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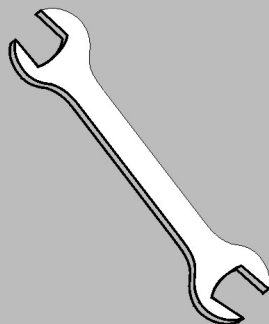
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# Kit Instruction—

## K15 0005

## K15 0005R



# Please Read

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The front cover displays pertinent identifying information for this manual. Most important, are the published manual number (part number) /ECN (date code). Generally, when a replacement manual is furnished, it will have the same published manual number, but the latest available ECN. This provides the user with the latest information applicable to his machine. Similarly all documents comprising the manual will be the latest available as of the date the manual was printed, **even though older ECN dates for those documents may be listed in the table of contents.**

When communicating with the Milnor factory regarding this manual, please also provide the other identifying information shown on the cover, including the publishing system, access date, and whether the document ECN's are the latest available or exact.

## References to Yellow Troubleshooting Pages

This manual may contain references to "yellow pages." Although the pages containing troubleshooting procedures are no longer printed on yellow paper, troubleshooting instructions, if any, will be contained in the easily located "Troubleshooting" chapter or section. See the table of contents.

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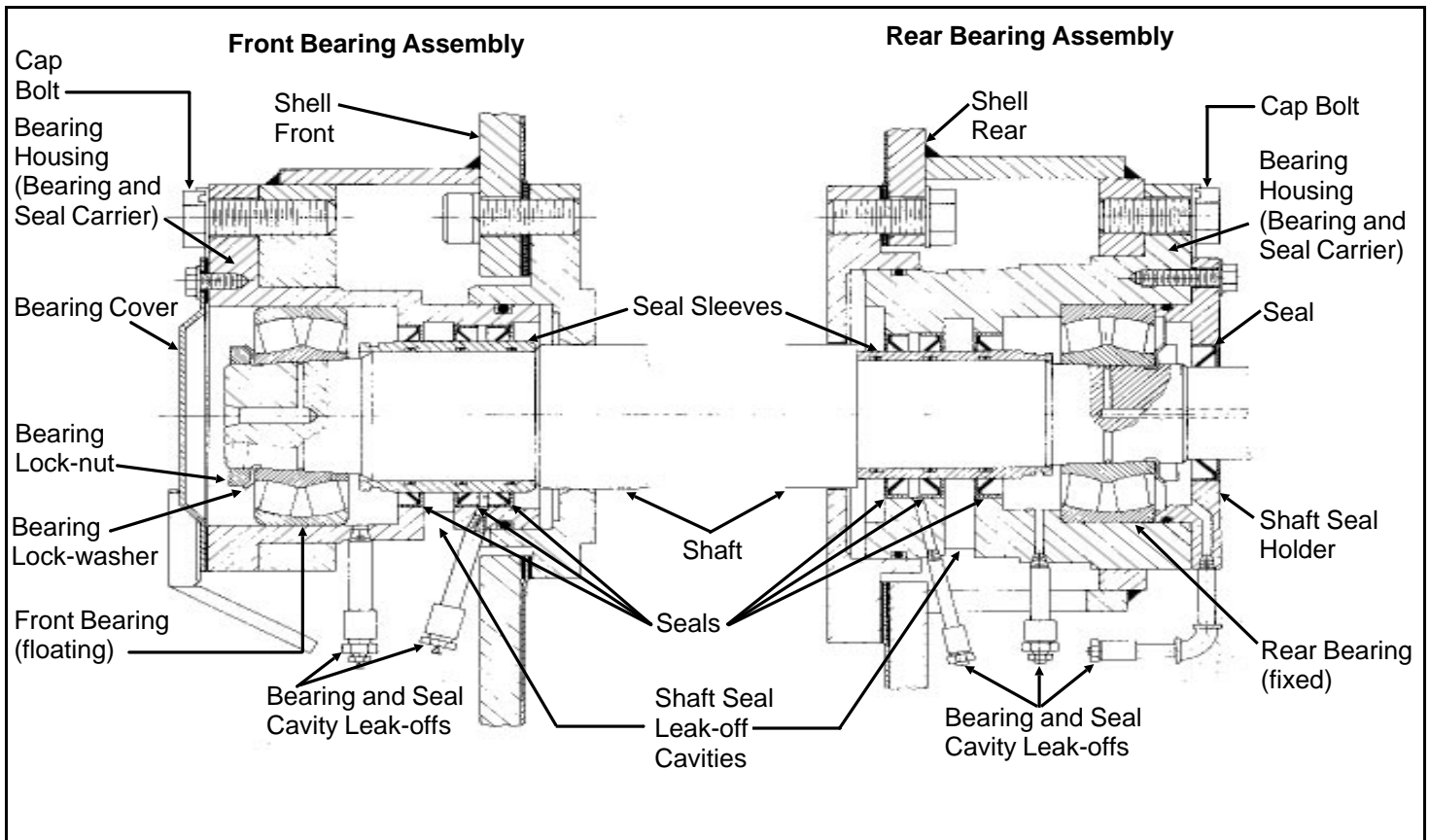
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## MAIN BEARING AND SEAL REPLACEMENT FOR DIVIDED CYLINDER MACHINES

