Montgomery Industries International, Inc
P.O. Box 3687 2017 Thelma Street
Jacksonville, Florida 32206 U.S.A.
(904) 355-5671 FAX (904) 355-0401

OPERATING, MAINTENANCE, LUBRICATION, AND SAFETY INSTRUCTIONS

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for

MODELS FS, HD & PM HOGS

A DVD is available for purchase which is designed to help in understanding the information contained in this manual

Bulletin 23-10-14

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SAFETY PRECAUTIONS

ANY MALFUNCTION OR OPERATION PROBLEM NOT COVERED IN THIS MANUAL SHOULD BE REPORTED TO THE FACTORY. OUR TRAINED ENGINEERS ARE AVAILABLE TO ASSIST YOU.

READ AND FOLLOW ALL INSTRUCTIONS IN THIS MANUAL BEFORE USING THIS EQUIPMENT.

√ Check teeth in rotor daily to make certain they are tight. Normal operation may cause these parts to loosen over time. If not re-tightened on a timely basis, the parts will hit the anvils and/or the screen causing damage to the unit and possibly causing severe injury to personnel in the area.

IT IS THE RESPONSIBILITY OF THE USER TO KEEP THE TEETH PROPERLY TORQUED AT ALL TIMES.

√ Due to the high inertia load of HOG rotor, multiple start-ups can cause excessive internal heat build-up in the motor, causing motor failure.

√ HOG should **not** be started more often than once in a two hour period.

√ Do **not** perform any maintenance work or any other operations on this equipment unless it is completely stopped and all electrical circuits are deactivated and locked out. We recommend that the person performing the maintenance work keep the lockout key on his person to ensure that no one else engages power without knowledge of maintenance work being performed.

√ Do **not** operate this or other machinery without proper training and complete understanding of all instructions contained in this manual.

√ Do **not** operate this or other machinery without all guards being installed.

√ Do **not** remove inspection door while HOG shaft if turning over.

√ Do **not** turn rotor over by hand or power with any part of the body between the teeth and anvils. This is a **high inertia** rotor and cannot be stopped easily, once in motion. **Even when barely moving, it has enough momentum to cut off a finger.**

- √ Do **not** look into the machine when rotor is turning. Wear safety glasses any time you are working on or in near proximity to operating equipment.
- √ The noise level of this equipment when operating is in excess of safe levels for unprotected ears. Wear hearing protection any time you are near this or other load machinery.
- √ Wear gloves any time you are working on this equipment.
- √ Under no circumstances should fingers be inserted in the holes of the HOG screen to facilitate removing. A slip of the screen could easily remove a finger.
- √ Do **not** clear obstructions from screen holes with hands while screen is in the machine.
- √ Use caution and proper lifting equipment to open the rear door of a HOG. The rear door is too heavy for one man to support.
- √ Be careful when installing new rings on a shaft as fingers are easily smashed.
- √ Be careful when installing new teeth into rings as fingers are easily smashed.
- √ **Never** wear loose clothing, especially a necktie, which could get entangled in moving machinery.
- √ Do **not** hand feed material directly into the HOG. If hand feeding is required, it should be onto a conveyor feeding into the hog.
- √ Do **not** poke sticks, poles, etc. into any access opening on HOG while it is operating. HOG should be completely stopped before attempting to clear any blockages.
- √ **Do not allow steel to enter the grinding area.** Steel (or other materials of similar strength) creates a safety hazard for personnel in the area and may cause major damage to the unit.

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INSTALLATION

- **FOUNDATION PREPARATION**

1. Unit must be mounted on a reinforced concrete foundation which should extend at least 6" beyond the base plate of the unit on all sides.

   The unit must be bolted down tightly. The foundation must be smooth, clean, and level and unit must be shimmed prior to tightening. Unit can bow and bind causing excessive stress when if anchoring alters the inherent contour of the base plate.

   When foundation is smooth, clean, and level and base plate is shimmed and grouted, tighten all anchor bolts holding down unit.

2. The minimum recommended thickness of reinforced concrete is 12" but local codes and frost line will determine the actual thickness required.

3. Anchor bolts should be 1" NC X 12” extending 3" above the top of the reinforced concrete.

4. The unit must be mounted with the base plate horizontal. Mounting on an angle may cause the bearings to fail.

5. If the unit is mounted on steel columns, the supporting structural steel sub-base and the column legs should be designed for a minimum capacity of 2.5 times the total static weight of all equipment supported to account for dynamic loading.

   Structure should incorporate rigid connections, support and bracing both perpendicular and parallel to the rotor with vertical gussets in both planes.

6. **Provide at least 36" of clearance on all sides of the unit for maintenance.**

- **SHIM & GROUT BASE PLATE**

1. With the HOG sitting flat on the foundation (do not bolt down), place shims under any corner which is not already flat.

2. After shimming corners where needed, insert shims 12” - 16” apart down all four sides as needed. Each shim should be of a size to fill the gap between the floor and the bottom of the HOG base plate.

3. Pack grout as far back under the base plate as possible, usually 2" to 3".

4. After the grout is dry, tighten all mounting bolts holding down HOG.

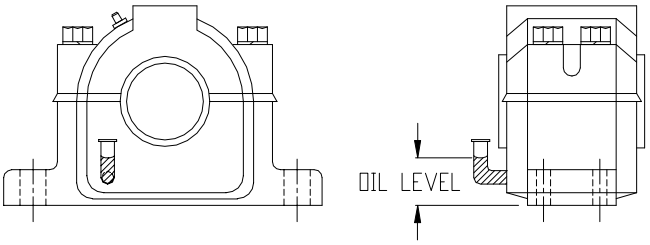
- **START-UP PROCEDURES**

1. Check bearings for proper lubrication.

GREASE IS FLAMMABLE AND EXPLOSIVE IN CONTACT WITH PURE OXYGEN!

Grease Bearings The bottom half of the housing, with the bearing sitting in the housing, should be filled 1/3 to 1/2 full of grease. (see *Bearing Lubrication* Section).

Static Oil Bearings Check sight gauge for proper oil level. Fill to oil levels based on bearing size. Oil level is measured from the bottom of the block base to the meniscus on oil sight gauge. Oil should be at level shown while HOG is shut down. When HOG is running, level of oil may rise or drop from shut down level.



USAF 500 The Static Oil Level should be 1-51/64" for 3-15/16" Bearings
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USAF 600 The Static Oil Level should be 2-9/16" for 4-15/16" Bearings
The Static Oil Level should be 2-11/16" for 5-7/16" Bearings

2. Check alignment of flexible coupling or V-belt drive.

3. Check tooth clearance. Access the teeth by opening the rear door.

BEFORE OPENING REAR DOOR, FIRST SECURE THE HOOK OF A LIFTING DEVICE TO THE PADEYE PROVIDED. USE EXTREME CAUTION NOT TO MASH OR CUT OFF FINGERS. DO NOT PUT FINGERS IN BOLT HOLES. KEEP CLEAR WHEN OPENING OR CLOSING.

Open rear door by removing the side bolts at the top of door and then loosening the side bolts at the bottom of door. Clearances between sides of teeth and anvils should be 1/32" to 3/32" and the radial clearance between the teeth and anvils should be 1/32" to 1/16".

4. Make certain all teeth are tight. The recommended torque for T3 teeth is

250 ft-lbs for Forged Teeth (discontinued in 2011)
350 ft-lbs for Manufactured Teeth
350 ft-lbs for 2-Part Teeth

Tightening beyond the elastic region of the steel can cause threads to stretch and/or the lock washer to permanently flatten or deform - any of which will undermine the connection.

A LOOSE TOOTH CAN HIT THE ANVILS AND/OR THE SCREEN CAUSING DAMAGE TO THE UNIT AND POSSIBLY CAUSING SEVERE INJURY TO PERSONNEL IN THE AREA.

5. Turn rotor by hand (or by pulling on drive belt) for a few rotations to check for binding.

6. Jog motor to verify correct shaft rotation under power.

7. Make certain that all guards are in place and secure.

8. If a blowpipe connection is used to collect the shredded material, make certain there are no objects obstructing the air flow that could cause the pipe to plug.

9. If a mechanical conveyor is used to collect the shredded material, make certain that it is properly installed.

BLO-HOG MODELS

10. Check air opening on side and remove any obstructions to the air flow. There must be a minimum of 12" clearance between the air opening and any obstruction (e.g. a wall).

11. Check pulley diameters and drive motor RPM to verify proper HOG shaft speed.

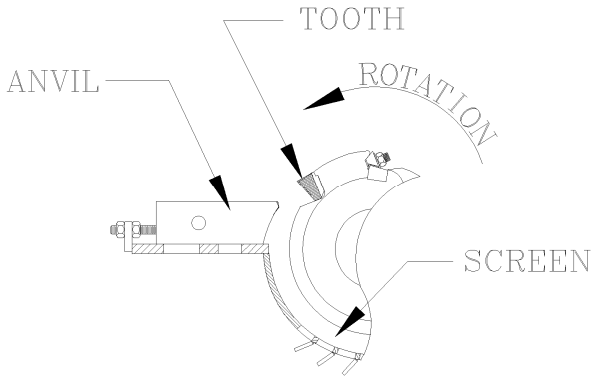
12. Check drive belts for proper tension. Operating a Blo-Hog with loose V-belts or a worn fan wheel can result in pipe stoppage from inadequate air flow.

PRINCIPLES OF OPERATION

NOTE: YOU MAY ALSO USE THE HOG MATERIAL LIST AS A VISUAL AID IN REFERENCE TO THE ITEMS DISCUSSED IN THIS MANUAL.

- **ANVILS**

1. Positive cutting action between the teeth and anvils performs what amounts to the first particle sizing function in a two stage process.



2. The Anvils are adjustable to maintain the proper tooth-anvil clearance for efficient hogging.

3. Anvils are hard-surfaced on all wearing surfaces.

   Because of the different coefficients of thermal expansion between the mild steel and the hardening alloys, hairline cracks may appear on cooling. Hairline cracks will not affect the life of these parts and the parts should not be considered defective because hairline cracks are present.

