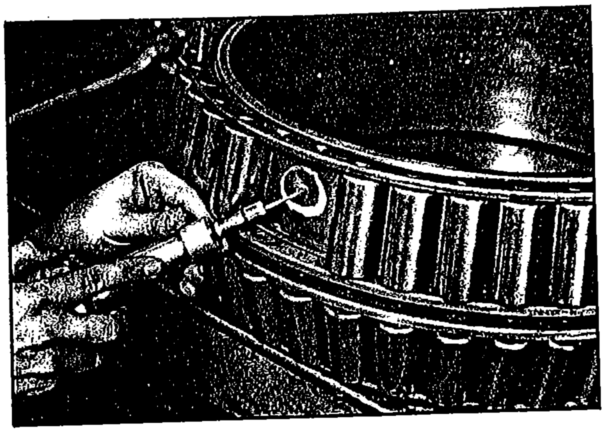


FIGURE 17

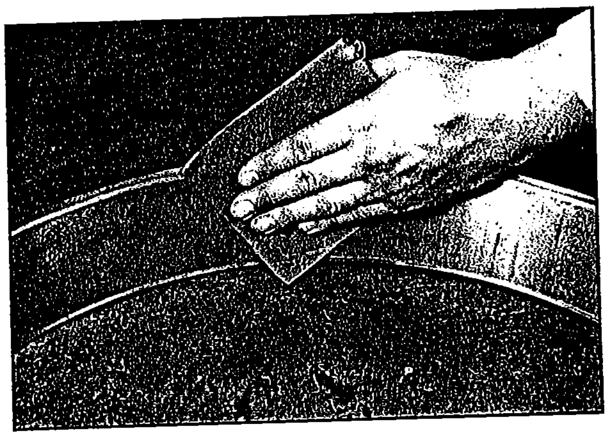


FIGURE 19

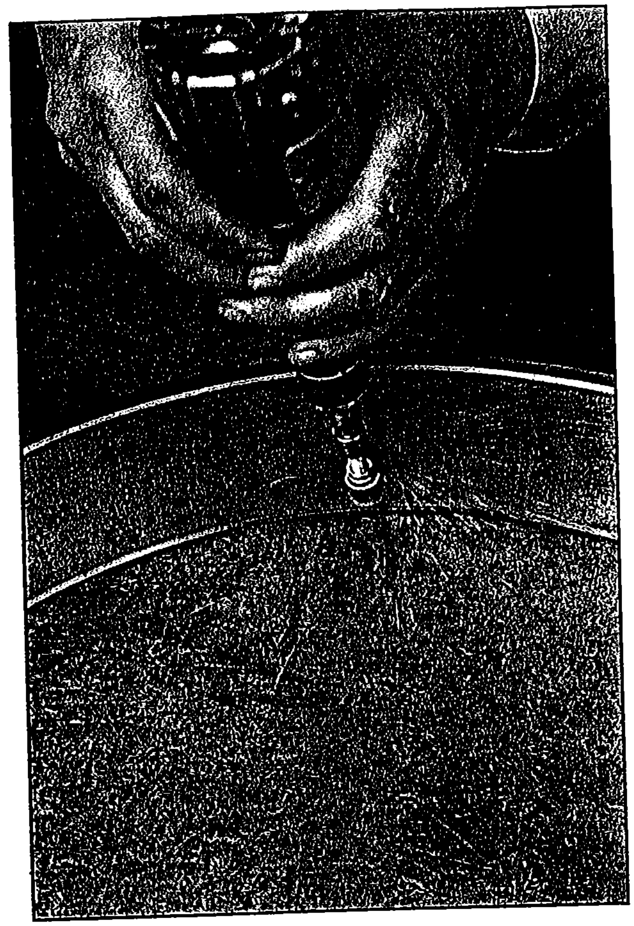


FIGURE 18

thoroughly inspected. The condition of parts can provide information about problems in the mill. Rusting of the parts can mean water is getting into the chocks through faulty seals. Severe bruising usually is a sign of contamination of the lubricant with dirt, scale or other foreign particles. Any small spalls or breakouts found should be repaired by the use of grinding and polishing tools (Figure 18).

Removing the loose metal and smoothing the rough edges will often stop the spread of the spall when the bearing is put back in service. It also prevents the loose metal from going through the bearing and causing further damage.

Large areas of rust or corrosion which have actually pitted the surface of the bearing parts cannot be entirely removed. Emery paper with a grit specification of 240 or 320 can be used to remove as much of the surface rust as possible (Figure 19). This will prevent the rust from contaminating the bearing when it is put back into service.

Bearing cups are non-rotating parts and repair of much larger spalled areas is practical by proper selection of cup load zones.

Cup load zones

Since the bearing cups are stationary in the chocks, only one portion or zone of the cup carries the rolling load at any one time. This portion is called the cup load zone and is roughly one-quarter of the outside diameter of the cup (Figure 20).

Most roll neck bearing cups are marked on their faces to show four quadrants (Figure 21). These markings enable you to keep a record of what quadrants have been used in the load zone. A good practice is to start each new bearing out in cup quadrant number 1, then go through 2, 3, 4 and start back to 1 on subsequent inspections. The Roll Neck Bearing Service Record cards described earlier offer a good means of keeping record of the cup load zones that have been used.

In back up rolls, for instance, the load zone is in the top of the top chock and at the bottom of the bottom chock (Figure 22). The chocks are usually heavier in section at these points. The bearing inspection period is a good time to rotate the cups one-quarter of a turn to bring a new cup load zone into position in the chock. Rotating the cups at every inspection will extend the useful life of the bearing by gradually distributing the load over the entire cup working raceway surface.

Any spalls in the cup which have been repaired should be kept out of the load zone when the bearing is reassembled in the chock.