This section applies to the front and rear cylinder shaft bearings of all divided cylinder machines (Rapid Load, Staph-guard<sup>®</sup>, dye machines, etc.). It does not apply to jackshaft bearings, idler shaft bearings or bearings on open pocket machines.

The bearings covered by this section are double row, spherical roller, self aligning bearings; Koya, SKF, FMC, Torrington or equal. Referring to FIGURE 1, the rear (clean side on Staph-guard<sup>®</sup> models) bearing is firmly held in the bearing housing (bearing and seal carrier) by the shaft seal holder, preventing axial movement. The front (soil side on Staph-guard<sup>®</sup> models) bearing is free to move axially in the bearing housing to accommodate thermal expansion of the shaft during operation and is thus the "floating" bearing. Both bearings are held in place on the tapered portion of the shaft by a bearing lockwasher and locknut.

The front and rear bearings are each protected from contamination from wash water by three spring loaded, lip type seals and a shaft seal leak-off cavity (that carries off any water that leaks past the main water seals) as shown in FIGURE 1.



**Figure 1** (MSSM0303AE)  
**Cross Section View of Front and Rear Bearing Assemblies**  
(Bearing Assembly for 60" and 72" WED Shown. Others similar.)

Access to the bearings and seals for lubrication is provided by the various grease passages. Excess lubricant is excreted through the bearing and seal cavity leak-offs as shown on FIGURE 1. The bearings and seals must be lubricated regularly and the leak-off cavities flushed out periodically through the plugged cleanout connections, in strict accordance with the preventive maintenance procedures elsewhere.

If bearing replacement becomes necessary due to wear, it is essential that the bearings *and seals* are replaced. Seal replacement requires removal of the bearing housing and seal sleeve. (In rare instances where the seals are known to be in good condition, it is not necessary to remove the bearing housing, seals or seal sleeve when a bearing is replaced.) **A pulling fixture is required to remove the bearing housing. A set of guide rods, a seal sleeve setting fixture and a bearing setting fixture are required for reinstallation of the housing.** These tools are available for rental or purchase from the Milnor<sup>®</sup> factory and are pictured elsewhere in this section. Contact the factory two weeks in advance of repairs, when ordering these tools.

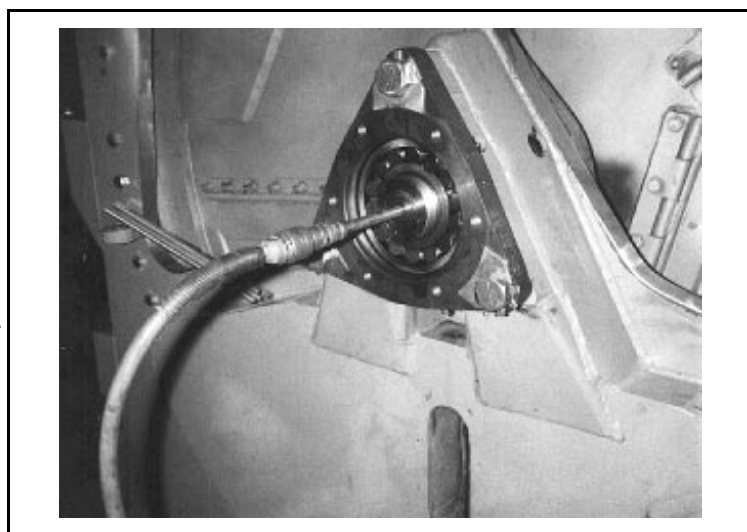
This maintenance is performed in the following order:

1. Remove old bearing(s). When removing both bearings, remove the front (soil side) bearing first.
2. Remove bearing housings, seal sleeves, and seals.
3. If both bearings were removed, install the bearing housing, seal sleeve, seals, and new bearing on the rear (clean side).
4. Install the bearing housing, seal sleeve, seals, and new bearing on the front (soil side).
5. Tighten bearing(s).

