

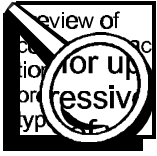
CC-01a

MAINTENANCE MECHANIC TRAINING

SKILL DEVELOPMENT GUIDE

Duty CC: Gear Boxes
CC-01a: Rebuild Gear Box

Issued 01/01/99



Task Preview

Rebuild Gear Box

A Maintenance Mechanic rebuilds a gear box when the gear box leaks or the gears will not rotate.

The gear box is usually rebuilt in the shop.

The steps for rebuilding the gear box are divided into three parts: disassemble, clean and inspect, and reassemble. During disassembly you will remove the output shaft, bevel gear and shaft, and bevel pinion shaft. These parts are cleaned and inspected for serviceability. The gear box components are reassembled in reverse order.

You will be required to handle cleaning solvents during the rebuild steps. Heavy industrial gloves and a respirator are the recommended protective equipment when cleaning pump components. Cleaning solutions must be disposed of per HAZMAT procedures.

How your skills will be checked

The Skill Check will require you to rebuild a gear box. All tools, materials, and resources will be available. The Evaluator will verify that your demonstration meets the skill objective by observing or measuring each task standard. You must demonstrate safe work practices during the Skill Check. Contact your Evaluator when you are ready for the Skill Check.



Skill Objective

Given a request to rebuild a gear box, rebuild the gear box.

Task Standards

1. The gear box must be rebuilt using the specified rebuild kit.
2. All screws must have Loctite 242 applied.
3. All flange and seals must have flange sealant applied to the surfaces.
4. All safe practices must be demonstrated.

What The You Will Need

This section contains the safety information, tools, and resources you will need before rebuilding a gear box.

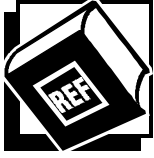
SAFETY FIRST

**DON'T TAKE
CHANCES**

- Follow all Caterpillar facility safety standards when performing this task.
- Wear heavy industrial gloves for protection from the hazards associated with the cleaning solvents.
- An explosion hazards exists with cleaning solvents. Smoking is not permitted in the paint or cleaning area.
- Know the location of the MSDS for the cleaning solvents.
- Cleaning solvents must be disposed of according to the HAZMAT regulations.



- metric wrenches and sockets
- metric socket head wrenches
- punches and cold chisels
- snapping pliers
- pry bars
- soft and hard face hammers
- blocks
- depth gauges
- sealant
- 2004 lubricant
- bearings: 32004, 30204X, 32303J2, 6208JZ



□ Service and Repair Instructions Right-Angle Helical Bevel Reducers

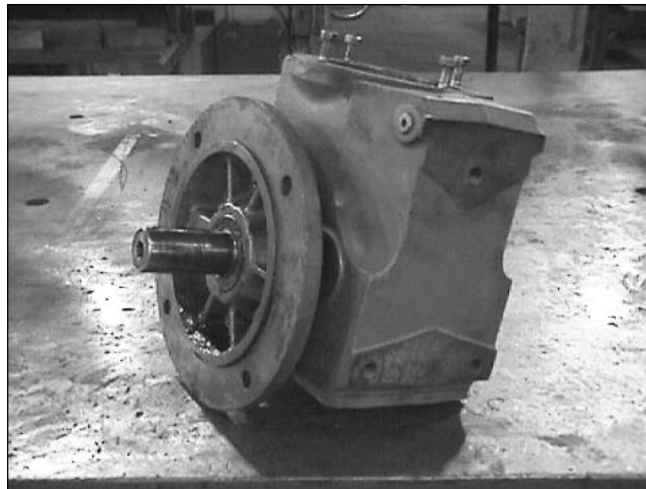


Task Steps

Rebuild Gear Box

Preparation

1. Remove any sprockets and keys from the output shaft.
2. Clean the outside of the gear box. See the figure below.



Clean KF66 Gear box

3. Drain the oil from the gear case, and discard the oil appropriately.

Note: Do not reuse the oil. If the drive is still warm, use extreme care when draining the oil. Hot oil can cause severe burns.