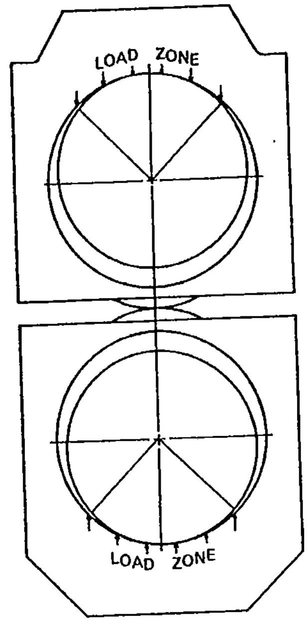


Figure 20

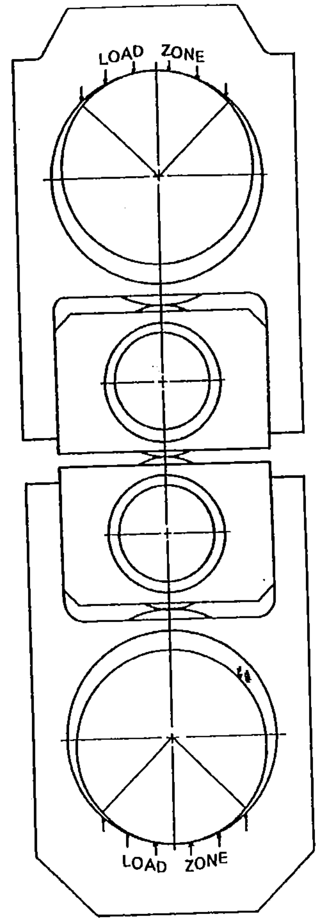


Figure 22

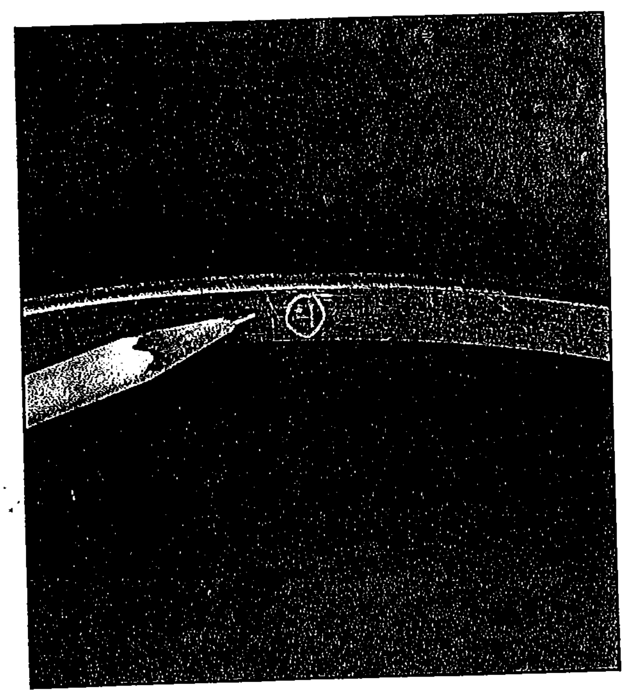


Figure 21

FIGURE 23

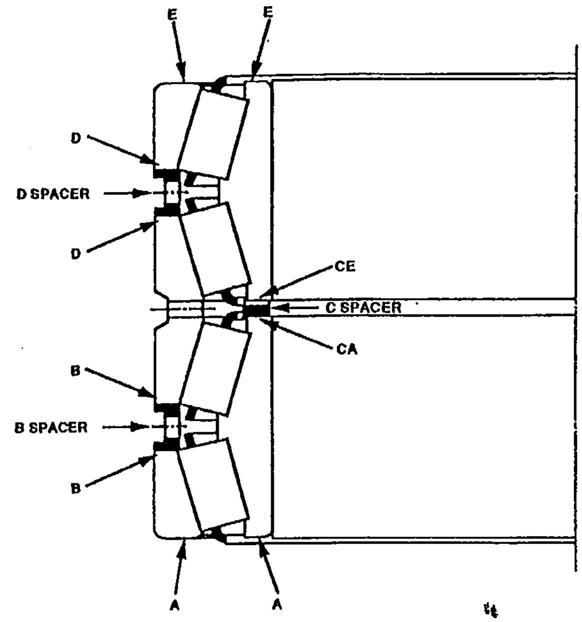


FIGURE 24

CHECK THE BEARING FOR WEAR

Wear in the bearings should be checked periodically. While it may not be necessary to check the wear at every routine 3 to 6 months inspection period, all bearings should be checked at least once a year for wear.

For wear measurement, the bearing should be stacked on a flat solid surface with the lower cup supported in a base fixture (Figure 23). This base fixture must be counterbored for cage clearance and allow free rotation of the bearing.

Bearing markings for correct stacking sequence

Any time the bearing is stacked up, whether for wear measurements in which case the cup and cone spacers are left out, or for actual assembly in the chock, the proper stacking sequence of the parts must be followed in order for the bearing to have the correct setting or running clearance.

The Timken Company uses a lettering system to ensure proper stacking (Figure 24). In the four-row roll neck bearing the parts are lettered A thru E and must be kept in alphabetical order. The bearing can be stacked with either the A end down or the E end down, but the parts must be kept in proper sequence. The B cup spacer must go in the B gap and the D cup spacer must go in the D gap. The C cone spacer can only go between the double cones in the C gap, with the flange side down to keep the spacer centered.

The complete marking system used on most of the four-row Timken bearings is shown in Figure 25.

Every spacer adjusted bearing has a serial number and all parts of that bearing must have the same serial number (Figure 26). The parts are **not** interchangeable. In addition to the serial number, there is also a suffix letter on the part to tell its proper position within the bearing.

Weighting bearing for measurement

It is necessary to add weight to the bearing being measured in order to properly seat the parts (Figure 27). The weight should be made to pilot on the bearing

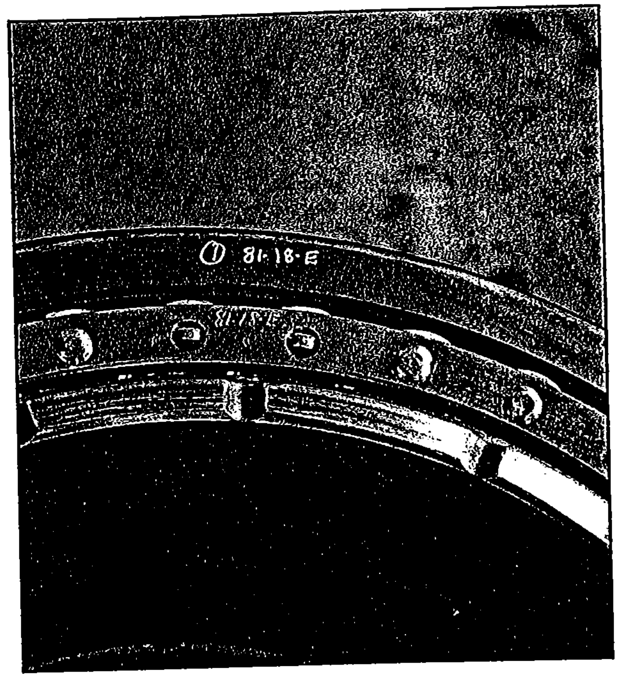
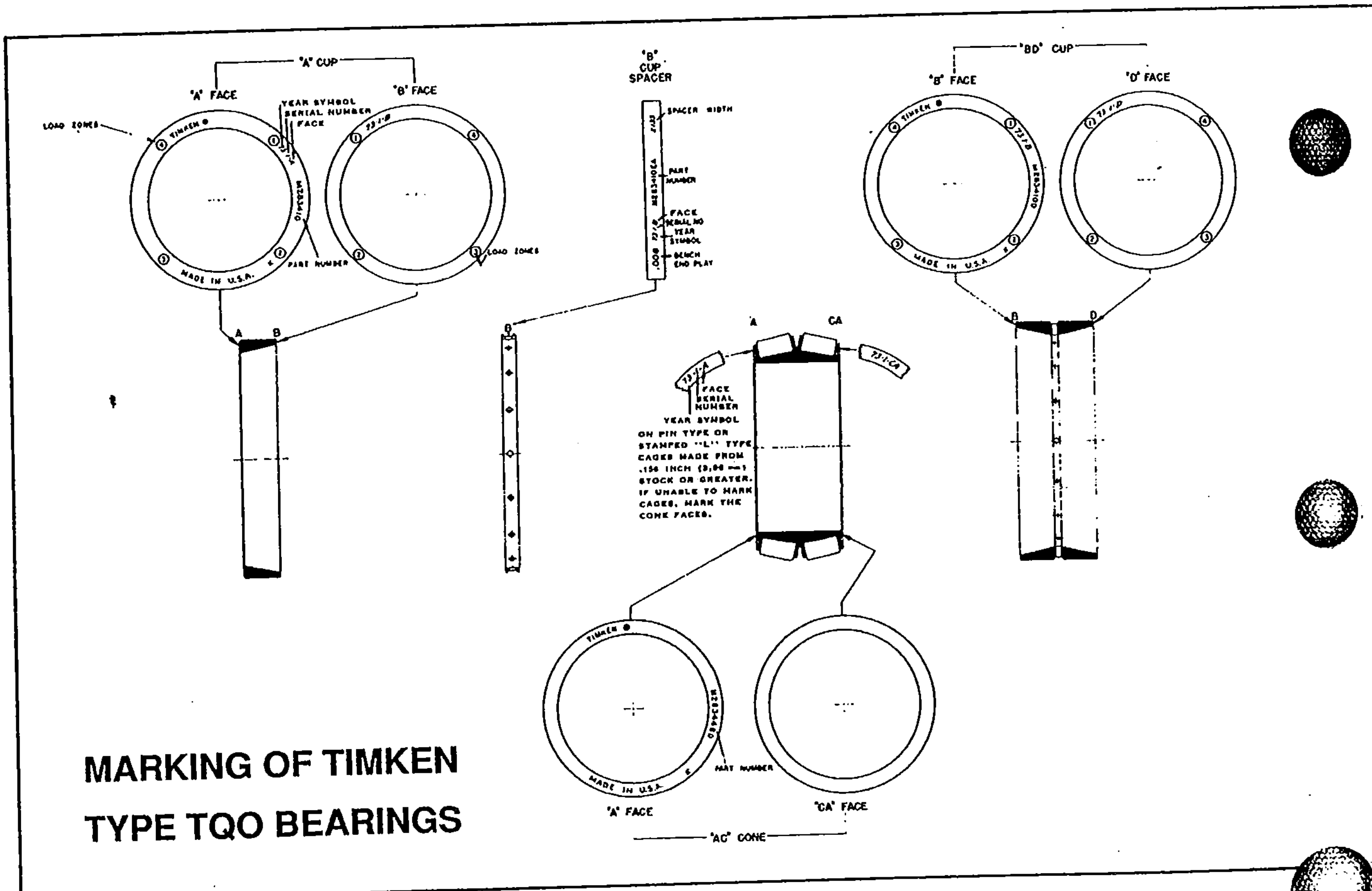