4. Maximum wear life from hardsurfaced parts results from using the proper hardsurfacing material and making sure that it has been applied correctly.

   The proper hardsurfacing of parts is a complex and methodical process. **Using new and rebuilt factory parts is the best way to ensure that the hardsurfacing has been applied correctly and that you can expect excellent performance.**

- **PUNCH AND DIE CUTTING**

All FS, HD and PM HOGS employ a unique cutting action involving stationary anvils positioned on the side of the machine with rotating teeth (hammers) that pass through rectangular pockets formed by these anvils.

This positive cutting action between the teeth and anvils performs what amounts to the first particle-sizing function in a two stage process.

The second sizing action occurs when the material cut by the action of the teeth against the anvils is directed downward and across a curved particle-sizing screen which fits underneath the rotating element.

The discharge from Montgomery Hogs is generally quite uniform in size, containing a minimum of fines.

- **REBUILDING TEETH AND ANVILS**

1. The allowable wear before rebuilding becomes necessary will depend upon the material being hogged. Generally, when the cutting edges of the teeth have worn to a 1/8" radius, the effect upon operation will be noticeable.

2. The order in which the wear occurs is first at the tip and sides of the teeth and usually much later on the cutting edges of the anvils.

3. Teeth and anvils should be removed and rebuilt before the hardsurfacing material has worn into the base metal. After that point of wear is reached, the base metal wears away rapidly and the cost of rebuilding soon reaches the cost of replacement.

4. General practice is to rebuild the anvils every second or third time the teeth are rebuilt or changed.

5. The teeth and anvils should be inspected frequently until a wear pattern is established and the operator knows at what interval the parts must be rebuilt.

6. Maximum wear life from hardsurfaced parts results from using the proper hardsurfacing material and making sure that it has been applied correctly.

   The proper hardsurfacing of parts is a complex and methodical process. **Worn teeth and anvils should be shipped to the factory and exchanged for parts rebuilt to factory standards.**

USING PARTS NOT MANUFACTURED BY MONTGOMERY INDUSTRIES MAY ENDANGER THE SAFETY OF PERSONNEL AND VOIDS ALL WARRANTIES.

- **ROTOR**

The rotor assembly consists of a solid steel shaft, a series of steel rings that are fixed to the shaft with shear pins (used for tramp metal protection) and harsurfaced teeth that are bolted to the rings.

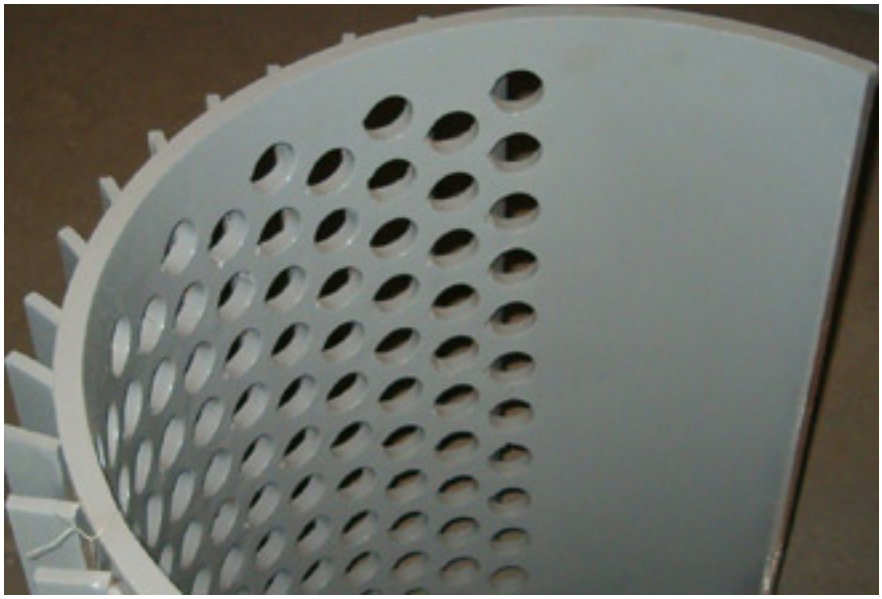
The shaft, rings and teeth are manufactured to tight factory tolerances using CNC machinery. Precision machining is used in order to provide a tight fit of components and reduce the potential for undesirable movement and/or metal fatigue.

Because the Montgomery Hog uses a high speed precision cut, **unchecked wear or failure to use Montgomery Industries factory parts can result in a loose or unpredictable fit of components.**

LOOSE FITTING PARTS CAN INCREASE THE POTENTIAL FOR PART FAILURE DUE TO METAL FATIGUE AND FOR PART MOVEMENT THAT CAN RESULT IN CATASTROPHIC COLLISION.

- **SCREEN**

The screen is used to control the size of the material discharged from the unit. The smaller the hole size in the screen, the smaller the end product will be.



However, capacity will be less compared to larger holes so it will take longer to process a given amount of scrap and more power will be consumed due to the longer grinding time. There will also be more wear on the cutters.

Therefore, the largest size hole that produces an acceptable end product should be selected to maximize capacity and minimize wear and power consumption.

- **TEETH**

1. Positive cutting action between the teeth and anvils performs what amounts to the first particle sizing function in a two stage process.

2. Teeth are hard-surfaced on the sides, face and top.

   Because of the different coefficients of thermal expansion between the mild steel and the hardening alloys, hairline cracks may appear on cooling. Hairline cracks will not affect the life of these parts and the parts should not be considered defective because hairline cracks are present.

3. Maximum wear life from hardsurfaced parts results from using the proper hardsurfacing material and making sure that it has been applied correctly.

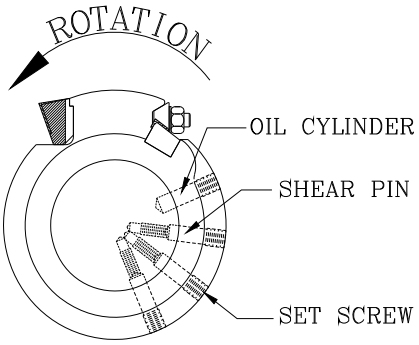
   The proper hardsurfacing of parts is a complex and methodical process. **Using new and rebuilt factory parts is the best way to ensure that the hardsurfacing has been applied correctly and that you can expect excellent performance.**

4. Normal operation may cause the teeth to loosen over time. The time over which fastenings may loosen varies with each application, depending on the type of material processed, the quantity of material processed, the hours per day of operation, the integrity and fit of the parts, and the level of vibration/imbalance during operation.

IT IS THE RESPONSIBILITY OF THE USER TO KEEP THE TEETH PROPERLY TORQUED AT ALL TIMES.

- **TRAMP METAL PROTECTION**

1. Shear pins are used to protect the HOG from tramp steel. Each breaker ring is secured and held in position on the shaft by three shear pins. The shearing strength of these pins is sufficient to carry loads encountered in normal operation of the HOG but will shear when heavy tramp steel enters the HOG. This configuration lets the ring stop while the shaft continues to turn.



2. A plastic cylinder of oil is inserted in each ring in the first hole behind the tooth to provide lubrication should these shear pins shear. A new oil cylinder must be installed when new shear pins are installed in the rings. Occasionally, damage will result in spite of this protection but under normal operating conditions the shear pin protection is effective.

3. On occasion, and in special instances, the three shear pins in a ring may shear from wood alone. In this case, adjacent rings should be chain-welded in pairs to provide the additional strength of three extra pins so it is necessary to shear six pins at once instead of just three. This configuration is normally done at the factory for applications where the need is anticipated.

4. The operator should familiarize himself with the spacing of the breaker rings on his HOG so that he will be able to detect, at a glance, any changes in the spacing which would indicate sheared pins.

5. Normally, a sheared pin will be accompanied by rotation of the ring out of position. A ring out of position will result in excessive vibration which will immediately be recognized and the HOG should immediately be shut down and the shear pins replaced.

MAINTENANCE PROCEDURES

- **BEARING LUBRICATION - GREASE**

USE EXTREME CAUTION - GREASE AND OIL ARE FLAMMABLE AND EXPLOSIVE IN CONTACT WITH PURE OXYGEN!

Hogs using grease lubricated bearings should be greased in accordance with the following specifications:

1. All model HOGS use a Class-3 fit.

2. The following types of grease may be used:

   √ **Chevron Duralith EP #2 is preferred.**
   Viscosity at 210° F: 80 SUS
   Drop point: 370° F

   Shell Alvania EP #2 is acceptable.
   Viscosity at 210° F: 80 SUS
   Drop point: 365° F

   Gulf Crown EP #2 is acceptable.
   Viscosity at 210° F: 82.5 SUS
   Drop point: 348° F

3. Any equivalent grease should have the following characteristics:

   - Usable temperature range up to 200° F operating temperature.
   - Viscosity of the oil in the grease should not be less than 100 SUS at the operating temperature.
   - The drop point of the grease must be in excess of 300° F.
   - Grease compounds with Lithium or non-soap bases are preferred. The No. 2 consistency grades have been found to be the most satisfactory for normal operating speeds.

4. The re-lubrication cycle must be determined from experience. It is important that fresh grease reaches internal surfaces of the bearing. Refer to the re-lubrication guide which has been provided in the appendix.

   When adding grease, a small amount at frequent intervals (approximately every 5 weeks) is preferable to a large amount at long intervals. A practical guide is V (ounces) = 0.25 x d x b, where d is the depth of the bearing (in inches) and b is the bore of the shaft (in inches).

5. When replacing old grease with new, the grease should be worked into the available spacing in the bearing by hand, forcing grease in between the rollers and under the edge. The bottom half of the housing should be 1/3 to 1/2 full of grease, depending on the operating conditions.

   An oversupply of grease in the bearing will result in churning and break-down of the grease and overheating of the bearing.