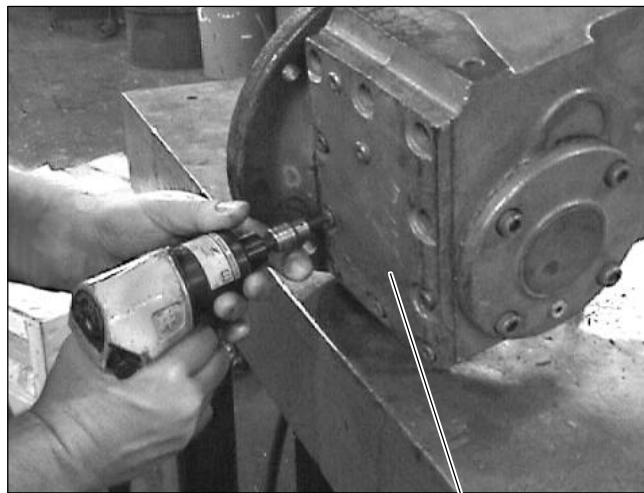
Disassemble

1. Remove the motor.

Note: If the motor is not attached to the gear box, start at step 2.

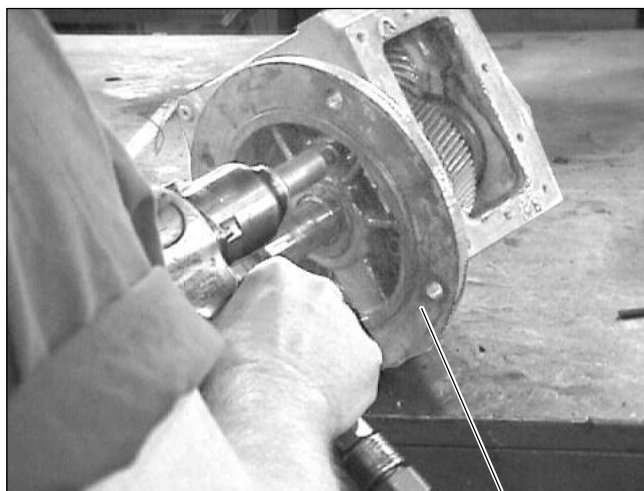
- Use a sling to support the motor so it will not fall.

- Remove the nuts securing the motor to the gear case.
 - Use a cold chisel and hammer to break the seal between the motor and gear case.
 - Use a pry bar to separate the motor from the gear case.
2. Remove the output shaft and gear.
- Remove the end cover. See the figure below.



End Cover

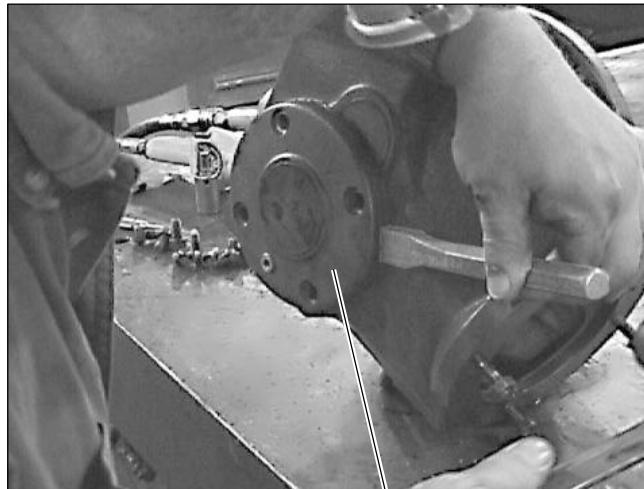
- Remove the output flanges and/or sealing flanges. See the figure below.



Output Flange

- Use a cold chisel and hammer to break the seal between the output flanges and/or sealing flanges and the gear case.

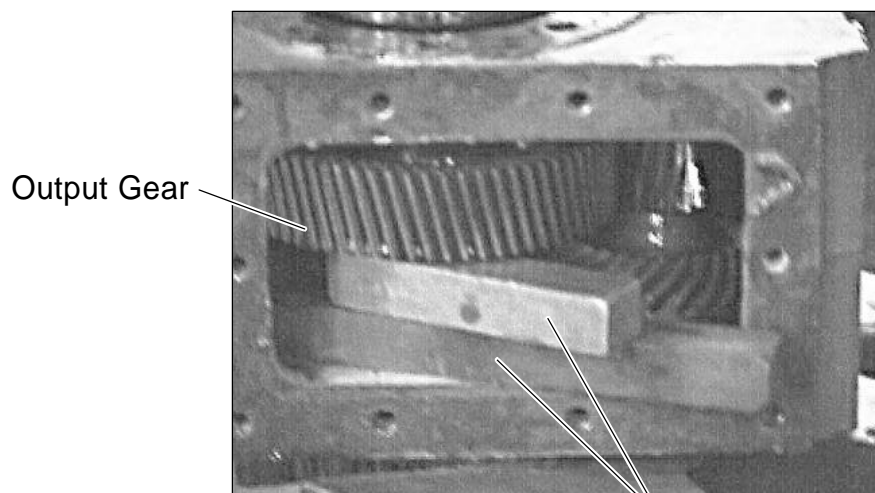
Note: The flanges have notches in them to insert a small chisel or prybar to remove the flange. See the figure below.