See the Main Bearing Assembly drawing for your machine for bearing component part numbers.

## Removing the Bearing (Front or Rear)

1. Loosen, then remove the main drive belts and cylinder shaft pulley (if applicable) by lowering the drive base with the jacking bolts. Do not attempt to pry belts off with a pry bar or by rolling the sheave. Remove the bearing cover (or shaft seal holder) to expose the bearing.
2. Bend back the locking tang on the bearing lock-washer then remove the locknut and lockwasher.
3. The center tapped hole in the shaft end is an oil passage through which oil may be forced between the tapered shaft and the bearing inner race. Install a pipe fitting into this tapped hole as shown in figure to the right. Using a "Porto-Power" or similar hand operated hydraulic pump, force fluid into the passage. Pump hard to build up fluid pressure. This pressure will cause the inner race to expand slightly; just enough to free the tapered surfaces and allow the bearing to slip off easily. If the bearing is not readily removed, remove the front water level



**FIGURE 2** (MSSM0303AE)  
**Connection From Hydraulic Pump to Assist in Bearing Removal**

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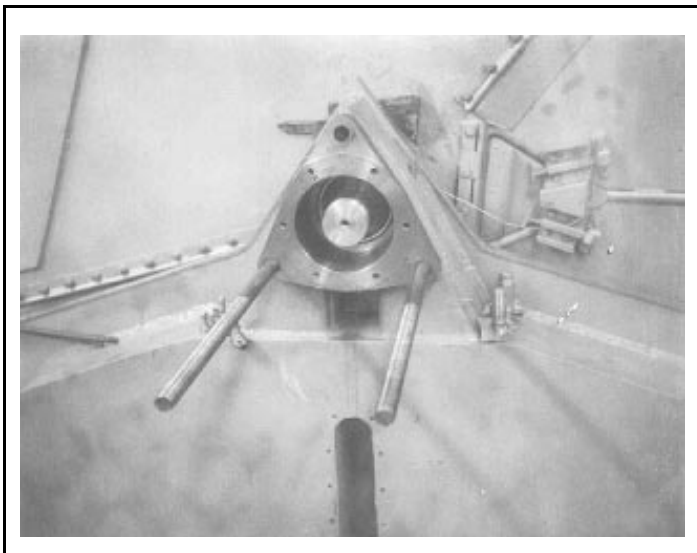
inspection plate and use a timber to pry up the cylinder to remove cylinder weight from the bearings. Once the bearing is removed, the cylinder drops only approximately 1/32" before the shaft comes to rest on the shaft support.

4. Slide the bearing off of the shaft and if it is to be reused, place it on a clean surface and cover with a clean, lint free cloth.

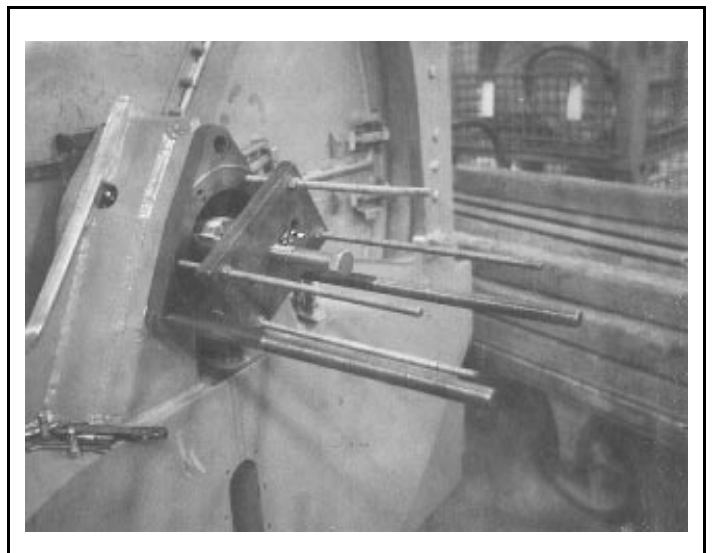
## Removing the Bearing Housing (Bearing and Seal Carrier), Seal Sleeve, and Seals (Front or Rear)

These procedures require the use of a pulling fixture and guide rods available from the Milnor<sup>®</sup> factory. With the bearing cover (or shaft seal holder) and the bearing removed, proceed as follows:

1. Remove the three bearing housing cap bolts and the grease lines from the bearing housing front plate. Install guide rods in two of the bolt holes, as shown in FIGURE 3.
2. Install the pulling fixture as shown in FIGURE 4, by placing each of the four threaded rods through a hole in the steel plate with hexnuts to the outside of the plate then screwing each rod into the appropriate tapped hole in the bearing housing (same holes as used to mount the bearing cover or shaft seal holder).