FIGURE 26



MARKING OF TIMKEN TYPE TQO BEARINGS

FIGURE 25

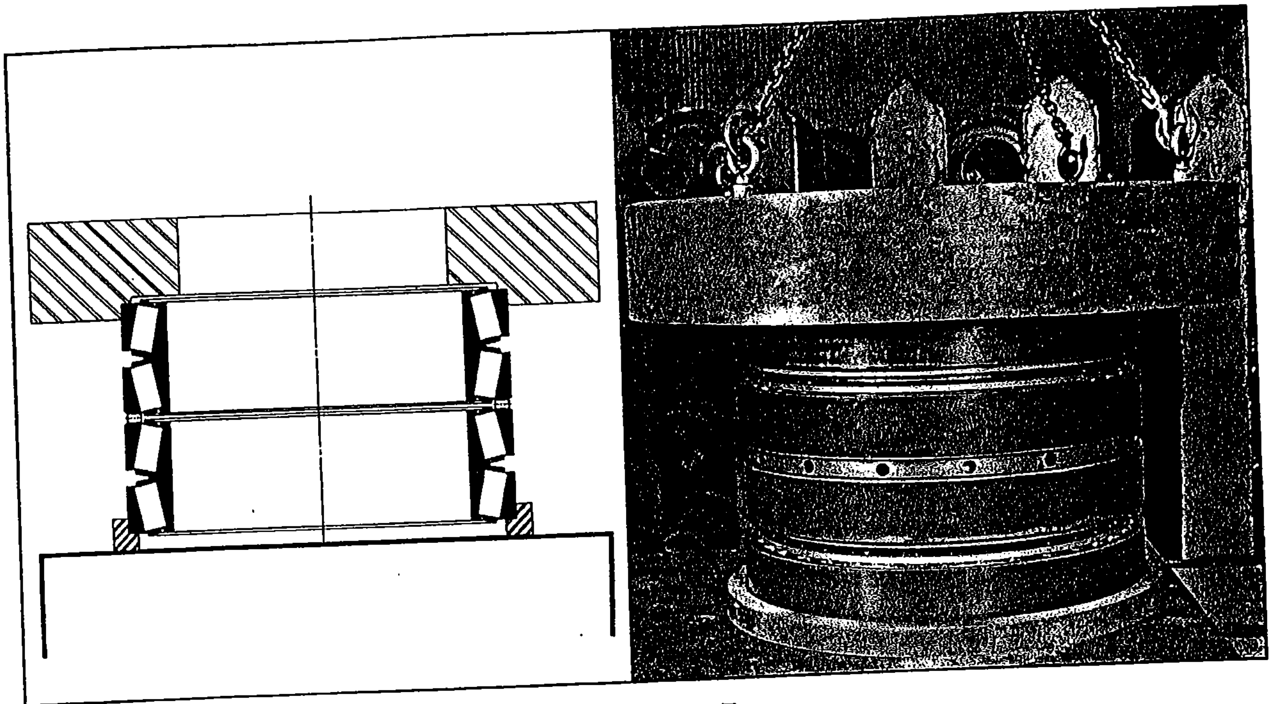


FIGURE 27

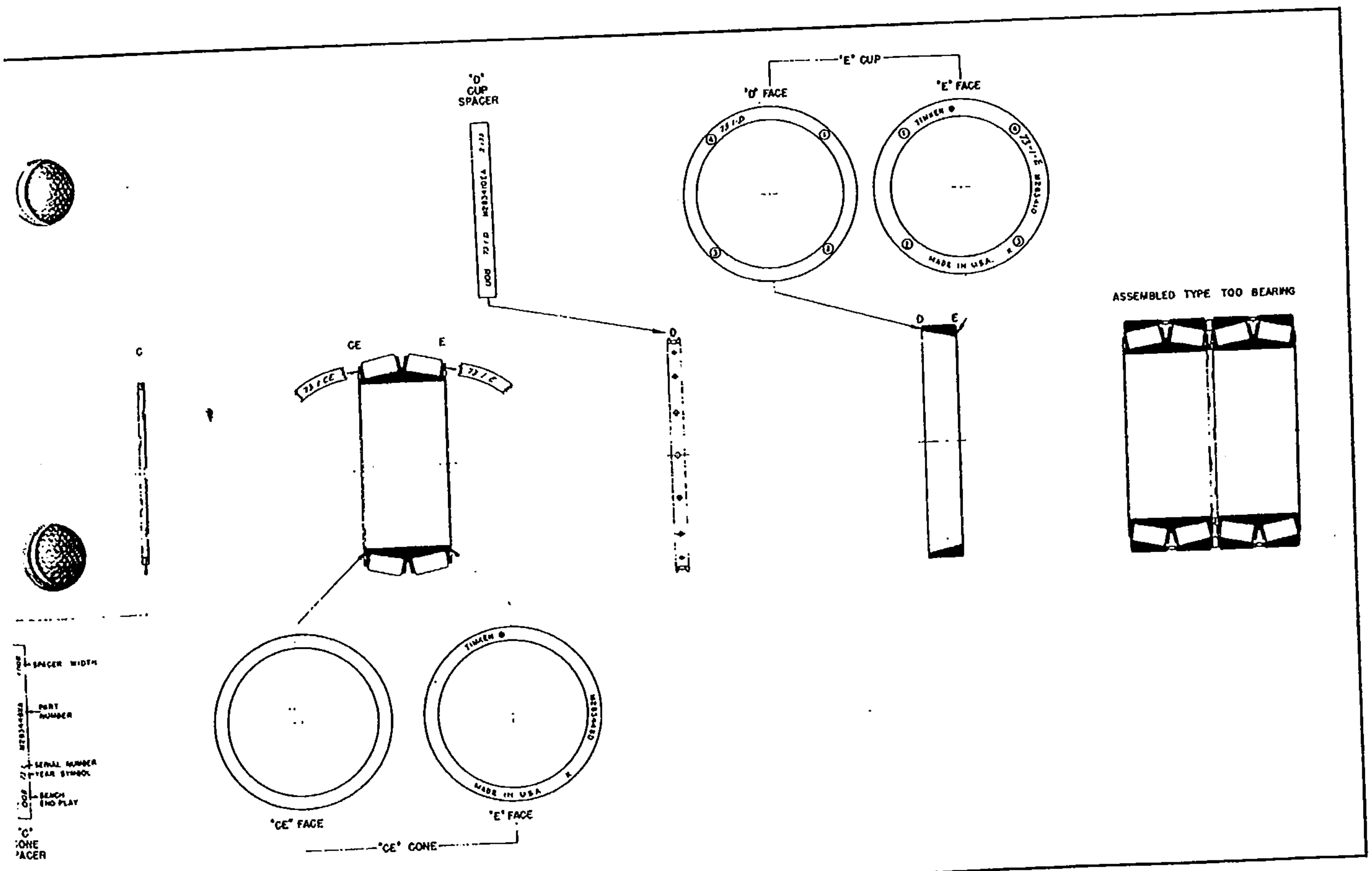

"D"
CUP
SPACER
"E" CUP
"D" FACE
"E" FACE
TIMKEN
MADE IN U.S.A.
ASSEMBLED TYPE TDO BEARING
C
CE
E
D
E
SPACER WIDTH
PART NUMBER
SERIAL NUMBER
YEAR SYMBOL
BENCH END PLAY
"C"
"CE" FACE
"E" FACE
"CE" CONE