Sealing Flange

Note: When removing the sealing flange, it may fall and could land on your foot.

- Place the gear case on its side in the press, with the bevel gear on the bottom side.
- Slide support blocks between the output gear and the gear case. See the figure below.



Output Gear

Support Blocks

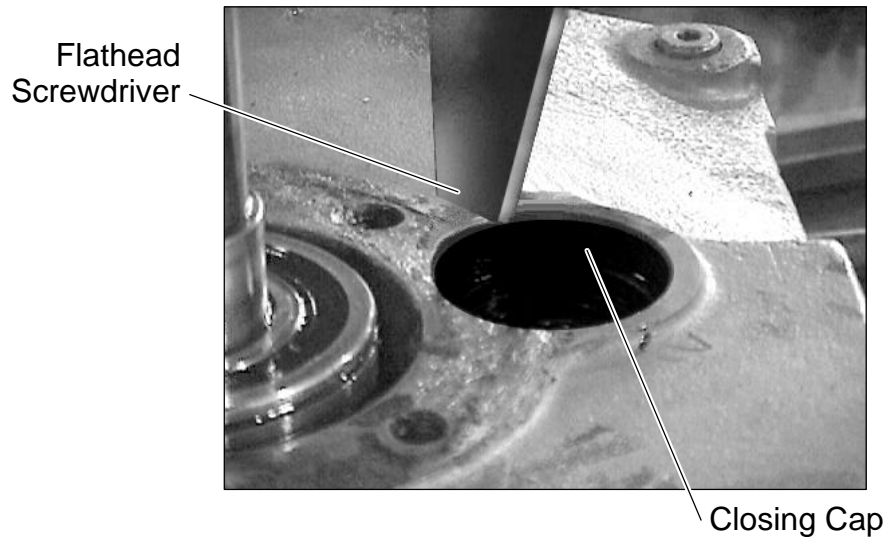
- Press the output shaft out of the gear case. See the figure below.



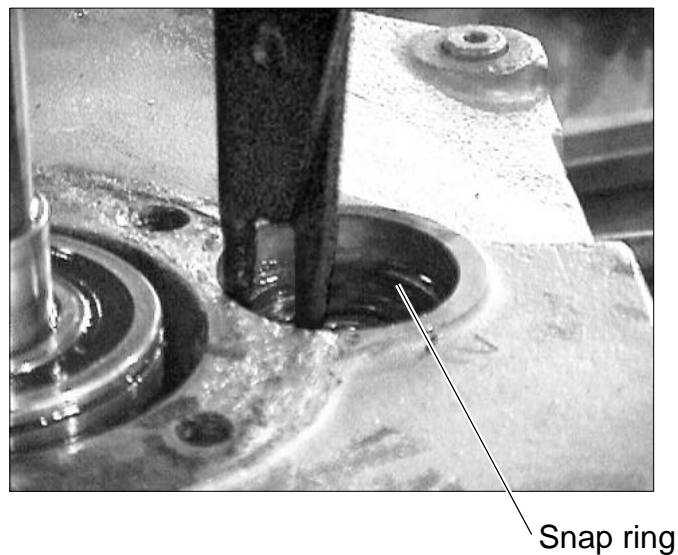
- Remove the output gear.
- Remove and discard the oil seals from the flanges.
- Remove the snap rings, thrust washers, shims, nilos rings (if installed), and closing caps from the flanges.
- Remove the bearings from the output shaft and/or from the flanges.

3. Remove the bevel gear and pinion shaft.

- Remove both closing caps using a flathead screwdriver. Pry along the edge of the end cap to carefully remove it. The end cap may be used later. See the figure below.