**FIGURE 3** (MSSM0303AE)  
**Two Bearing Housing Guide  
Rods in Position**



**FIGURE 4** (MSSM0303AE)  
**Bearing Housing Pulling  
Fixture in Position**

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**NOTE:** Step 2a or 2b below will cause the bearing housing to slide away from the shell. Shims were placed under one or more of the three bearing housing pads during factory assembly to align the housing and insure its being exactly parallel with the shaft. **When removing the bearing housing, be sure to keep these shims separate and identified so that they may be returned to their proper location, otherwise the bearing and seal will be out of line and may be damaged after a short operating period.** As a precaution in case the shims are lost during disassembly, you will find stamped next to the bearing housing the proper thickness of shims required (if any) under each adjacent bearing housing pad. The stamped number indicates the shim thickness in thousandths of an inch. For example, the number “38” indicates that 38/1000 (.038") shims would be required under this pad.

- 2a. Tighten all four hexnuts on the threaded rods such that the pulling fixture plate is pressed against the shaft end. With an impact wrench, tighten down on the center bolt until the housing slides out, or
- 2b. If no impact wrench is available, simply continue to tighten down on each of the four hexnuts behind the pulling fixture plate, alternately and progressively, until the housing slides out. It may be necessary to place a spacer (approx. two inches long) between the plate and the shaft to provide enough clearance between the plate and the bearing housing.
3. Once the bearing housing is free of the shell, carefully slide it off of the guide rods and place on a clean work surface.
4. The seal sleeve will almost always remain on the shaft when the housing is removed. Remove the seal sleeve *taking care not to damage or scar it* and place it on a clean work surface.

## Precautions for Bearing Replacement

The most important ingredient in successful bearing and seal installation is *cleanliness*. The bearing housing must be free of all foreign matter. The grease and leak-off passages must be blown clear and all *foreign* matter removed. You must have a clean work area. Keep your hands and tools free from grit and grime. Wash your hands before starting and as required during these procedures. Foreign matter is, without doubt, the most frequent cause of bearing failure, and one over which the manufacturer has no control.

Where cleaning is required, bearings, bearing housings and seal sleeves may be cleaned with the following solvents or cleaning agents (in strict accordance with the manufacturer’s recommendations as such substances are generally toxic and/or explosive under certain conditions):

Benzene	Gasoline	Naptha
Chlorethane	Kerosene	Trichlorethylene
Freons	Mineral Spirts	

Do not, however, expose any components to the above substances for more than 24 hours and only use at room temperature. Never use the following solvents or cleaning agents: alcohols, cresols, phenols, flouro propanols, or other similar chemicals or mixtures.

**NOTE:** Hammer blows, overheating, or improper use of force can damage precision parts.

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## Replacing the Bearing Housing, Seal Sleeve, and Seals (Front or Rear)

1. With the seal sleeve removed, press all old seals out of the bearing housing. Remove the large o-ring from the outside of the housing. Thoroughly clean the bearing housing and flush out all grease passages to make certain they are unblocked. Remove the o-rings from the inside of the seal sleeve and clean the seal sleeve.
2. While the bearing housing is disassembled, charge all grease passages with grease. This will assure that there are no blockages.
3. Replace the o-rings in the seal sleeve and the large o-ring on the outside of the bearing housing. Replace with new o-rings if the old ones are worn.
4. Press new seals into the bearing housing. You may gently work the seals in with a mallet and metal drift as shown in FIGURE 5.