FIGURE 28

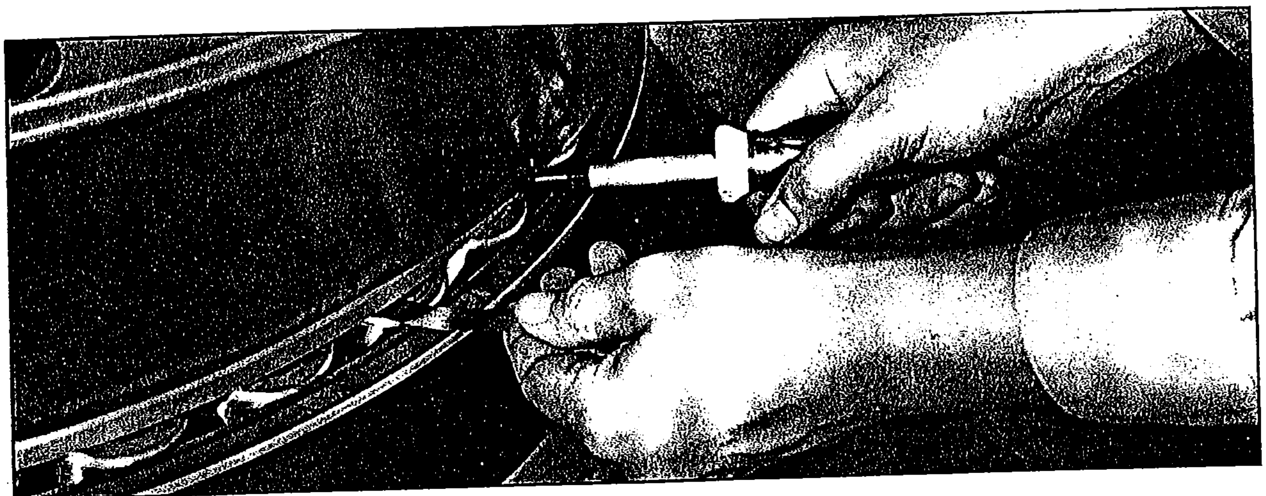


FIGURE 29

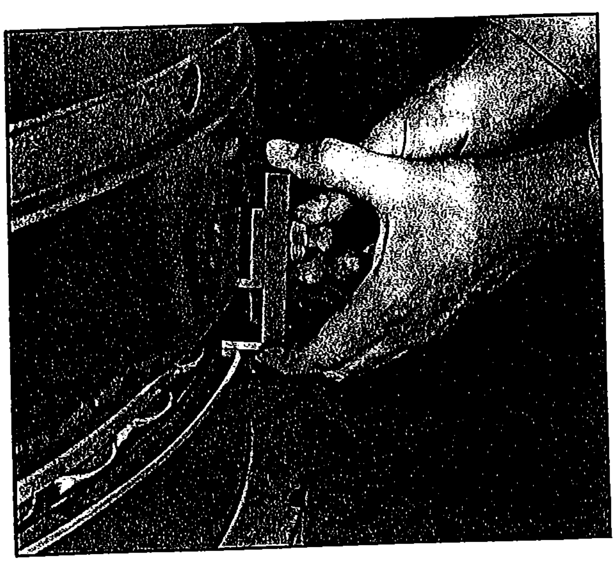


FIGURE 30

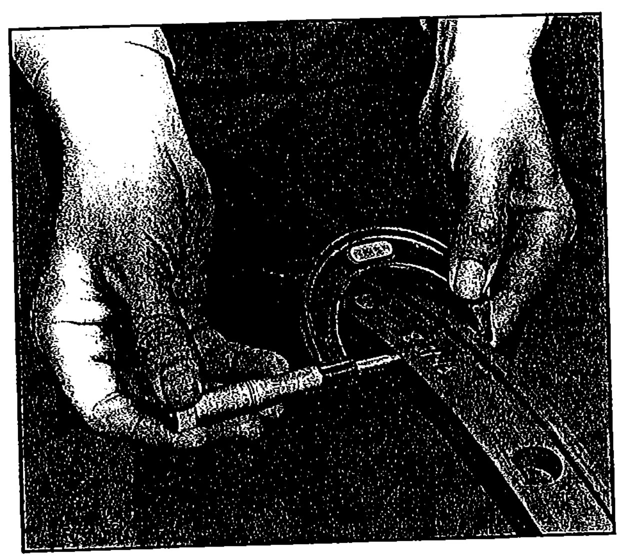


FIGURE 31

cup outside diameter and counterbored to clear the cage. Bearings with considerable service especially need this weight as their parts may have become out-of-round and can be difficult to seat properly. The weight applied should be equal to the weight of the bearing being measured.

The lifting chain is kept in place, with some slack, at all times.

Timken Company Representatives are available to help design and demonstrate the use of these fixtures as well as instruct maintenance personnel on the bearing measurement procedure.

Seating bearing parts

After weighting the bearing, the parts must be rotated to seat the rollers. A light oil should be applied to the rollers to help protect the bearing (Figure 28). Considerable rotation of the bearing may be necessary to seat the parts fully, particularly on those bearings with long service records.

Approximate seating can be checked by trying to insert a 0.002" feeler gauge between the large end of the rollers and the rib of the bearing cone, as illustrated in Figure 29. All four sets of rollers should be checked for seating.

Spacer and space measurements

With all parts seated, the B cup space, D cup space and the C cone space are measured at four places 90° apart around the bearing (Figure 30). The average of the four readings for each space is then obtained and used as the width for that space.

The B, D, and C spacers are then measured to obtain their actual width (Figure 31). The width of the spacers should be parallel within 0.001".

Axial end play

Bearings properly set with end play will always have spacer widths greater than the corresponding spacer gap, as demonstrated in Figure 32. The difference between the spacer width and spacer gap measurement is the end play in the two rows of rollers adjacent to that spacer.

The wear in all parts of a used bearing may not be the same and the end play in each set of rollers may show some differences. Ordinarily, there is not much difference between the sets unless some unusual operating conditions has loaded one end of the bearing severely or faulty seals at one end of the chock have allowed localized contamination of the lubricants.

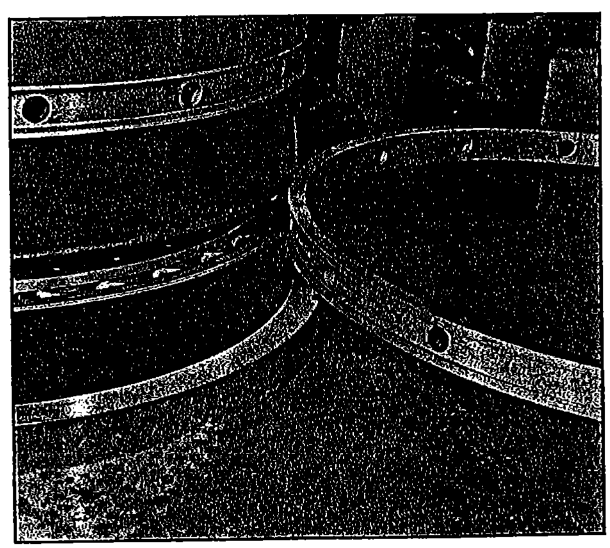


FIGURE 32

Readjustment recommendations

The bearing setting can be adjusted to the required amount by regrinding each spacer width so that it is wider than the measured space by the amount of the end play desired in the bearing.