6. The bearing housing must be cleaned, flushed with mineral spirits, and repacked with appropriate grease at least once per year.

- **BEARING LUBRICATION - OIL**

USE EXTREME CAUTION - GREASE AND OIL ARE FLAMMABLE AND EXPLOSIVE IN CONTACT WITH PURE OXYGEN!

1. If for any reason the bearings are switched from grease to oil lubrication, the bearing should be washed clean of all grease.

   In the bottom half of the bearing housing below the shaft seal (slinger ring) there is a vertical hole drilled in each side of the housing. These holes are used to return oil back to the oil chambers. They should be cleaned thoroughly because if they are plugged, the oil will not return and may soon empty the bearing.

2. For HOGS using oil lubricated bearings, either static lubrication or circulating oil systems, the following oil types may be used:

   √ **Mobile DTE Oil AA is preferred.**
   API Gravity: 0.897
   Minimum Flash Temperature: 460° F
   Viscosity: 120-130 SUS at 210° F
   Viscosity Index: 95

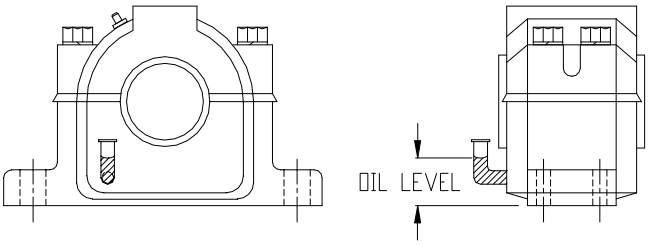
   Mobile DTE Oil HH is acceptable.
   API Gravity: 0.9
   Minimum Flash Temperature: 520° F
   Viscosity: 140-155 SUS at 210° F
   Viscosity Index: 95

   Shell Tellus Oil 976 is acceptable.
   API Gravity: 27.6
   Minimum Flash Temperature: 495° F
   Viscosity: 126 SUS at 210° F
   Viscosity Index: 97

3. Any equivalent oil should have the following characteristics:

   - Usable temperature range up to 200° F operating temperature.
   - Minimum Flash Temperature of 460°F
   - Viscosity at 210° F must be a minimum of 100 SUS.

4. Check sight gauge for proper oil level. Fill to oil levels based on bearing size. Oil level is measured from the bottom of the block base to the meniscus on oil sight gauge. Oil should be at level shown while HOG is shut down. When HOG is running, level of oil may rise or drop from shut down level.



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- **BEARING REPLACEMENT - REMOVING AN OLD BEARING**

STOP THE HOG

1. Bend out the locking device on the lock ring to release the nut.

2. Loosen the nut about two or three turns.

   To loosen the nut, place a spanner wrench or heavy bar of brass or bronze against the nut. Use a heavy sledge to hit the wrench or bar and keep moving around the nut with the wrench or bar. Do **not** keep pounding in one place as this will ruin the threads on the sleeve and nut.

3. Place a cylinder slightly larger than the bearing journal of the HOG shaft and long enough to clear the end of the shaft against the bearing unit locking nut.

4. Using a sledge hammer, strike the end of the cylinder with a level swing to jar the bearing loose from the tapered sleeve. If the bearing unit resists separating from the tapered sleeve, use wood blocks as a wedge behind the bearing unit so that it cannot move.

5. Once the bearing unit is loose, all of the bearing components will easily slide off of the shaft.

- **BEARING REPLACEMENT - INSTALLING A NEW BEARING**

1. Clean the shaft thoroughly and remove any rough spots with either a file or an emery cloth.

2. Slide the bearing unit onto the shaft.

3. Place the adapter in the bearing unit and put on the locking ring and nut. **DO NOT TIGHTEN THE NUT.**

4. Allow shaft and bearing unit to rest in the bottom half of the housing for tightening.

5. Install the stabilizing ring, if applicable. The HOG only uses one stabilizing ring per set of bearings, customarily installed opposite the drive end.

6. The bearing unit is secured on the shaft by tightening the lock nut with a spanner wrench or with a blunt chisel and hammer.

7. While tightening the nut, keep checking the clearance between the top roller and outer race with a feeler gauge until the proper clearance is reached. Refer to Schedule "A" below for clearance requirements.

   It should be noted that the Reduction In Internal Clearance as shown in Schedule "A" means that the initial clearances (clearances set by the bearing manufacturer) should be reduced by the amount shown. These are tolerances recommended by the bearing manufacturer.

SCHEDULE "A" (SKF Bearings)

Shaft Journal	Bearing	Bore (mm)	Unmounted Clearance	Reduction In Internal Clearance	Mounted Clearance
2.9375	22217CCK/C3W33	85	0.0043 - 0.0055	0.0018 - 0.0025	0.0025 - 0.0030
3.9375	22222CCK/C3W33	110	0.0053 - 0.0067	0.0020 - 0.0028	0.0033 - 0.0039
4.4375	22226CCK/C3W33	130	0.0063 - 0.0079	0.0025 - 0.0035	0.0038 - 0.0044
4.9375	22328CCK/C3W33	140	0.0063 - 0.0079	0.0025 - 0.0035	0.0038 - 0.0044
5.4375	22232CCK/C3W33	160	0.0071 - 0.0091	0.0030 - 0.0040	0.0041 - 0.0051

NOTE: Values are in inches unless noted. The above clearances are based on a Class-3 fit.

8. Once the proper clearance is achieved, lock the lock nut in place with the locking ring.

- **ROTOR DISASSEMBLY**

BLOCK UP PROPERLY AND SECURE FEED HOPPER AND CONVEYOR BEFORE REMOVING LOWER HOPPER -- THEN REMOVE ROTOR ASSEMBLY. NEVER PUT FINGERS OR HAND THROUGH INSPECTION HOLE.

SECURE ROTOR SO IT CANNOT SHIFT PRIOR TO BEGINNING WORK. RINGS ARE TOO HEAVY FOR A MAN TO LIFT WITHOUT MECHANICAL ADVANTAGE. USE A LIFTING DEVICE.

1. Remove the flywheel by removing the four studs that hold the flywheel in position.

2. If the machine has a fan wheel, also remove the square head set screws from the flywheel retaining flange.

3. Insert two 7/8" NC bolts into the two holes that are drilled and tapped through the flywheel.

4. Remove the split retaining ring.

5. Shift the flywheel retaining flange forward tight against the flywheel by using steel blocks between the retaining flange and end flange (the steel blocks will be between the retaining flange and the fan hub on Blo-Hogs).

6. Tighten the two 7/8" bolts to apply pressure to remove the flywheel from the shaft. The fan wheel on a Blo-Hog can be removed in the same manner.

   In some instances, the flywheel may be on so tight that pressure on the bolts will fail to move it. In such instances, generous heat may be applied to the flywheel while tightening the bolts.

   If the flywheel is to be pressed off, a 100-ton press will be required.

7. To remove the rings from the shaft, first remove all set screws, spacers, shear pins and oil cylinders from the rings. The rings may then be removed in pairs or pressed off as one unit. As described previously, heat may also be required.

Worn Rotors should be shipped to the factory for rebuilding to factory standards.

USING PARTS NOT MANUFACTURED BY MONTGOMERY INDUSTRIES MAY ENDANGER THE SAFETY OF PERSONNEL AND VOIDS ALL WARRANTIES.

- **ROUTINE MAINTENANCE**

1. Check temperature of bearings.

   Temperature monitor decals are attached to the top of the bearing to aid in determining the operating temperature of the bearing.

   The normal operating temperatures are between 140° Fahrenheit and 160° Fahrenheit. Operating temperatures are allowable up to 200° Fahrenheit.

   During the first day or two of operation, new bearings may heat up to temperatures exceeding the normal range. Although this occurrence is expected, bearings should be checked daily for one week to ensure that the temperature has decreased to a normal operating range after the bearing has seated and adjusted to the housing.

   Operating temperatures above 200° Fahrenheit will cause most lubricants to break down, which can result in damage to the bearings and HOG. We recommend a MONTGOMERY BEARING ALERT as an optional piece of equipment. When used, the BEARING ALERT constantly monitors the temperature of the bearing without having to rely on an operator being present when a critical temperature is reached or exceeded. If the bearing becomes too hot, the BEARING ALERT will activate audible and visible warning signals and, when properly wired, shut down the equipment involved.

2. Normal operation may cause the teeth to loosen over time.

   Initially check fastenings daily to make certain they are tight.

   The time over which fastenings may loosen varies with each application, depending on the type of material processed, the quantity of material processed, the hours per day of operation, the integrity and fit of the parts, and the level of vibration/imbalance during operation.

   The recommended torque for T3 teeth is

   250 ft-lbs for Forged Teeth (discontinued in 2011)
   350 ft-lbs for Manufactured Teeth
   350 ft-lbs for 2-Part Teeth

   Tightening beyond the elastic region of the steel may cause threads to stretch and/or the lock washer to permanently flatten or deform - any of which will undermine the connection.

   A loose tooth can hit the anvils and/or the screen causing damage to the unit and possibly causing severe injury to personnel in the area.

Due to the wide variation in applications, there is no standard interval between checks that would be applicable to all installations. Actual operating experience will allow each customer to determine the maximum time interval between checks for the particular installation.

IT IS THE RESPONSIBILITY OF THE USER TO KEEP THE TEETH PROPERLY TORQUED AT ALL TIMES.

3. Check the teeth and anvils for wear.

   The teeth and anvils should be inspected frequently until a wear pattern is established and the operator knows at what interval the parts must be rebuilt.

4. If the HOG is V-Belt driven, V-Belts should be initially re-checked and re-tightened after one to two weeks of operation. After this initial break-in period, the belts should be checked periodically.

- **SCREEN REMOVAL AND INSTALLATION**

STOP THE HOG.

DO NOT STICK FINGERS THROUGH HOLES IN SCREEN AT ANY TIME.