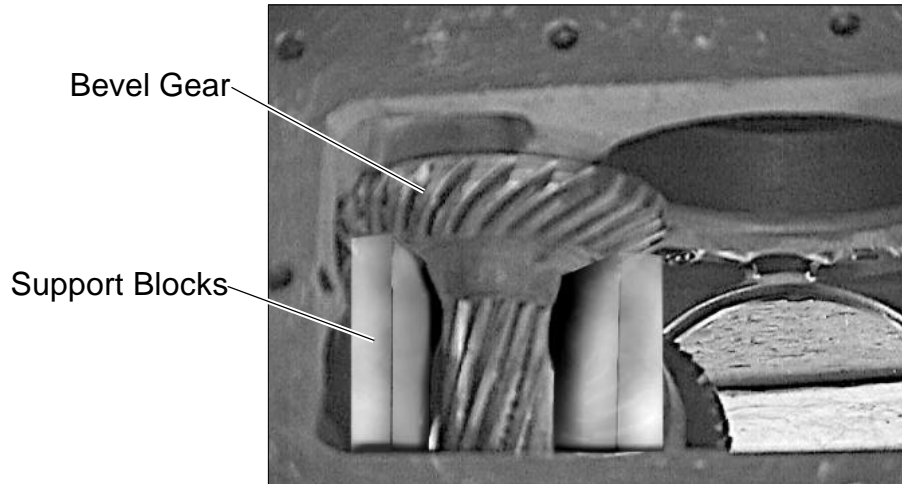


- Remove the snap rings, shims, and thrust washers.

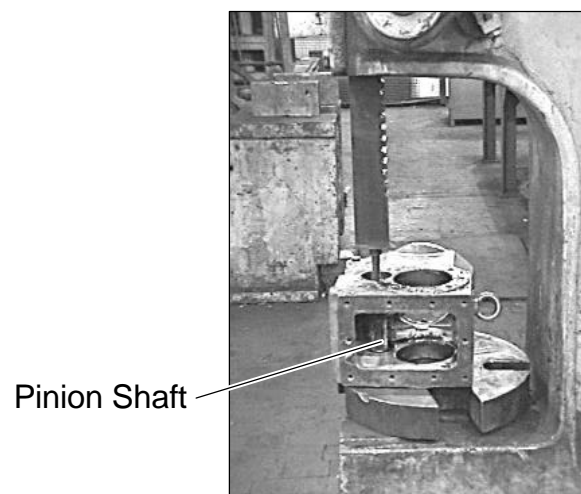


- Place the gear case on its side in the press, with the bevel gear on the top side.

- Slide support blocks between the bevel gear and the gear case.



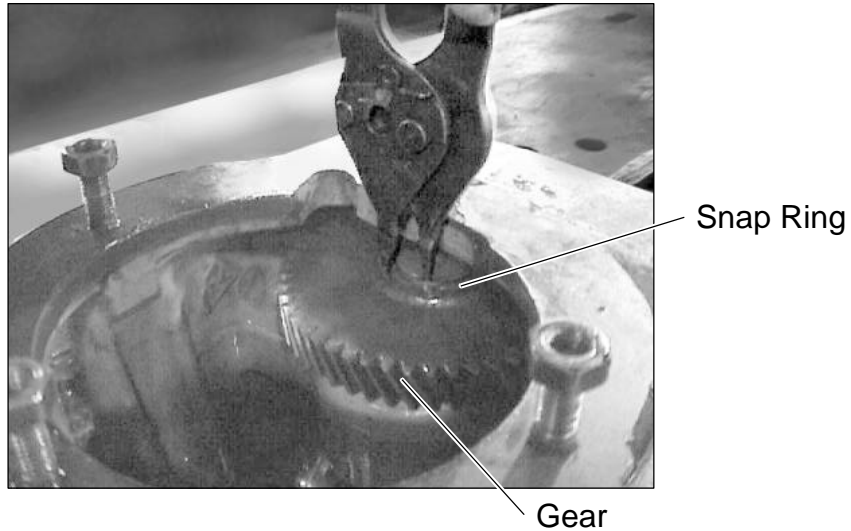
- Press the pinion shaft out of the gear case. See the figure below.