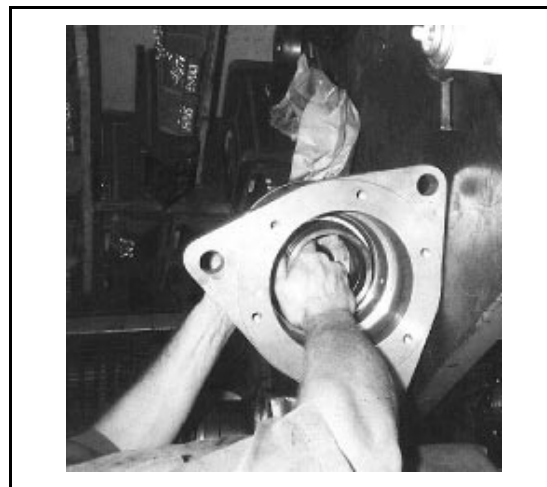
### ▲ CAUTION ▲

Each seal must be of the proper material and face the proper direction. The type of material and direction the seal faces may differ from one seal to another within the same bearing housing and also from one type of machine to another. It is essential to consult the Main Bearing Assembly drawing for your machine for the proper part number and direction to face each seal.

5. Slip the seal sleeve into the bearing housing as shown in FIGURE 6 below right, using care not to damage or fold under any of the seal lips. Be sure to insert the sleeve in the proper direction (see Bearing Assembly drawing).



**FIGURE 5** (MSSM0303AE)  
**Installing Seals in  
Bearing Housing**



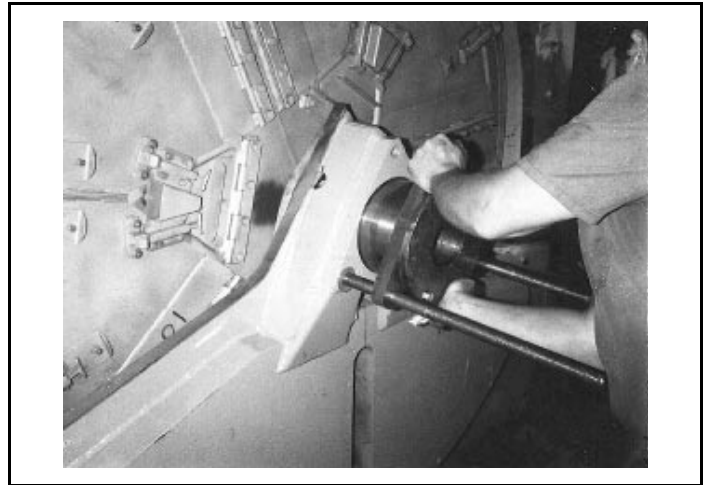
**FIGURE 6** (MSSM0303AE)  
**Installing Seal Sleeve in  
Bearing Housing**

**NOTE:** If both housings are being installed, install the rear housing first.

6. With two of the three temporary guide rods in position on the shell, place the bearing housing onto the guide rods and install the seal sleeve setting fixture on to the bearing housing as shown in FIGURE 7. The seal sleeve setting fixture prevents the seal sleeve from being pushed out of the housing as the housing is inserted into the shell. Note that the seal sleeve setting fixture and the bearing setting fixture are very similar, but the seal sleeve setting fixture has a longer hub.
7. With a clean, lint free cloth, apply a coating of light machine oil to the outside of the housing, to assist in installation. Push the housing into the shell as shown in FIGURE 8. Once the housing is far enough into the shell to support itself, place any shims back into position between the housing and the shell. Remove, then replace guide rods if required to place shims under bearing housing pads.