SECURE ROTOR SO IT CANNOT SHIFT PRIOR TO BEGINNING WORK.

USE EXTREME CAUTION NOT TO MASH OR CUT OFF FINGERS.

BEFORE OPENING REAR DOOR, FIRST SECURE THE HOOK OF A LIFTING DEVICE TO THE PADEYE PROVIDED.

USE EXTREME CAUTION NOT TO MASH OR CUT OFF FINGERS.

DO NOT PUT FINGERS IN BOLT HOLES.

KEEP CLEAR WHEN OPENING OR CLOSING.

BE SURE THAT ALL PERSONNEL ARE CLEAR OF SCREEN FALLING AREA.

A CHAIN HOIST SHOULD BE USED FOR MECHANICAL ADVANTAGE IN BOTH REMOVING AND RESETTING THE SCREEN ON THE LARGER MODEL HOGS.

GRAVITY INFEED MODELS

1. The screen in the HOG is held in place by the screen hold down bar.
2. To remove the screen, first remove the nuts and lock washers on the hex head capscrews.
3. Open the rear door and remove the cap screws and screen clamping bar.
4. Roll the screen up and forward around the rotor until the back of the screen hits the front of the hopper. A pry bar inserted through the holes in the screen may be helpful for rolling the screen around the rotor.
5. Continue to maneuver the screen until the front of the screen will clear the rear door.
6. Let the screen down.

Reverse the procedure for installing the screen.

HORIZONTAL INFEED MODELS

1. The screen in the HOG is held in place by the screen rings and screen hold down bolts.
2. Loosen the screen hold down bolts to remove pressure from the screen.
3. Open the rear door.
4. Roll the screen up and forward around the rotor until the back of the screen is clear of the screen rings. A pry bar inserted through the holes in the screen may be helpful for rolling the screen around the rotor.
5. Lift screen out of the HOG.

Reverse the procedure for installing the screen.

- **SHAFT LUBRICATION**

Lubrication between the rings and the shaft is required to prevent galling the shaft in the event the shear pins are sheared.

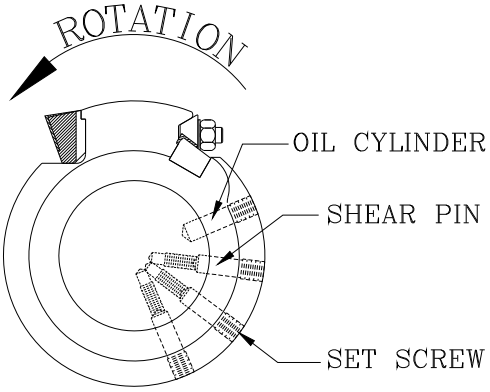
1. On older model HOGS (Serial Number less than 472) which are equipped with a grease passage through the shaft, a small amount of grease should be pumped into this passage each time the bearings are greased to ensure a supply of grease at the internal surface of the breaker rings in the event the shear pins are sheared.

2. On later model HOGS (Serial Number 472 and higher) this grease passage has been replaced with a plastic oil cylinder inserted in each ring. If the shear pin is sheared, it will also be necessary to install a new oil cylinder in this ring at the time the shear pins are replaced.

- **SHEAR PIN REPLACEMENT**

SECURE ROTOR SO IT CANNOT SHIFT PRIOR TO BEGINNING WORK.

USE EXTREME CAUTION NOT TO MASH OR CUT OFF FINGERS.



Check the position of the lugs on the rotor to determine the change in ring spacing. Refer to the separate material list in conjunction with the following instructions.

1. Remove all 1-1/8” setscrews from rings in which pins have sheared.

2. Remove sheared pieces of shear pins from the ring using a Shear Pin Extractor.

   If a Shear Pin Extractor is unavailable, use a 5/8” NC X 6” long capscrew:

a) Run a 5/8" NC nut up on the capscrew until it is next to the head.
b) Place a 5/8" flat washer over the hole and screw the capscrew into the sheared pin in the ring as far as possible.
c) Run down the nut until it touches the flat washer.
d) As the nut is tightened, the sheared pin will be pulled to the top of the hole in the ring.
e) A strong tug on the bolt will extract the top half of the sheared pin from the ring.
f) Repeat the procedure until the top half of all sheared pins have been removed.

3. Remove refuse from oil cylinder hole.

4. Rotate the breaker ring until the 1-1/16" diameter oil cylinder hole in the ring is over the sheared pin in the HOG shaft. Note that this hole is oversized for easier shear pin removal.

5. Drive the Shear Pin Punch into the hole in the center of the shear pin. This will make the hole in the pin round enough to allow an allen wrench to pass through the pin.

6. Place the allen wrench in the 3/4" X 1-3/4" set screw in the shaft and back this set screw out, forcing the bottom half of the sheared pin out of the shaft.

7. Run the set screw back into the shaft as far as it will go and repeat the procedure for the other sheared pins.

8. After running set screws back down into the shaft as far as they will go, drive in new shear pins. **Do not use yellow brass.** Shear Pins are made from Tobin Bronze which is much stronger than brass.

9. Be sure that shear pins seat on the bottom of the hole.

10. Be careful to install with the threaded half of the shear pin in the ring and the unthreaded half of the shear pin in the shaft.

11. Insert a new oil cylinder cartridge in the oil cylinder hole and replace the spacers.

12. Apply a liberal amount of Lock-Tite DC-3 to the threads of the 1-1/8" set screws before inserting into the holes and tightening.

13. Center-punch the edge of the hole in the ring in three places around each set screw in order to prevent it from vibrating out.

- **TEETH - CHANGING**

SECURE ROTOR SO IT CANNOT SHIFT PRIOR TO BEGINNING WORK.

USE EXTREME CAUTION NOT TO MASH OR CUT OFF FINGERS.

1. Before installing T-3 teeth, be sure that the face of the ring lug is clean and free of debris.

2. All new and factory repaired forged and manufactured teeth are shipped with a Heavy Duty Hex Nut and Lock Washer, which should be replaced each time parts are changed to ensure the integrity of the fastener.

   When installing T-3 2-Part teeth, use Grade-5 Bolts and Lock Washers.

   The recommended torque for T3 teeth is

   250 ft-lbs for Forged Teeth (discontinued in 2011)
   350 ft-lbs for Manufactured Teeth
   350 ft-lbs for 2-Part Teeth

   Tightening beyond the elastic region of the steel can cause threads to stretch and/or the lock washer to permanently flatten or deform - any of which will undermine the connection.

   A loose tooth can hit the anvils and/or the screen causing damage to the unit and possibly causing severe injury to personnel in the area.

3. While changing the T-3 teeth, inspect the inside teeth for wear and determine if they also need changing.

4. While changing teeth, inspect the anvils for wear and determine if they also need changing.

- **TEETH - CLEARANCE**

1. The clearance between the sides of the teeth and anvils is normally 1/32” to 3/32”

2. The radial clearance between the teeth and anvils is normally 1/32” to 1/16”

3. While insufficient clearance will result in a physical interference, too much clearance can result in loss of some capacity and stringy material passing through the HOG uncut.

4. Teeth and anvils should be rebuilt at the factory to factory specifications to ensure that proper clearances are maintained and that no interference will result when rebuilt parts are installed in the HOG.

- **TEETH - TIGHTNESS**

1. Initially check fastenings daily to make certain they are tight.

   The recommended torque for T3 teeth is

   250 ft-lbs for Forged Teeth (discontinued in 2011)
   350 ft-lbs for Manufactured Teeth
   350 ft-lbs for 2-Part Teeth

   Tightening beyond the elastic region of the steel can cause threads to stretch and/or the lock washer to permanently flatten or deform - any of which will undermine the connection.

   Normal operation may cause the teeth to loosen over time.

   Due to the wide variation in applications, there is no standard interval between checks that would be applicable to all installations. Actual operating experience will allow each customer to determine the maximum time interval between checks for the particular installation.

A LOOSE TOOTH CAN HIT THE ANVILS AND/OR THE SCREEN CAUSING DAMAGE TO THE UNIT AND POSSIBLY CAUSING SEVERE INJURY TO PERSONNEL IN THE AREA.

IT IS THE RESPONSIBILITY OF THE USER TO KEEP THE TEETH PROPERLY TORQUED AT ALL TIMES.

2. The time over which the teeth will loosen varies with each application, including

   - Type and Quantity of material processed
   - Hours per day of operation
   - Tramp metal occurrence
   - Integrity of the tooth
   - Initial torque/tightness
   - Integrity of the ring seat
   - Integrity of the ring lug
   - Amount of vibration / balance of the hog

TROUBLESHOOTING INFORMATION

- **BEARINGS ARE OVERHEATING**

Temperature monitor decals are attached to the top of the bearing to aid in determining the operating temperature of the bearing.

The normal operating temperatures are between 140° Fahrenheit and 160° Fahrenheit. Operating temperatures are allowable up to 200° Fahrenheit.

DO NOT RUN HOG WITH BEARING CAP BOLTS OR ANCHOR BOLTS LOOSE.

During the first day or two of operation, new bearings may heat up to temperatures exceeding the normal range. Although this occurrence is expected, bearings should be checked daily for one week to ensure that the temperature has decreased to a normal operating range after the bearing has seated and adjusted to the housing.

Operating temperatures above 200° Fahrenheit will cause most lubricants to break down, which can result in damage to the bearings and HOG. We recommend a MONTGOMERY BEARING ALERT as an optional piece of equipment. When used, the BEARING ALERT constantly monitors the temperature of the bearing without having to rely on an operator being present when a critical temperature is reached or exceeded. If the bearing becomes too hot, the BEARING ALERT will activate audible and visible warning signals and, when properly wired, shut down the equipment involved.

1. Too much grease or oil will cause overheating. Make sure that the bearing is well lubricated but not over lubricated.

   When a bearing is overheating, it is common to assume that it needs lubrication. However, if a bearing is hot from too much lubrication, adding lubrication only worsens the problem.