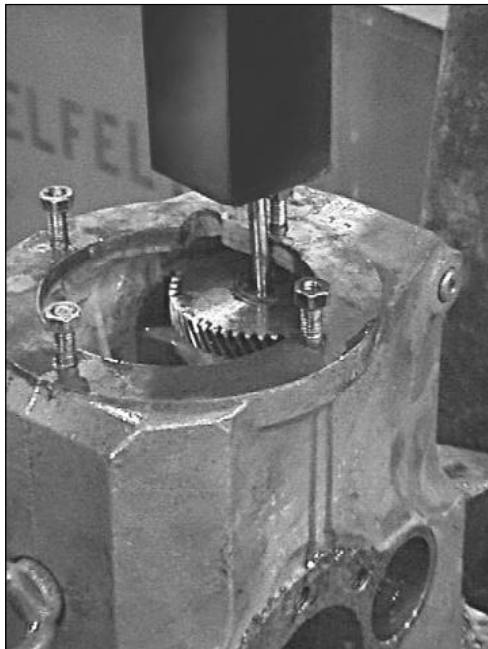
- Remove the bearings, nilos rings (if installed) from the gear case housing and/or pinion shaft.

4. Remove the bevel gear and shaft.

- Remove the snap ring and shims. See the figure below.



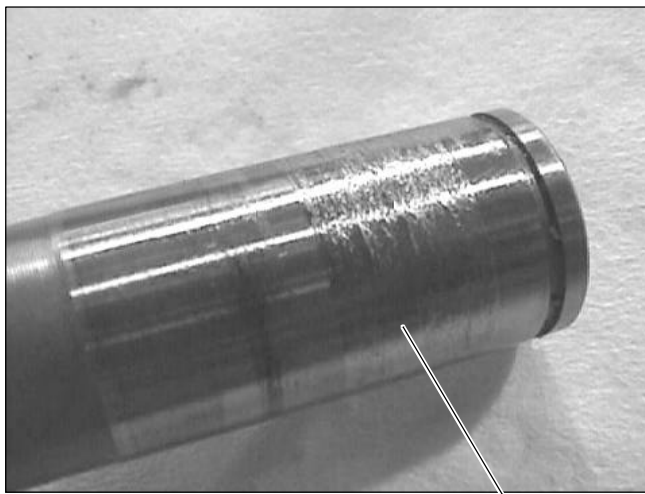
- Place the gear case on its end in the press, with the gear on the top.
- Press the gear, roller bearing, spacer, and outer race of the bearing out of the gear case. See the figure below.



- Remove the spacer, inner race of the bearing, and shims from the bevel pinion shaft.