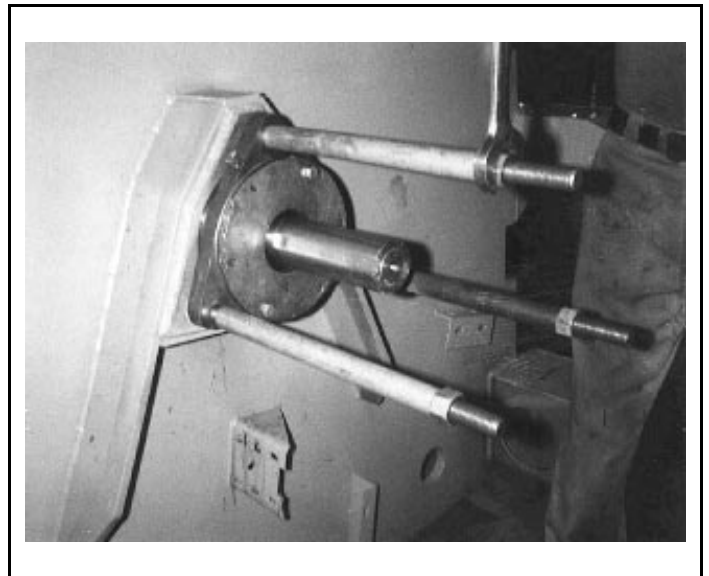


**FIGURE 7** (MSSM0303AE)  
**Installing the Bearing Housing Setting Fixture onto Housing (42" machine shown)**



**FIGURE 8** (MSSM0303AE)  
**Pushing the Bearing Housing into the Shell (60" Rapid-load machine shown)**

8. Install the third guide rod, spacers if required, and hex-nuts, using these to seat the housing fully, as shown in FIGURE 9. Remove the seal sleeve setting fixture.
9. Remove the guide rods and install the bearing housing cap bolts. See "BOLT TORQUE REQUIREMENTS" elsewhere, for proper torques.
10. With the grease gun, pump grease into the inner portion of the bearing cavity, such that when the bearing is installed, the space between the bearing and the seals will be approximately 1/3 full of grease.
11. Proceed to "Measuring Unmounted Clearance . . ." below, even if both the front and rear bearings are being replaced. Once the rear bearing is installed, the bearing housing replacement procedures may then be repeated for the front (soil side) bearing housing.



**FIGURE 9** (MSSM0303AE)  
**Tightening the Bearing Housing into the Shell (42" machine shown)**



## Measuring Unmounted Clearance and Setting Bearing (Front or Rear)

The bearings used on Milnor<sup>®</sup> washer and dye extractors are the very best anti-friction devices available for these applications. However, the anti-frictional characteristics of the bearings will be reduced if they are not properly installed. It is of critical importance when installing these tapered roller bearings, to accomplish the following (A step by step procedure follows this synopsis):

1. Accurately measure the unmounted internal clearance of the bearing (gap between the rollers and outer race before the bearing is installed). This is an essential quality control measure.
2. Calculate the final internal clearance by subtracting the specified clearance reduction (amount that the internal clearance must be reduced when the bearing is tightened onto the tapered shaft) from the unmounted clearance.
3. Tighten the bearing onto the shaft until the final internal clearance as calculated is achieved and verified by measurement.

These measurements are taken in thousandths of an inch. Although this requires precise work, attention to detail and a good set of feeler gauges, it is the only way to insure that the bearing will be tightened onto the shaft to precisely the right tension. If you have any questions on performing the measurements or adjustments described below, your local bearing supplier or the Milnor<sup>®</sup> factory can assist you. Although these procedures require precision over and above that normally required for laundry room maintenance, they are standard in bearing installation and absolutely essential:

**NOTE:** Step 1 which follows, requires a good set of feeler gauges including .001" through .010" in thousandths of an inch increments. Contact your local bearing supplier.

1. When you are ready to proceed (and not before) remove the new bearing from its box or protective wrapping. Do not attempt to clean the bearing or wash out the preservative coating. On a clean work surface, stand the bearing on edge and insert a .003 feeler gauge into the bearing as shown in FIGURE 10, at right. The gauge should be inserted just inside the outer race between two rollers and worked through to the opposite row of rollers. Rotate the inner race of the opposite row so that the end of the feeler gauge is caught between a roller and the outer race.
2. Try to pull the gauge straight out. If it comes out, increase the size of the gauge by .001". If it does not come out, decrease the gauge by .001". The thickest feeler gauge that will come out is the unmounted internal clearance of the bearing.
3. Compare the measured clearance with the "Unmounted Clearance" in the table below. If the measured clearance is not within the range shown, do not use the bearing. Contact your bearing supplier for an exchange.



**FIGURE 10** (MSSM0303AE)  
**Measuring Bearing  
Unmounted Clearance  
(bridge for 42" machine shown)**

**NOTE 1:** The clearances listed in the chart are industry standards and therefore apply to all brands of bearings supplied by Milnor®. If other sources of bearings are used, refer to the manufacturer's instructions for proper clearances.

**NOTE 2:** To locate your bearing on the chart, match the first five characters of the manufacturer's part number (*not the Milnor® part number*) with those in the chart. For example, for a manufacturer's part number 22217LBK, find under "Manufacturer Part Number" the line "22217 . . ."