   Oil Bearings — To check for an excess amount of oil, simply inspect the oil sight gauge.

   Grease Bearings — **SHUT DOWN HOG.** To check for an excess amount of grease, remove the bearing cap and inspect.

   If there is too much grease, it will be necessary to remove one (and only one) drain plug while the HOG is running to permit excess grease to escape. Be sure to replace the drain plug.

A good procedure to follow when lubricating a bearing is to remove one drain plug after lubricating. If a bearing has been over lubricated, the excess will escape. This procedure should be followed each time the bearing is lubricated to avoid overheating due to over lubrication.

2. A bearing tightened on an uneven surface will cause overheating.

   SHUT DOWN HOG. Loosen the bearing bolts and check between the bottom of the bearing and pedestal with a feeler gauge. If the bearing is bolted down on an uneven surface or there is material under the bearing, the bearing housing can warp – causing excessive heat under operation.

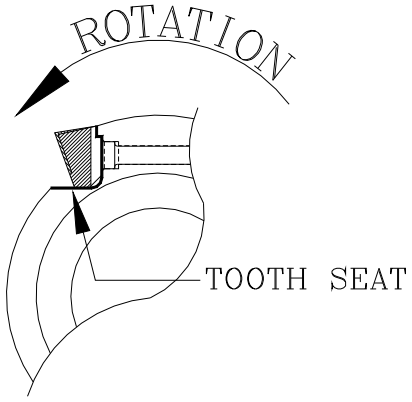
3. An uneven surface between the upper and lower bearing housing can result in overheating.

   SHUT DOWN HOG. The following procedure should be done with the cap bolts just snug but not tight.

   Check the bearing cap where the cap rests on the bottom housing. There should be zero gap between the upper and lower bearing housing. If a feeler gauge will go between the upper and lower housing, check the gauge thickness and add shim stock to fill in.

- **BENT TOOTH SHANKS / TOOTH BREAKAGE**

1. Bent shanks on T-3 teeth can indicate an improper tooth seat and the need for immediate repair or replacement of the ring to avoid failure of the tooth.



2. An improper seat for a tooth can be caused by wear from abrasion, damage from tramp steel, or

more commonly from abuse (i.e. hammering on the seat to turn the ring when the tooth is not in position in the ring lug).

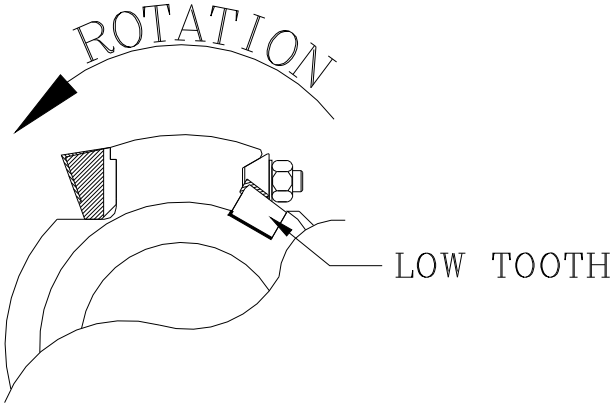
If a tooth head has been broken off, damage is usually sustained to the tooth seat before the machine can be stopped.

3. A damaged seat results in bending movement in the tooth when under impact load during operation. This movement typically results in crystallization of the tooth shank and eventual failure of the tooth.

4. A gap between the bottom of the tooth and the breaker ring of more than 0.01" will allow sufficient rotation of the tooth head to cause crystallization of the tooth shank.

   If such a gap exists, it should be welded up and hand ground to provide a snug fit on the bottom surface of the tooth.

5. Severe abrasion over a long period of time will wear down the diameter of the ring until the outside of the ring is even with or below the bottom of the small tooth. This wear allows material to pack under the small tooth which can force the small tooth up until it eventually strikes the anvil. Such a strike will break the tooth.



6. Over tightening of the hex nut on the T-3 tooth can cause elongation of the shank at the beginning of the threads. Stretched threads can reduce the ability of the threads to hold the tooth and it can eventually loosen enough to strike the anvils and break the tooth.

   The nut should be tightened only until the lock washer is flat and the nut is snug.

   Recommended torque values are listed in the Appendix.

- **EXCESSIVE PIN SHEARING**

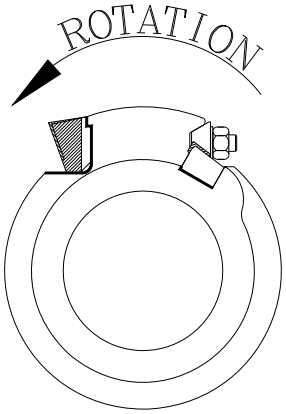
1. Shearing of pins from wood only (no steel in the HOG) is usually caused from shear pin holes wallowing out. Shear pin holes become wallowed from shearing of pins over a prolonged period or from frequent shearing.

   Frequent shearing of pins can also be caused by rings being worn loose on the shaft. This problem may be corrected by welding adjacent rings in pairs so that it is necessary to shear six pins instead of three.

- **EXCESSIVE RING WEAR**

1. Except for the fact that it is usually accompanied by severe wear externally, a small amount of wear on the inside of the ring (caused by frequent shearing of pins or continual operation with pins in a shear condition) is usually not detrimental, although it will sometimes cause the shear pins to shear prematurely as mentioned above.

2. When the edges of the rings begin to show excessive wear or when the face of the lug where to tooth seats is damaged, the rings should be returned to the factory for reconditioning. If the rings are not allowed to wear excessively, they can be rebuilt to factory specifications at a fraction of the replacement cost.



3. On older model HOGS (Serial Number less than 472) with grease lubrication to the inside of the ring, a small amount of wear will also cause the rings on the far end of the shaft from the grease fitting to be tight on the shaft.

   This tightness is because the pressure in the grease chamber is lost at the loose ring and there is insufficient pressure to force grease to the rings at the far end of the shaft. Insufficient lubrication of these rings can cause them to freeze on the shaft.

- **EXCESSIVE VIBRATION**

1. A pin has sheared.

   Normally, a sheared pin will be accompanied by rotation of the ring out of position. A ring out of position will result in excessive vibration which will immediately be recognized and the HOG should be shut down and the shear pins replaced.

   The operator should familiarize himself with the spacing of the breaker rings on his HOG so that he will be able to detect, at a glance, any changes in the spacing which would indicate sheared pins.

2. Rings are worn.

   New HOG rotors are dynamically balanced before leaving the factory. However, due to abrasion over the normal course of operation, the rings may eventually wear to a point where the original balance weights no longer serve to balance the hog.

3. Bearings are worn.

   As bearings wear over time, the original tolerances between the bearing unit and the bearing housing can loosen, resulting in increased vibration of the HOG.

4. Shaft is bent.

   If a significant amount of tramp metal gets into the HOG, the shaft may bend. How much a shaft can bend before it is no longer usable depends upon the drive configuration and where along the shaft it is bent. It is important to recognize that operating a HOG with a bent shaft will significantly decrease the expected life of the bearings.

5. HOG is not bolted securely to its foundation.

6. HOG foundation is inadequate.

   It is important that the installation instructions be followed when preparing the foundation. It is especially important that elevated platforms be properly engineered to support the dynamic loading of the HOG.

- **SCREENS - LONG STICKS / PLUGGING**

Screens of various designs and sizes are used to control the end product from the HOG.

1. Long pieces coming through the HOG or the screen plugging up is usually the result of a worn screen or worn teeth and anvils.

2. Occasionally, a plug-up above the Rotor is blamed on the screen plugging up when this is not the case. An incorrect screen selection which is not compatible with the material being processed will also cause the screen to plug.

WARRANTY INFORMATION

The Warranty on parts manufactured by Montgomery Industries is for one year from date of shipment excluding normal wear and tear and excluding abuse of the equipment.

The Warranty on parts manufactured by Montgomery Industries covers replacement cost of the parts only. No labor expense incurred in replacing the parts under Warranty is covered.

The Warranty on parts not manufactured by Montgomery Industries is the standard Warranty offered by the actual manufacturer of the parts. These parts include all electrical components, all hydraulic system components, and all mechanical drive components.

Do not attempt to alter the equipment in any way or do anything you are not specifically qualified to do. If there is any question whatsoever concerning the safety or advisability of your intended action, do not proceed without written permission from Montgomery Industries.

Any malfunction or operation problems not covered in this manual should be reported to the factory as a quick and simple answer may save many hours of unsatisfactory operation.

A factory engineer is always available for discussion of any problems which may arise.

USING PARTS NOT MANUFACTURED BY MONTGOMERY INDUSTRIES MAY ENDANGER THE SAFETY OF PERSONNEL AND VOIDS ALL WARRANTIES.