It is not usually necessary to regrind the spacers until the wear has increased the end play to double the original figure. For instance, on a bearing with a 0.012" original end play, regrinding of the spacers would not be necessary until the bearing measurement for wear showed 0.024" end play in the bearing.

The general rule when regrinding spacers is to grind the widths to provide for one and one-half times the original bearing end play. If the new bearing had called for 0.012" end play, regrind the spacer to provide 0.018" end play. The increase over new bearing end play is necessary to compensate for the use of weights during measurement. This is a safety factor to ensure against too tight a setting. Figure 33 shows a sample calculation for a bearing with an original end play of 0.012". A record of the spacer gap and spacer width should be kept on the backside of the Roll Neck Bearing Service Record card.

BEARING END PLAY READJUSTMENT

WHEN TO READJUST END PLAY

Original End Play in Bearing (New)	.012"
Regrind Spacers when End Play doubles to	.024"
Regrind Spacers to provide 1-1/2 times original end play	.018"

SPACER WIDTH CALCULATION

Space Measurement	1.024"
End Play Desired	+.018"
Regrind Spacer to	1.042"

All 3 spaces, 'B', 'C' and 'D' are calculated as above using proper values of space measurement for 'B', 'C' and 'D'.

FIGURE 33

FIGURE 34

INSPECT AND REPAIR THE CHOCK

Keeper plates and rocker plates should be inspected to make sure they are in good condition, with proper bevels permitting the chocks to rock and align themselves under roll neck deflection conditions. Proper clearance between the chocks and the windows in the mill housing must be maintained.

The bearing chocks should be cleaned out thoroughly and all lubrication and vent holes blown out with air (Figure 34). If oil mist lubrication is used, special attention should be given to assuring the mist reclassifier fittings are clean.

Heavy corrosion or fretting in the chock should be buffed or polished out (Figure 35). Periodic checks for bore size and out-of-roundness should be made (Figure 36) and recorded. Long service can distort the chocks. The bearing cups are a loose fit in the chock and the fitting practice (Figure 37) varies with the size of the bearing. Suggestions for permissible chock bore out-of-roundness and over size limits due to service are shown in Figure 38.

Backing shoulders in the chock should be free of burrs to permit proper seating of

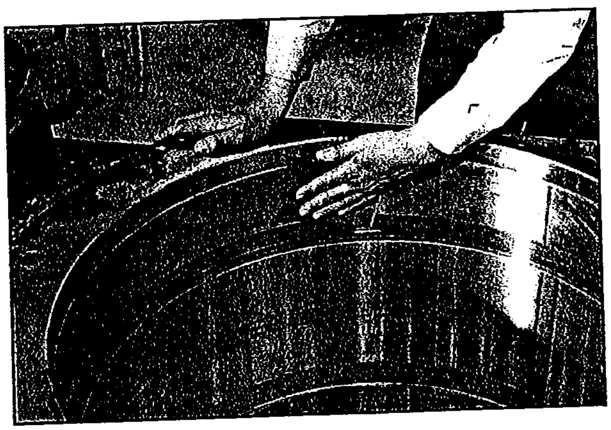


FIGURE 35

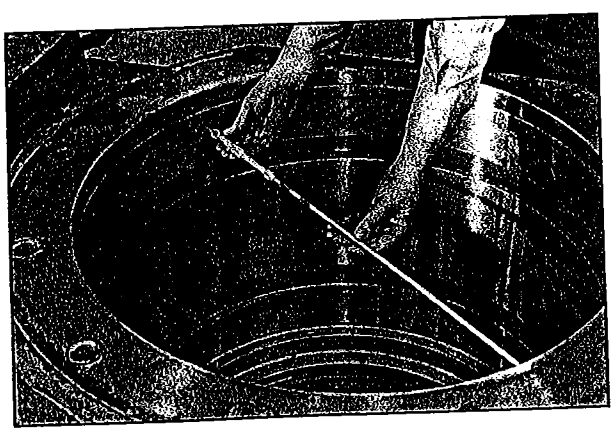


FIGURE 36

Cup fitting practice

Outside Diameter, in.		Chock bore is normal cup outside diameter, in.		
Over	To	Min.	Max.	Fit
0	12	+0.002	+0.008	0.001 to 0.008 Loose
12	24	+0.004	+0.006	0.002 to 0.006 Loose
24	36	+0.006	+0.009	0.003 to 0.009 Loose
36	48	+0.008	+0.012	0.004 to 0.012 Loose
48	60	+0.010	+0.015	0.005 to 0.015 Loose

FIGURE 37

Permissible changes in chock bores from service

Cup Outside Diameter, in.	Maximum chock bore "out-of-roundness" limits, in.	Maximum chock bore over normal cup outside diameter
to 12	0.006	+0.009
+12 to 24	0.012	+0.018
+24 to 36	0.018	+0.027
+36 to 48	0.024	+0.036
+48 to 60	0.030	+0.048

FIGURE 38

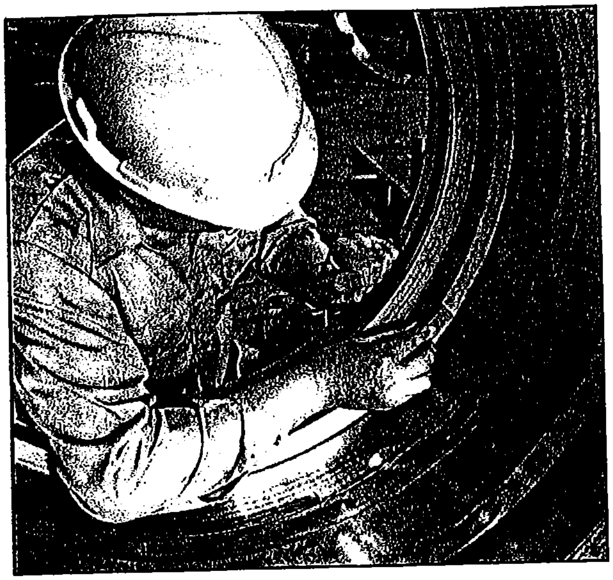


FIGURE 39

FIGURE 41

FIGURE 40

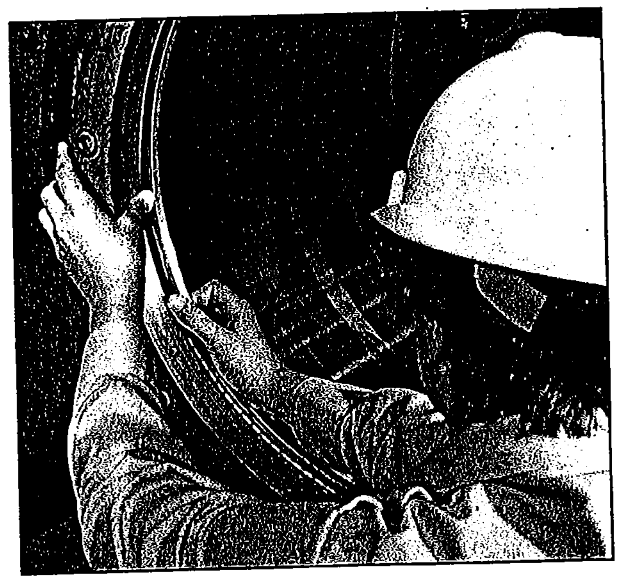
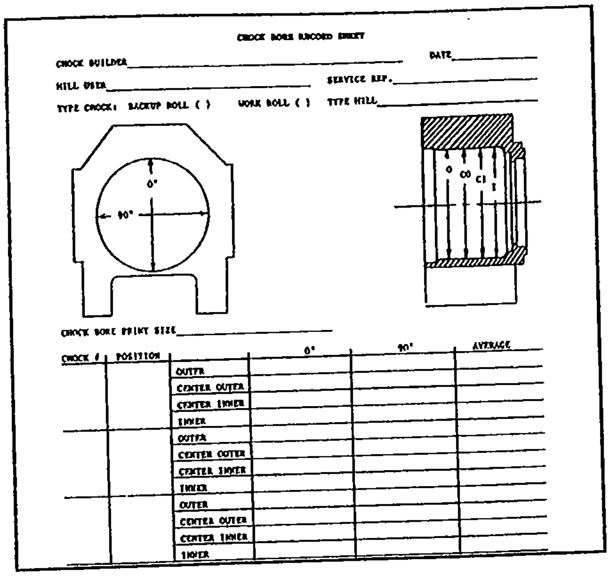