**Table of Bearing Clearances**

Manufacturer Part Number	Unmounted Clearance		Clearance Reduction	
	Minimum	Maximum	Minimum	Maximum
22330 . . .	.0071	.0091	.002	.003
22213 . . .	.0030	.0039	.001	.002
22216 . . .	.0028	.0037	.001	.002
22217 . . .	.0044	.0057	.0015	.0025
22312 . . .	.0030	.0039	.001	.002
22316 . . .	.0037	.0049	.001	.002
22320 . . .	.0044	.0057	.0015	.0025
22328 . . .	.0063	.0081	.002	.003
23220 . . .	.0044	.0057	.0015	.0025

4. Calculate and record the final internal clearance by deducting the "Clearance Reduction" for your bearing (see above chart) from the measured clearance. For example, if you measured .004 and the clearance reduction is .001 to .002, then the final internal clearance should be between .002 and .003.
5. Hand pack the bearing with grease by rotating the inner race and rollers, forcing grease between all rollers.

**NOTE:** The bearing will be set into position in Step 6. If both front and rear bearings are being installed, the rear (clean side on Staph-guard® models) bearing should be set in position first because it is the fixed bearing.

6. Set the bearing into the housing (with the taper facing the proper direction) and seat the bearing using the bearing setting fixture. This fixture is installed in similar fashion to the seal sleeve setting fixture. If you have just set the rear bearing and the front bearing housing is yet to be installed, leave the bearing setting fixture in place for now.
7. If you have just set the rear bearing and the front bearing housing is yet to be installed, repeat all steps in bearing housing installation, measuring unmounted clearance and setting bearing, for the front bearing and housing. The bearing setting fixture should not be removed from the rear housing until it is needed to seat the front bearing. This will prevent rear bearing components from being pushed out of position by the shaft as the front housing components are seated. Remove the bearing setting fixture from the front housing once the bearing is seated.

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## Tightening Bearing(s) (Front and/or Rear)

1. Once both bearings are seated, or if only one bearing was replaced, install the bearing lockwasher(s) and locknut(s). Use a hammer and a metal drift as shown in FIGURE 11, to tighten the locknut. **It is imperative to only tap lightly and to assure that metal chips from the drift or locknut do not fall off and contaminate the bearing.** If both bearings are being tightened, work between the front and rear bearings and turn the basket by hand periodically, while tightening the locknut(s).
2. After tightening the bearing(s) onto the tapered shaft, check the internal clearance as pictured in FIGURE 12, by working a feeler gauge between the outer race and a roller of the outer row then between the outer race and a roller of the inner row.

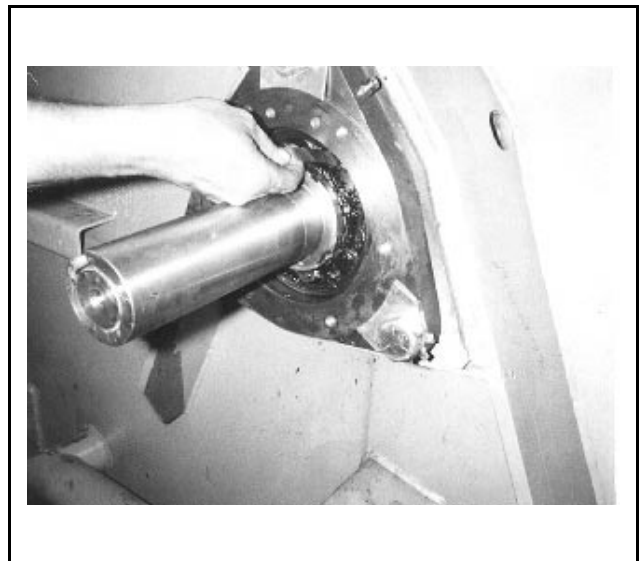
**NOTE:** Sometimes, when setting the bearings, all the load is taken by only one row of rollers (although the load would quickly equalize on both rows after the machine has run for only a few minutes). If all the load is taken by one row, you will get an erroneous clearance reading. It is therefore, necessary to use the feeler gauge to measure the *clearance of both rows of rollers*. With the bearing in place on the machine it is admittedly rather difficult to get a feeler gauge back past the first row of rollers to measure the second *but it must be done*.

3. If one row of rollers is tight but the other has measurable clearance, tap lightly on the end of the shaft nearest the tight row of rollers to cause the shaft to shift axially and equalize the roller loading. Adjust the bearing tightness to achieve the internal clearance previously calculated.
4. When the proper internal clearance has been attained, lock the nut by bending over the matching tang on the lockwasher, making sure that all unused tangs are bent as near the nut as possible so that they will not rub against the bearing roller cage.