APPENDIX

- **FASTENER TIGHTNESS**
- **TOOTH WEAR**
- **BEARINGS**

MONTGOMERY
INDUSTRIES INTERNATIONAL

Recommended Torque

It is the responsibility of the user to make sure fastenings are properly tightened

Recommended Torque

T3 Forged Tooth[1]	**250 ft-lbs**	Threaded Shank	7/8" Heavy Hex Nut	Lock Washer
T3 Manufactured Tooth	**350 ft-lbs**	Threaded Shank	7/8" Heavy Hex Nut	Lock Washer
T3 2-Part Tooth	**350 ft-lbs**	Threaded Shoulder	7/8" Hex Bolt (Grade-5)	Lock Washer
Anvils (Gravity Models)	**250 ft-lbs**	7/8" Square Head	7/8" Nylock Nut	
Anvils (HZF Models)	**250 ft-lbs**	7/8" Socket Head	7/8" Nylock Nut	Flat Washer
Anvil Tie Rod	**250 ft-lbs**	Threaded Ends	7/8" Heavy Hex Nut	Flat Washer
KC Forged Tooth[1]	**330 ft-lbs**	Threaded Shank	1" Heavy Hex Nut	Lock Washer
KC Manufactured Tooth	**450 ft-lbs**	Threaded Shank	1" Heavy Hex Nut	Lock Washer
KC 2-Part Tooth	**450 ft-lbs**	Threaded Shoulder	1" Hex Bolt (Grade-5)	Lock Washer
KC Lug Inserts	**450 ft-lbs**	1-1/4" Socket Head	1" Socket Head	
KC Anvil Points	**450 ft-lbs**	1-1/4" Socket Head		Lock Washer
LRW Tooth Insert	**100 ft-lbs**	1/2" Socket Head		Lock Washer

Important Notes / Recommended Procedures

⚠ **NORMAL OPERATION MAY CAUSE FASTENINGS TO LOOSEN OVER TIME.**

⚠ **TIGHTENING BEYOND THE ELASTIC REGION OF THE STEEL CAN CAUSE THREADS TO STRETCH AND/OR THE LOCK WASHER TO PERMANENTLY FLATTEN OR DEFORM - ANY OF WHICH WILL UNDERMINE THE CONNECTION.**

⚠ **A LOOSE TOOTH CAN HIT THE ANVILS AND/OR THE SCREEN, CAUSING DAMAGE TO THE UNIT AND POSSIBLY CAUSING SEVERE INJURY TO PERSONNEL IN THE AREA.**

√ Initially check fastenings daily to make certain they are tight. The time over which fastenings may loosen varies with each application, depending on the type of material processed, the quantity of material processed, the hours per day of operation, the integrity and fit of the parts, and the level of vibration/imbalance during operation.

Due to the wide variation in applications, there is no standard interval between checks that would be applicable to all installations. Actual operating experience will allow each customer to determine the maximum time interval between checks for the particular installation.

√ Be careful when installing new parts as fingers are easily smashed.

√ All new and factory repaired forged and manufactured teeth are shipped with a Heavy Duty Hex Nut and Lock Washer, which should be replaced each time parts are changed to ensure the integrity of the fastener.

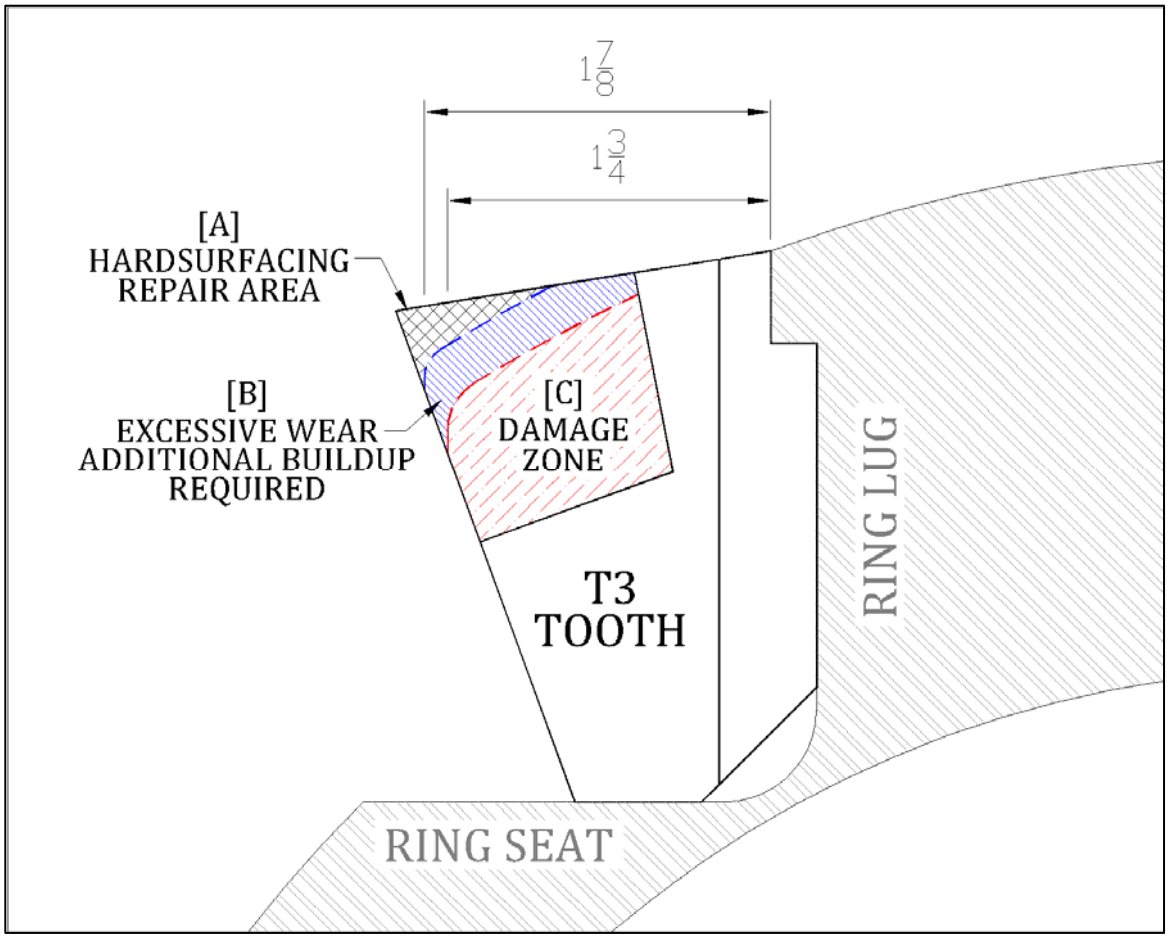
(1) Forged Teeth discontinued in 2012 but in circulation as repairs. Forgings are continuous at the shank/shoulder interface.

MONTGOMERY INDUSTRIES INTERNATIONAL

Hardsurface Wear Zones – T3 Teeth

√ The teeth and anvils should be inspected frequently until a wear pattern is established and the operator knows at what interval the parts must be rebuilt.

√ General practice is to rebuild the anvils every second or third time the teeth are rebuilt or changed.



[A] Normal Repair Area The allowable wear before rebuilding becomes necessary will depend upon the material being hogged. Generally, when the cutting edges of the teeth have worn to a 1/8" radius, the effect upon operation will be noticeable as capacity and end product begin to degrade.

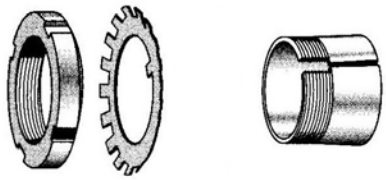
[B] Excessive Wear Area Teeth and anvils should be removed and rebuilt before the hardsurfacing material has worn into the base metal. After that point of wear is reached, the base metal wears away rapidly and the cost of rebuilding soon reaches the cost of replacement. Capacity and end product continue to degrade.

[C] Damage Zone Wear is well into the base metal and other parts are exposed to accelerated wear. The cost of rebuilding exceeds the cost of replacement. Capacity and end product degrade significantly.

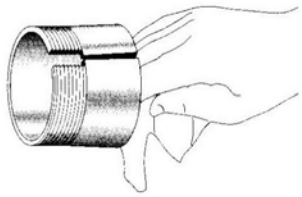
- **BEARING REPLACEMENT - INSTALLING A NEW BEARING**

1. Clean the shaft thoroughly and remove any rough spots with either a file or an emery cloth.

2. Screw off the nut and remove the locking washer.

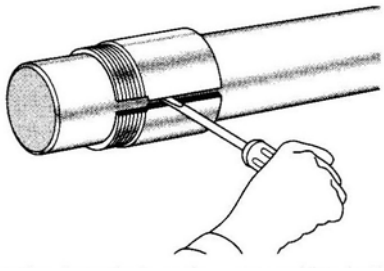


3. Wipe the preservative from the surface of the sleeve and then oil the bore surface lightly. Use a thin mineral oil.

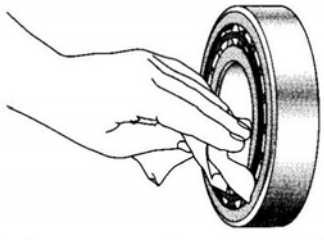


4. Slide the inner bearing housing seal onto the shaft prior to sliding on the adapter.

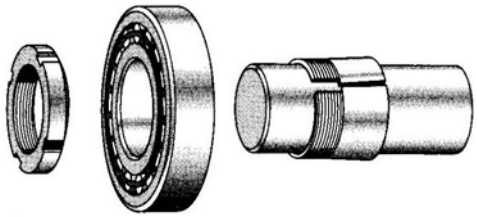
5. Open up the sleeve by inserting a screwdriver in the slit; then slide the sleeve along the shaft to the correct position.



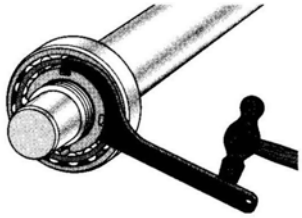
6. Wipe the preservative from the bore of the bearing and then oil the surface lightly. Use a thin mineral oil.



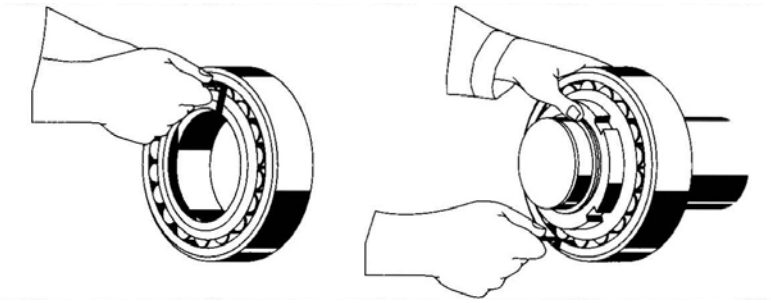
7. Place the bearing on the sleeve. Screw on the nut with its chamfer facing the bearing, but do not mount the locking washer. Do not push the inner ring up on the taper.