FIGURE 42

the cups (Figure 39). Burrs can work loose in service and may get in the bearing. Backing shoulders on the cover plate (Figure 40) should also be free of burrs.

All seals should be checked thoroughly and replaced if worn badly or torn (Figures 41 & 42). Seals play a major role in getting good service from the bearings and great care should be taken to keep good seals in the chocks at all times.

A record of each chock inspection and measurements should be kept by the maintenance personnel and chock repairs made when necessary. A typical chock record card is illustrated in Figure 43.



CHOCK BORE RECORD SHEET

CHOCK BUILDER ______ DATE ______

MILL USER ______ SERVICE REF. ______

TYPE CHOCK: BACKUP ROLL ( ) WORK ROLL ( ) TYPE MILL ______

CHOCK BORE PRINT SIZE ______

CHOCK #	POSITION		0°	90°	AVERAGE
		OUTER			
		CENTER OUTER			
		CENTER INNER			
		INNER			
		OUTER			
		CENTER OUTER			
		CENTER INNER			
		INNER			
		OUTER			
		CENTER OUTER			
		CENTER INNER			
		INNER			

FIGURE 43

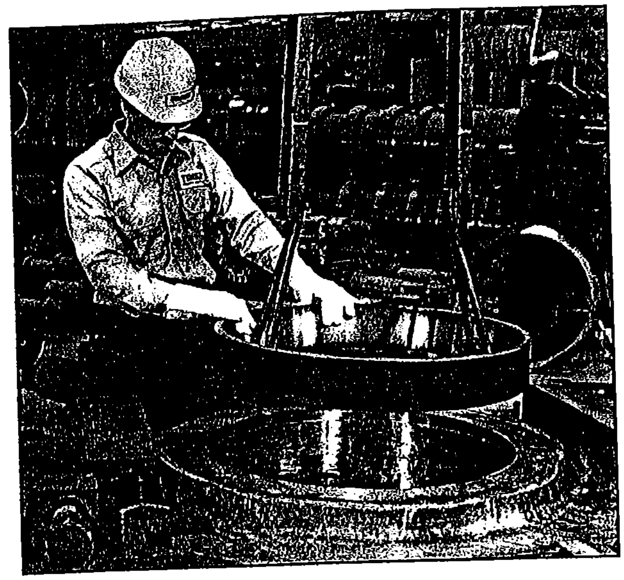


FIGURE 44

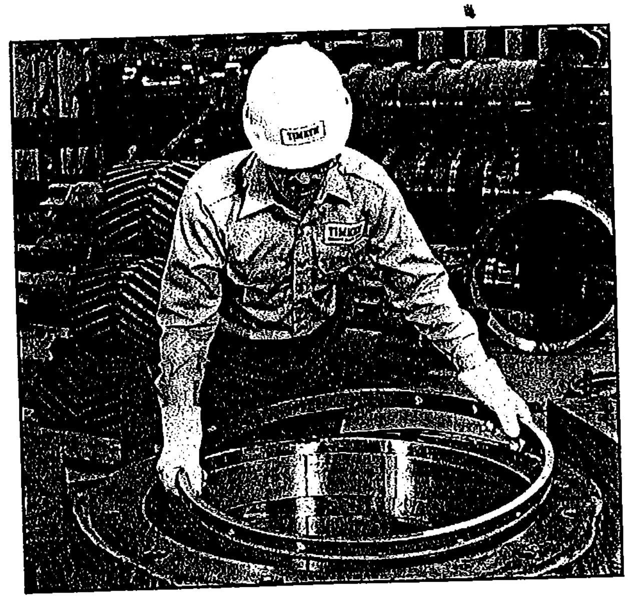


FIGURE 45

ASSEMBLE THE BEARING INTO THE CHOCK

Before assembling the bearing in the chock, check the record card to make sure which load zone or quadrant is to be used. A light coating of oil or grease in the bore of the chock will help ease the assembly and can help reduce fretting or corrosion between the cups and the chock bore in service.

The bottom cup is installed in the chock first (Figure 44). Each cup should be turned until the proper load zone number is in the required position.

The corresponding cup spacer is installed next (Figure 45). Care should be taken to avoid nicking or raising burrs on the spacers.

Heavy burrs can cause cocking and misalignment of the parts or faulty bearing setting.

When grease is used to lubricate the bearings, each cone should be packed with grease as the parts are being assembled in the chock.

Additional grease should be added through the regular fittings after the bearing is completely assembled in the chock. When circulating oil or oil mist lubrication is used, a light coating of the oil should be on the parts as they are assembled. Additional oil must be added to provide the required oil level after the chock is set upright.

The bottom double cone and double cup are next installed into the chock (Figure 46).

The cone spacer (Figure 47) and top cup spacer are put into position next. The cone spacer pilots on the face of the bottom cone to keep the spacer from shifting out of position. To make sure the cup spacers are not cocked or hanging up on the chock bore, slide or rotate them into position on the cup.

The top double cone and top cup are the last parts to be installed into the chock (Figure 48).

If the cup becomes slightly cocked and hangs up in the chock bore, the use of an appropriate sized hammer **on** a mild steel bar against the cup face will ease assembly (Figure 49).