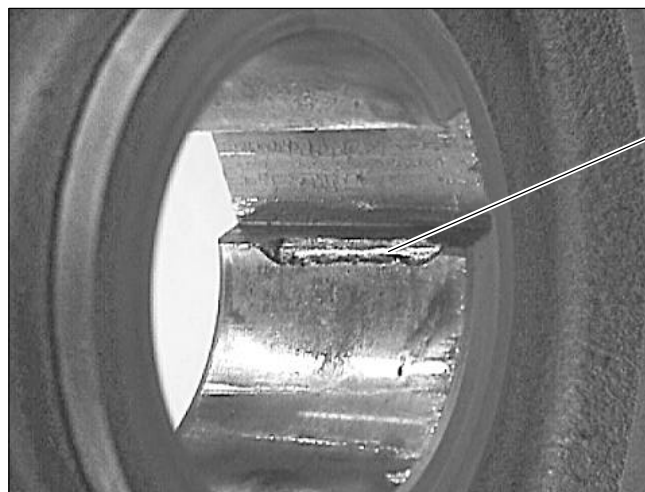
Clean and Inspect

1. Clean all parts.
2. Inspect the polished surfaces of the shafts for nicks and scarred surfaces. See the figure below.



Scarred Surface

3. Inspect all gears for broken or damage teeth, nicks, and scarred surfaces. See the figure below.

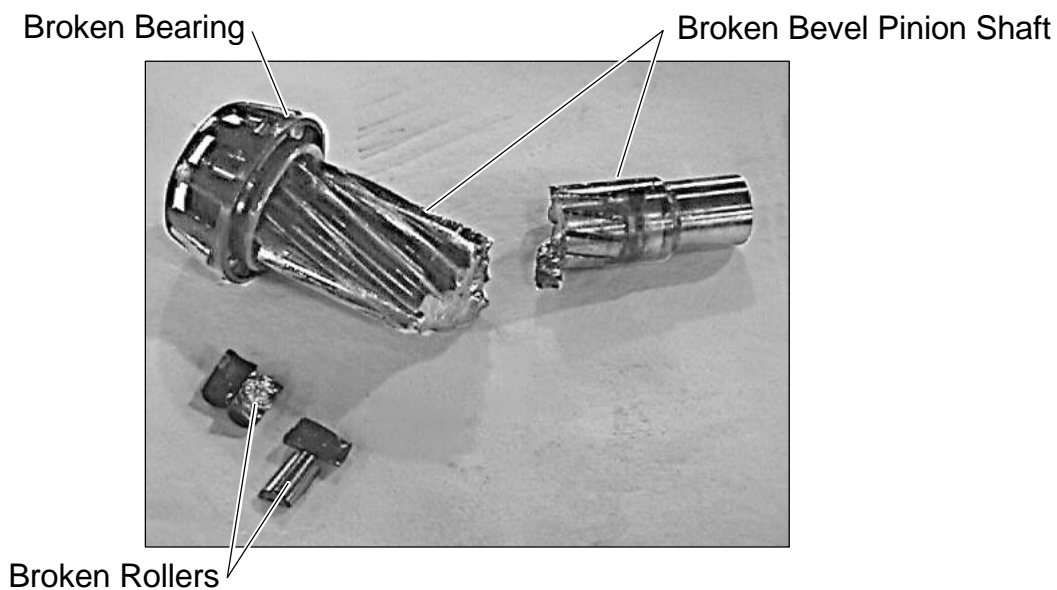


Nick

4. Inspect all pinion shafts for breakage, nicked teeth, or scarred polished surfaces.

Note: It is best to replace all bearings, but if all of the bearings are not available perform step 5.

5. Inspect all bearings for nicks or damage rollers. See the figure below.



6. Replace all defective components.

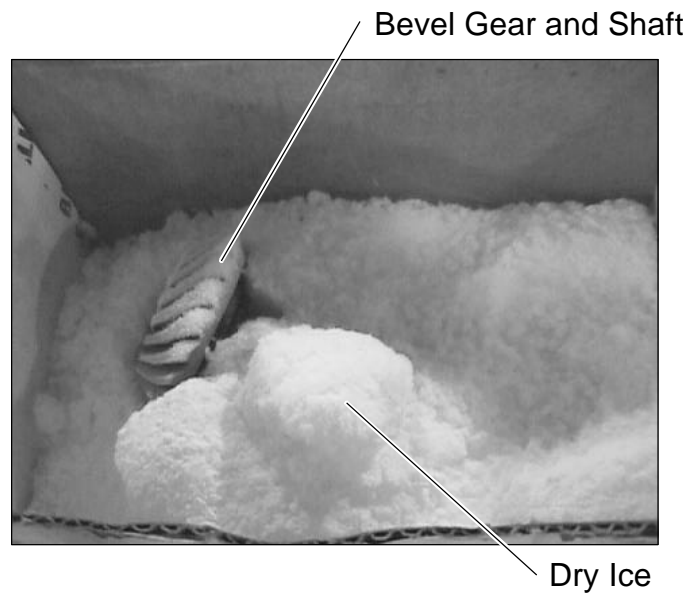
Pre-assembly

1. Oil all the bearing bores before installing the bearings.
2. Ensure that the bevel pinion and bevel gear are a matched set. If replacing either item, replace both as a matched set.

Note: If all of the bearings are available, it is best to replace them.