8. The bearing unit is secured on the shaft by tightening the lock nut with a spanner wrench or with a blunt chisel and hammer. Turn the nut sufficiently to ensure that the shaft makes proper contact (self-locking) with the sleeve, but do not drive the bearing any further up the sleeve until you begin checking the mounted clearance.



9. While continuing to tighten the nut, keep checking the clearance between the top roller and outer race with a feeler gauge until the proper clearance is reached. Refer to Schedule "A" below for clearance requirements, based on the bearing manufacturer's recommendations.

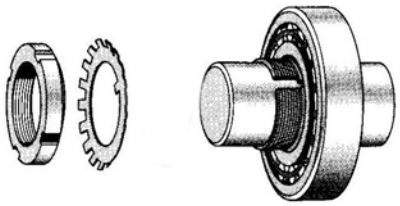


SCHEDULE "A" (SKF Bearings)

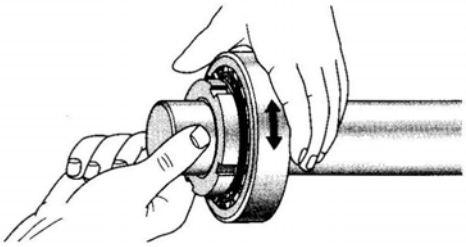
Shaft Journal	Bearing	Bore (mm)	Unmounted Clearance	Reduction In Internal Clearance	Mounted Clearance
2.9375	22217CCK/C3W33	85	0.0043 - 0.0055	0.0018 - 0.0025	0.0025 - 0.0030
3.9375	22222CCK/C3W33	110	0.0053 - 0.0067	0.0020 - 0.0028	0.0033 - 0.0039
4.4375	22226CCK/C3W33	130	0.0063 - 0.0079	0.0025 - 0.0035	0.0038 - 0.0044
4.9375	22328CCK/C3W33	140	0.0063 - 0.0079	0.0025 - 0.0035	0.0038 - 0.0044
5.4375	22232CCK/C3W33	160	0.0071 - 0.0091	0.0030 - 0.0040	0.0041 - 0.0051

NOTE: Values are in inches unless noted. The above clearances are based on a Class-3 fit.

10. Once the proper mounted clearance is achieved, unscrew the nut, place the locking washer in position, and tighten the nut firmly again.

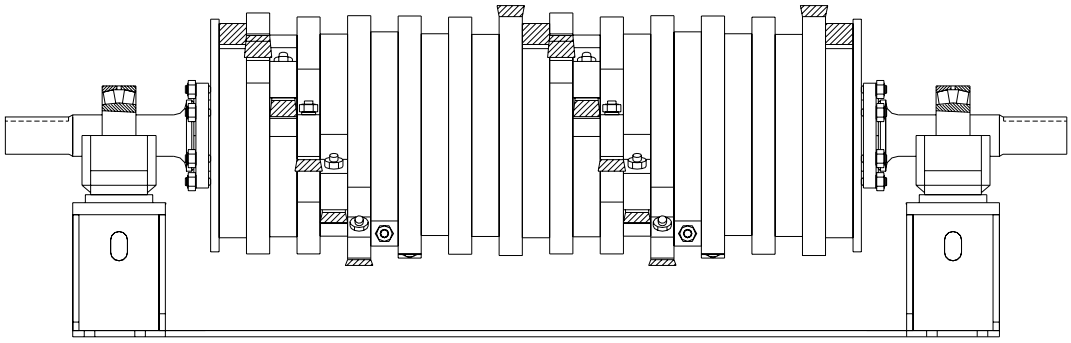


11. Check that the shaft or outer ring can be rotated easily by hand.

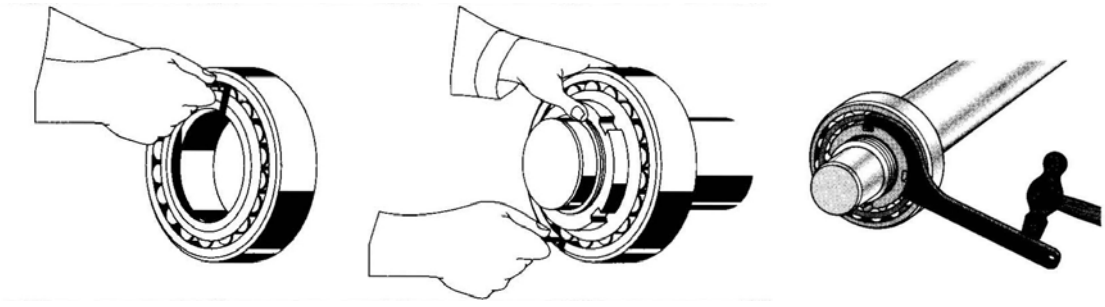


CAUTION: A loose adapter sleeve can lead to the inner ring turning on the adapter sleeve and/or the adapter sleeve turning on the shaft. To insure that the nut is not excessively tight, make certain the outer ring of the bearing rotates freely. For a C3 fit bearing, the outer ring will swivel freely.

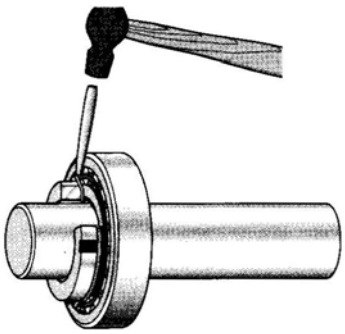
12. Allow rotor and bearing unit to rest in the bottom half of the housing for final tightening.



13. Verify mounted clearance and tighten further as needed. Refer to Schedule "A" above for clearance requirements, based on the bearing manufacturer's recommendations.



14. Lock the lock nut in place by bending one of the locking washer tabs down into one of the slots in the nut. Do not bend it to the bottom of the slot.



15. Apply lubrication.

16. Slide the outer bearing housing seal onto the shaft and insert the stabilizing ring, if applicable.

    The HOG uses only one stabilizing ring per set of bearings, customarily installed on the drive end. The stabilizing ring is a partial ring that can be installed around the shaft and located inside the bearing housing after the bearing has been attached.

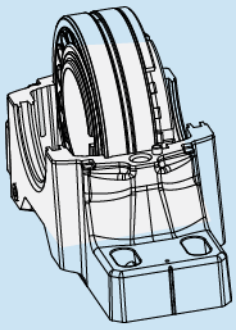
Table 10

Initial grease charge for SAF pillow block assemblies

SAF	SAF	SAF	SAF	SAF	Initial charge oz.	Initial charge lbs.
—	—	507	—	—	$2^1/_2$	
—	—	509	—	—	3	
—	—	510	—	—	4	
—	308	—	—	—	$4^1/_2$	
—	309	—	609	—	5	
—	—	511	—	—	5	
—	310	—	610	—	$6^1/_2$	
—	—	513	—	—	$7^1/_2$	
—	311	—	611	—	8	
—	—	515	—	—	9	
—	312	—	—	—	10	
216	313	516	613	—	13	
217	—	517	—	—	13	
—	314	—	—	—	14	
218	315	518	615	—	14	
—	316	—	616	—	16	
—	317	—	617	—	20	
220	—	520	—	024	21	
—	318	—	618	—	22	
222	—	522	—	026	28	
224	320	524	620	028	40	
226	322	526	622	030		$3^1/_4$
—	—	—	—	032		$3^1/_4$
228	—	528	—	034		$3^1/_4$
230	324	530	624	—		$3^3/_4$
232	326	532	626	036		$4^1/_4$
—	—	—	—	038		$4^1/_4$
234	328	534	628	040		$5^1/_4$
236	330	536	630	—		6
238	332	538	632	044		$7^1/_4$
240	334	540	634	048		$8^1/_2$
244	338	544	638	052		$11/_2$
—	340	—	640	056		$15/_2$

Figure 13

Grease fill line



Step 8

Stabilizing rings

A stabilizing ring should be used if a spherical roller or self-aligning ball bearing is to be "Held" or Fixed" (i.e. locating the shaft). The stabilizing ring should also be used for all toroidal roller bearing (CARB) units. In cases when only one locating ring is used, move the shaft axially so that the stabilizing ring can be inserted between the bearing outer ring and housing shoulder on the locknut side of bearing, where practical. For bearings that will be free to float in the housing, generally center the bearings in the housing seat.

Note: There must be only one "held" bearing per shaft. One bearing should be "free" to permit shaft expansion. Some housings require two stabilizing rings, which must be inserted to obtain a "held" assembly with the bearing centered in the housing. Stabilizing rings enclosed in standard housings are intended for spherical roller bearings or CARB. A different stabilizing ring is required for self-aligning ball bearings (purchased separately).

Step 9

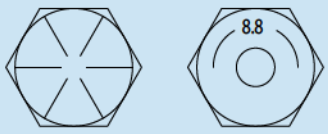
Upper half housing (Cap)

The bearing seat in the cap should be thoroughly cleaned, lightly oiled and placed over the bearing. With oil lubrication, use a sealing compound such as Permatex 2 or equivalent at the split surfaces; apply sparingly. Wipe a thin film near the outer edges. Excessive amounts may get forced between the housing bore and bearing outside diameter. This can pinch an outer ring or make a "free" bearing actually "held".

Two dowel pins will align the cap to its mating base. **Note:** Caps and bases of housings are not interchangeable. Each cap and base must be assembled with its original mating part. All SKF SAF and SAFS split housings are match marked with serialized identification on the cap and base to assist in assembling of mating parts. To complete the assembly, the lockwashers and cap bolts are then applied and tightened to the proper tightening torque for the specific cap bolts. See **Table 11** and **Figure 14**. The rubber plug and plastic fitting in the cap holes of M5 style SAF housings should be removed and discarded. Replace with appropriate metallic plugs/fittings that are supplied with each SKF M5 style SAF housing.