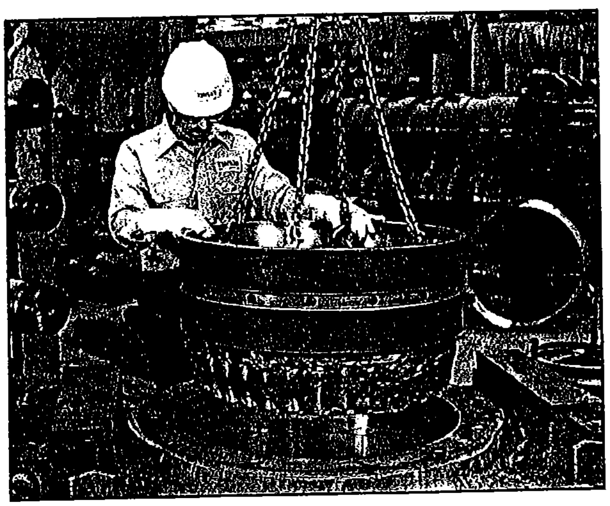


FIGURE 46

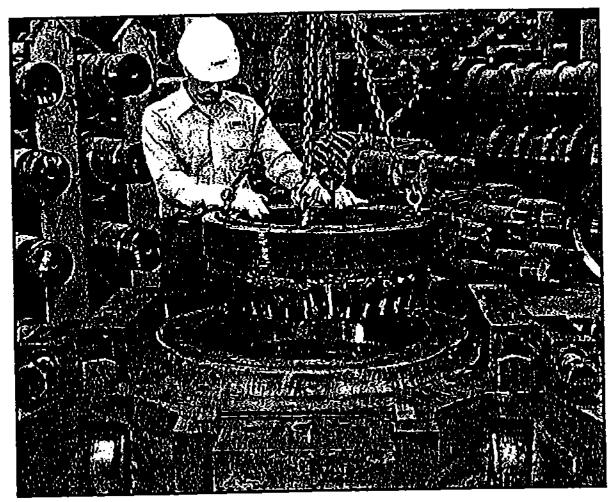


FIGURE 48

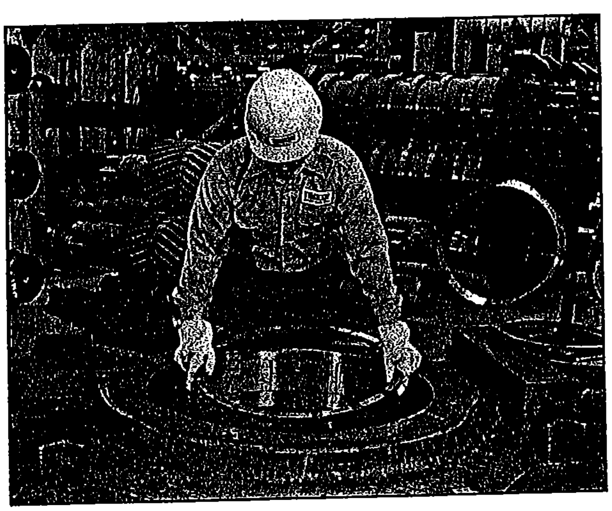


FIGURE 47

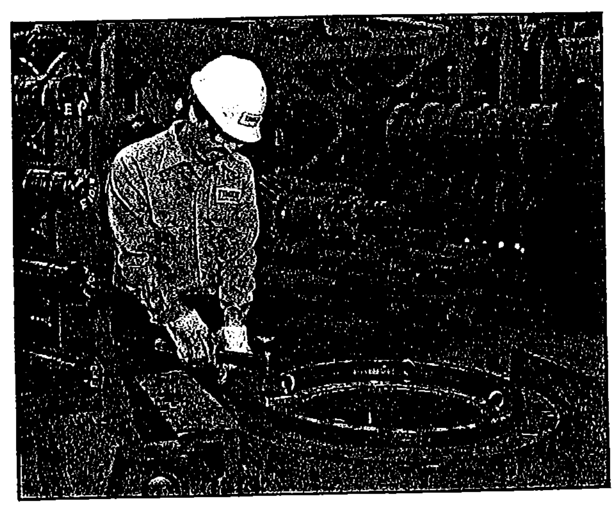


FIGURE 49

Chock cover plate gasket selection

The cover plate should be applied without gaskets, and four equally spaced bolts tightened up evenly, until the bearing cover is uniformly seated against the bearing cup.

The gap between the cover plate flange and the face of the chock is checked in several places adjacent to the bolts and the average obtained (Figure 50). The gasket or gaskets selected should equal the width of the gap plus 15 percent to 25 percent more to allow for compression of the gasket at the same time the bearing cups are being clamped up tight by the cover plate. The 15 percent to 25 percent figure is for cork or other similar compressible gasket material. If harder material is used, reduce the gasket pack to only 5 percent to 10 percent over the actual measured gap.

To ensure the gasket is compressed evenly, and the bearing is properly clamped, notch the gasket in four places prior to installation (Figure 51). This permits four areas to be remeasured after installation.

After measuring the gap, selecting the proper gasket and notching the gasket; the cover plate should be removed. After applying the cover plate with the gasket in place, pull up on the bolts evenly back and forth across the chock. This permits even compression of the gasket pack and avoids possible distortion of the cup spacer and bearing.

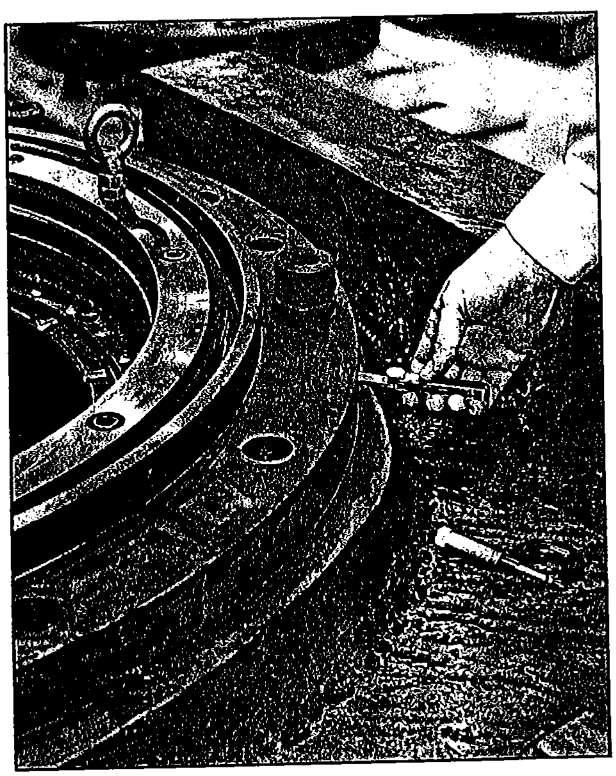


FIGURE 50

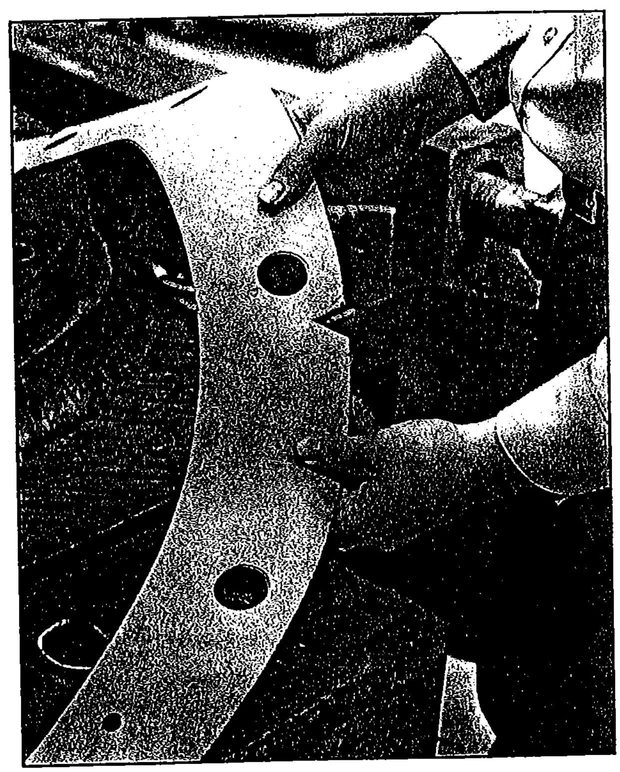


FIGURE 51

INSPECT THE ROLL NECK

Before applying the completed chock and bearing assembly to the roll neck, the neck should be inspected and checked for size and general condition (Figure 52). The bearing cones are usually applied with a loose fit on the roll neck. Figure 53 shows the fitting practice used for the various bearing size ranges. Suggestions for permissible service wear limits on roll necks are shown in Figure 54.

Make sure any raised nicks or gouges on the roll neck are stoned or filed down before reassembly (Figure 55). Heavy burrs can cause difficulty in assembling the cones on the neck, particularly on new rolls with nominal sized necks.

FIGURE 52

The seal riding surface should be polished or repaired (Figure 56). Sharp edges that could cut the seal lip at assembly should be removed.

Coat the neck with lubricant to help combat scuffing (Figure 57). Also, the seal riding surface should be lubricated to help ease the seals over the chamfered edge.