Assemble the B evel Pinion and Shaft

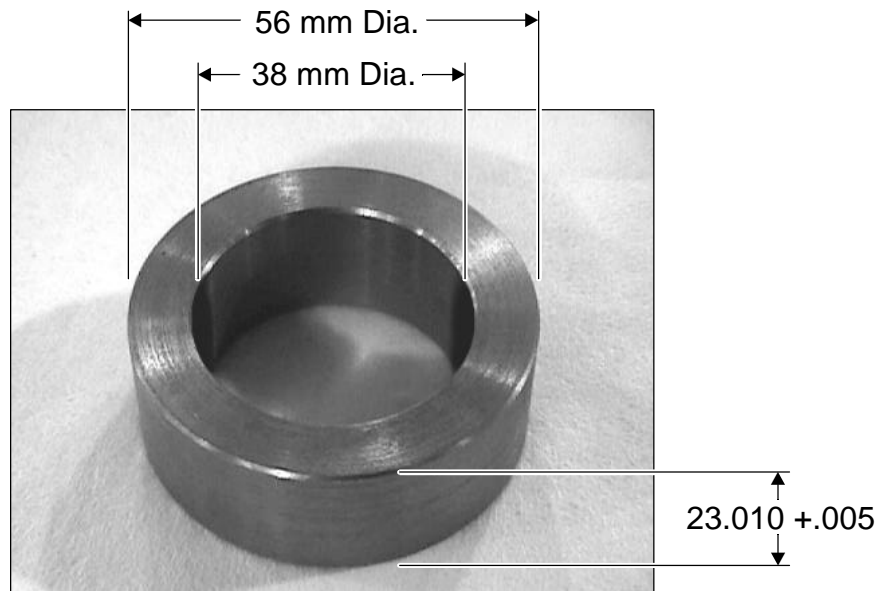
1. Bury the pinion shaft in dry ice. See the figure below.



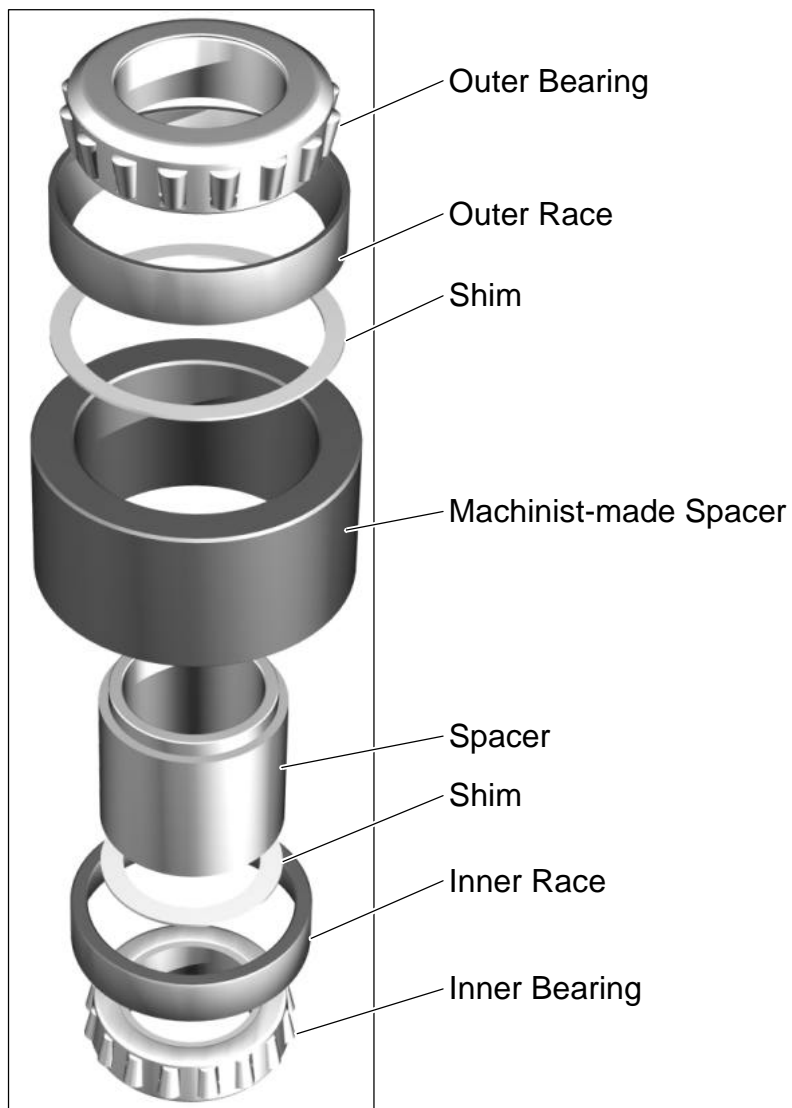
2. Determine the shimming required for the taper roller bearings.

Note: If you do not have a spacer measuring 56x38x23.010 mm, continue with the following procedure. This spacer applies to the KF66A gear case. If you have the spacer, go to step 3.