**Check each unused tab individually to insure this.**

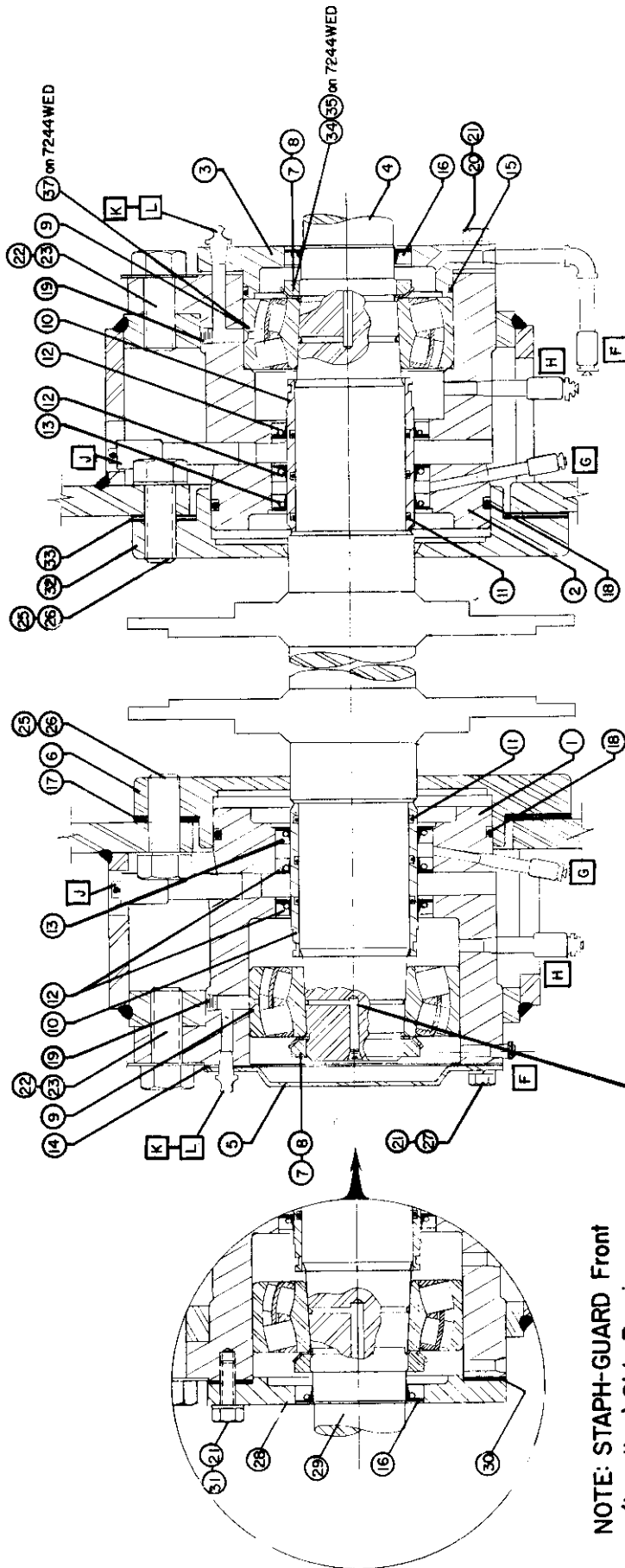


**FIGURE 11** (MSSM0303AE)  
**Tightening the Bearing  
Locknut (42" machine shown)**



**FIGURE 12** (MSSM0303AE)  
**Measuring the Mounted Internal  
Clearance of the Bearing  
(42" machine shown)**

- 
5. With the grease gun, fill the space between the bearing and the front of the housing 1/3 full of grease.
  6. Install the bearing cover plate or shaft seal holder, as appropriate. When installing the shaft seal holder, take care not to damage the seal as it is gently pushed over the shaft. Cover the keyway on the end of the shaft with tape to prevent the sharp corners of the keyway from cutting the seal lip. Also, make sure that the seal lip does not turn over as it passes over rough areas.



**NOTE: STAPH-GUARD Front  
(Loading) Side Bearing  
Assembly Arranged in This  
Manner.**

**NOTE: This Passage (Both Ends) Permits Use Of  
Hydraulic Assistance When Removing  
Bearings. DO NOT GREASE Except When  
Dismantling Machine. See Instruction  
Manual For Details.**

# MAIN BEARING ASSEMBLY

PELLERIN MILNOR CORPORATION