Figure 14

Identification of cap bolt grade



SKF "A" style SAF (iron)
SKF SAFS (steel)
SAE J429 grade 8
cap bolts are black in color
(use table 11 values)

SKF "M5" style SAF (iron)
ISO R898 class 8.8
cap bolts are painted blue
(use table 11 values)

The information presented in this section is intended to provide the user with basic and practical information on the lubrication of unit roller bearings. It does not include theoretical background. As the world leader in rolling bearing technology, SKF has extensive information available on the subject of bearing lubrication theory. Some of this information can be found in other SKF publications including the **General Catalog** and the **Bearing Installation and Maintenance Guide**. If you have questions regarding bearing lubrication not addressed here or in these other SKF publications, please contact SKF Applications Engineering.

Lubrication

SKF unit roller bearings are supplied pre-lubricated with enough grease for initial operation. They are also supplied with a grease fitting to be used when relubrication is necessary due to contamination or because the original grease has worn away. Relubrication is performed by attaching a grease gun to the fitting and slowly adding grease, preferably while the shaft is rotating, until clean grease emerges from the seals. **If grease is added too quickly, such as with high–pressure equipment, the seals may be blown out or otherwise damaged.**

What kind of grease should be used when relubricating?
The grease supplied in unit roller bearings is SKF LGEP2, a lithium soap based grease, NLGI 2 consistency, with a mineral base oil that has a viscosity of 190 cSt @ 40°C. This grease is suitable for the majority of unit roller bearing applications and will provide effective lubrication up to operating temperatures of 180°F (82°C). When relubricating, a grease with similar soap base, consistency, base oil type and viscosity should be used. Greases with different soap bases or consistencies are sometimes incompatible and can cause bearing failure. Bearings with greases other than LGEP2 can be supplied by special order; bearings also can be supplied without grease when customers wish to use their own grease. If this is the case, the grease should be selected using the same guidelines as outlined in the Lubrication section for Split Pillow Blocks on pages 202 and 203.

How much grease should be used?
Relubrication is best performed while the bearing is rotating to help ensure even distribution. The correct quantity is simply that amount which causes clean grease to emerge from the seal contact surface.

How often should the bearing be relubricated?
The bearing should be relubricated as often as necessary to prevent the build up of contaminants at the seal contact surface. If the bearing is operating in a clean environment, then relubrication intervals can be calculated according the charts and information on page 207 (in the splits section of the catalog).

Relubrication intervals

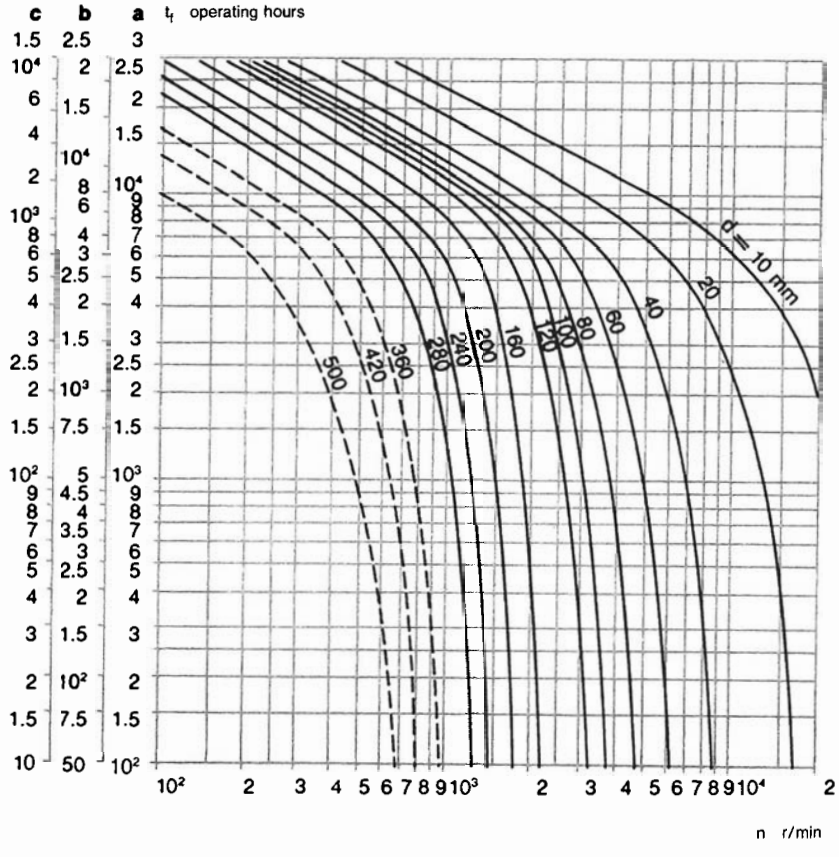
The relubrication intervals t_f for normal operating conditions can be read off as a function of bearing speed n and bore diameter d of a certain bearing type from Diagram 1. The diagram is valid for bearings on horizontal shafts in stationary machines under normal loads. It applies to good quality lithium base greases at a temperature not exceeding 70 °C. To take account of the accelerated ageing of the grease with increasing temperature it is recommended that the intervals obtained from the diagram are halved for every 15° increase in bearing temperature above 70 °C, remembering that the maximum operating temperature for the grease given in the tables on pages 128 and 129 should not be exceeded. The intervals may be extended at temperatures lower than 70 °C but as operating temperatures decrease the grease will bleed oil less readily and at low temperatures an extension of the intervals by more than two times is not recommended. It is not advisable to use relubrication intervals in excess of 30 000 hours. For bearings on vertical shafts the intervals obtained from the diagram should be halved.

For large roller bearings having a bore diameter of 300 mm and above,the high specific loads in the bearing mean that adequate lubrication will be obtained only if the bearing is more frequently relubricated than indicated by the diagram, and the lines are therefore broken. It is recommended in such cases that continuous lubrication is practiced for technical and economic reasons. The grease quantity to be supplied can be obtained from the following equation for applications where conditions are otherwise normal, i.e. where external heat is not applied (recommendations for grease quantities for periodic relubrication are given in the following section)

$$G_k = (0.3 \ldots 0.5)\ D\ B \times 10^{-4}$$

where

G_k = grease quantity to be continuously supplied, g/h
D = bearing outside diameter, mm
B = total bearing width (for thrust bearings use total height H), mm



Scale a: radial ball bearings
Scale b: cylindrical roller bearings, needle roller bearings
Scale c: spherical roller bearings, taper roller bearings, thrust ball bearings; full complement cylindrical roller bearings (0.2 t_f); crossed cylindrical roller bearings with cage (0.3 t_f); cylindrical roller thrust bearings, needle roller thrust bearings, spherical roller thrust bearings (0.5 t_f)

Diagram 1

Relubrication procedures

One of the two procedures described below should be used, depending on the relubrication interval t_f obtained:

- if the relubrication interval is shorter than 6 months, then it is recommended that the grease fill in the bearing arrangement be replenished (topped up) at intervals corresponding to 0.5 t_f; the complete grease fill should be replaced after three replenishments, at the latest;
- when relubrication intervals are longer than 6 months it is recommended that all used grease be removed from the bearing arrangement and replaced by fresh grease.

The six-month limit represents a very rough guideline recommendation and may be adapted to fall in line with lubrication and maintenance recommendations applying to the particular machine or plant.

Replenishment

By adding small quantities of fresh grease at regular intervals the used grease in the bearing arrangement will only be partially replaced. Suitable quantities to be added can be obtained from

$$G_p = 0.005\ D\ B$$

where

G_p = grease quantity to be added when replenishing, g
D = bearing outside diameter, mm
B = total bearing width (for thrust bearings use total height H), mm

To facilitate the supply of grease using a grease gun, a grease nipple should be provided on the housing. It is also necessary to provide an exit hole for the grease so that excessive amounts will not collect in the space surrounding the bearing. This might otherwise cause a permanent increase in bearing temperature. However, as soon as the equilibrium temperature has been reached following a relubrication, the exit hole should be plugged or covered so that the oil bled by the grease will remain at the bearing position. The danger of excess grease collecting in the space surrounding the bearing and causing temperature peaking, with its detrimental effect on the grease as well as the bearing, is most pronounced when bearings operate at high speeds. In such cases it is advisable to use a grease escape valve rather than an exit hole. This prevents over-lubrication and allows relubrication to be carried out without the machine having to be stopped. A grease escape valve consists basically of a disc which rotates with the shaft and which forms a narrow gap together with the housing end cover. Excess and used grease is thrown out by the disc into an annular cavity and leaves the housing through an opening on the underside of the end cover. Further details regarding the design and dimensioning of grease escape valves will be supplied on request.

To ensure that fresh grease actually reaches the bearing and replaces the old grease, the lubrication duct in the housing should either feed the grease adjacent to the outer ring side face or, better still, into the bearing which is possible, for example, with spherical roller bearings and double row full complement cylindrical roller bearings.

Where centralized lubrication equipment is used, care must be taken to see that the grease has adequate pumpability over the range of ambient temperatures.

If, for some reason, it is necessary to change from one grease to another, a check should be made to see that the new and old greases are compatible (see under "Miscibility", page 128).

Renewing the grease fill

When the end of the relubrication interval t_f has been reached the used grease in the bearing arrangement should be completely removed and replaced by fresh grease. As stated on page 127, under normal conditions, the free space in the bearing should be completely filled and the free space in the housing filled to between 30 and 50% with fresh grease. The requisite quantities of grease to be used for SKF housings are given in the section "Bearing housings".

In order to be able to renew the grease fill it is essential that the bearing housing is easily accessible and easily opened. The cap of split housings and the cover of one-piece housings can usually be taken off to expose the bearing. After removing the used grease, fresh grease should first be packed between the rolling elements. Great care should be taken to see that contaminants are not introduced into the bearing or housing when relubricating, and the grease itself should be protected. Where the housings are less accessible but are provided with grease nipples and exit holes or grease valves it is possible to completely renew the grease fill by relubricating several times in close succession until it can be assumed that all old grease has been pressed out of the housing. This procedure requires much more grease than is needed for manual renewal of the grease fill.