Cone fitting practice

Bores, In.		Neck diameter is normal bearing bore, In.		
Over	To	Max.	Min.	Fit, In.
2	3	-0.002	-0.003	0.002 to 0.004 Loose
3	4	-0.003	-0.004	0.003 to 0.005 Loose
4	5	-0.004	-0.005	0.004 to 0.006 Loose
5	6	-0.005	-0.006	0.005 to 0.007 Loose
6	8	-0.006	-0.007	0.006 to 0.008 Loose
8	12	-0.007	-0.008	0.007 to 0.009 Loose
12	24	-0.008	-0.010	0.008 to 0.012 Loose
24	36	-0.010	-0.013	0.010 to 0.016 Loose

FIGURE 53

Permissible service wear on mill roll necks

Cone bores, In.	Permissible minimum neck diameter below normal bearing cone bore, In.
to 3	-0.012
+3 to 4	-0.015
+4 to 5	-0.018
+5 to 6	-0.021
+6 to 8	-0.024
+8 to 12	-0.027
+12 to 24	-0.036
+24 to 36	-0.048

FIGURE 54

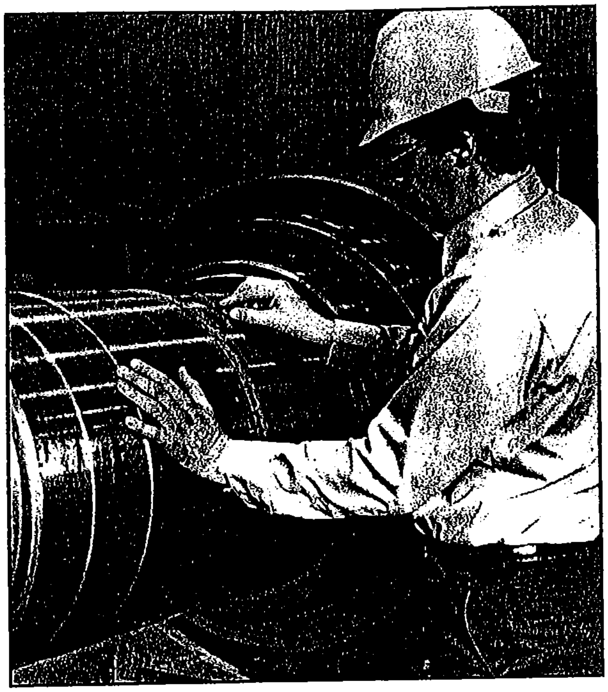


FIGURE 55

FIGURE 56

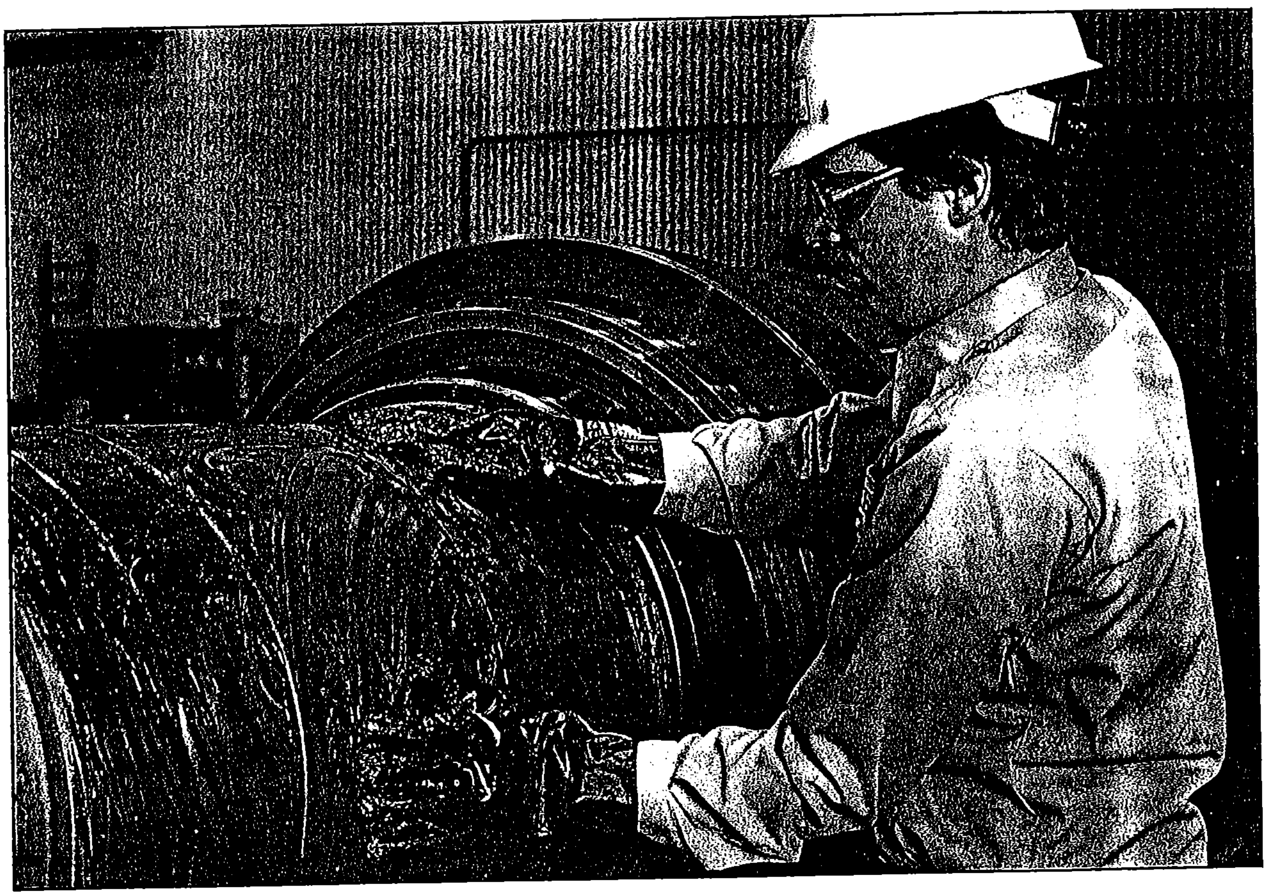


FIGURE 57

INSTALL THE CHOCK ONTO THE ROLL NECK

Careful handling of the chock while sliding it on or off the roll neck will help prevent a large portion of the most commonly found seal damage.

After installing the chock onto the roll neck, the threaded and keyed retaining ring, the retaining nut and split hinged ring should be fixed in place. The threaded ring is held into position by the split hinged ring which is fitted into a groove in the roll neck and secured. This arrangement provides for a positive means of locating the bearing. The retaining nut is provided with a number of slots or holes on the outside diameter to aid in turning it into position. One of the most important points to observe in this procedure is to make sure the retaining nut is backed off at least a sixth of a turn **after** being drawn up tight against the cone follower when seating the parts and then locked (Figure 58). This back off allows a small gap between the cone faces and the thrust rings which permits lubrication to run between these faces to help prevent scoring and heating of the bearing. Many cases of "hot running bearings" have been cured by simply backing the nut off. This nut back off applies to all straight bore bearings with loose cone fits used in either work rolls or backup rolls.

Lubrication

While the bearings are in service in the mill, they should be kept adequately lubricated at all times. Automatic lubrication systems, properly adjusted, assure a good supply of lubricant. If circulating oil or oil mist lubricating systems are used, periodic checks for contamination of the oil in the chocks should be made. Chocks should be drained often enough to prevent an accumulation of large amounts of water or rolling solutions. After draining the chocks, new oil must be added to maintain the proper level.

Timken Company Representatives can provide suggestions for the type, the grade, and the amount of lubricant to be used in roll neck bearing applications.

With proper care, maintenance and lubrication, Timken tapered roller bearings will continue to do the tough, rugged job expected of them in your rolling mill.

FIGURE 58

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BUENOS AIRES, ARGENTINA

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