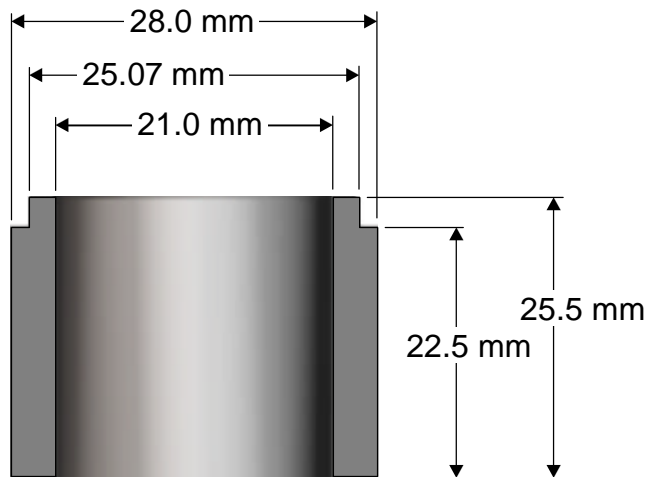
- Ask a Machinist to make a spacer as shown below. The following dimensions are: 'A' 56, 'B' 38, and 'C' $23.010^{+.005}$. This spacer is used to represent the bearing bore of the gear box. See the figure below.



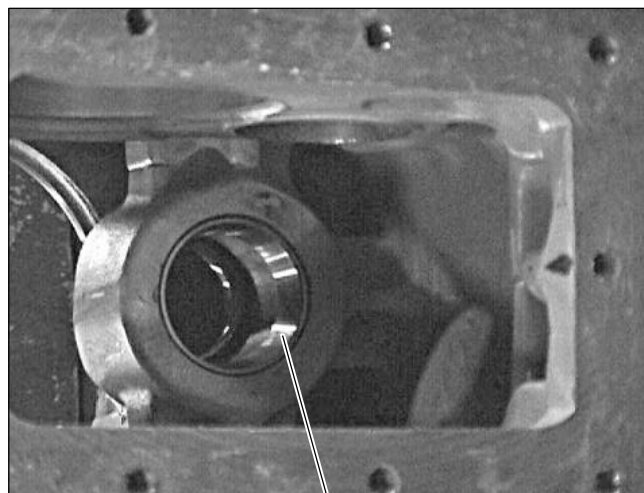
- Stack the taper roller bearing, spacer, shims, fabricated spacer, and the taper roller bearing as shown below. Initially use 0.5mm shims.



Note: If the gear box you are rebuilding does not have a spacer with part number 123 003 4, ask a Machinist to make one using the dimensions shown below.



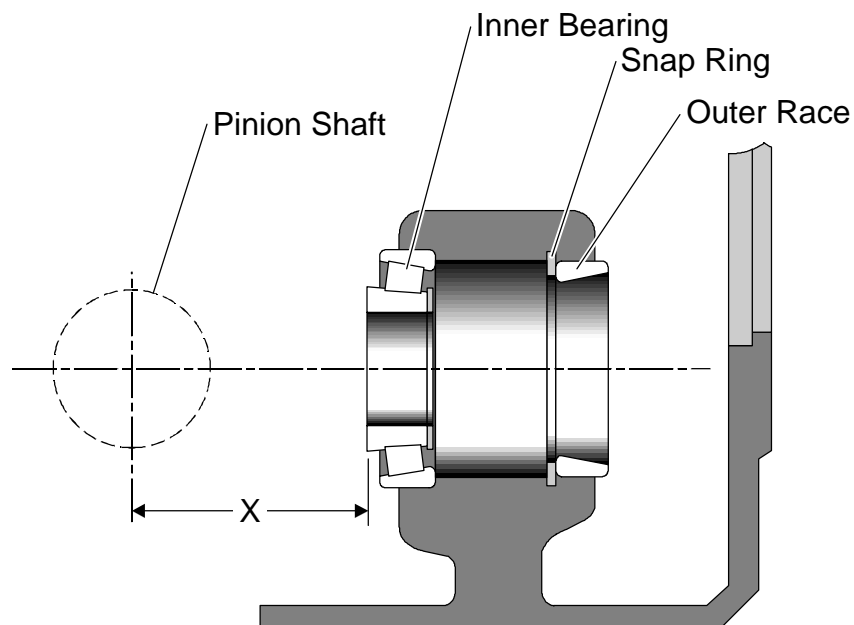
- Using a hand press, apply slight pressure to the stack while rotating the bearings.
 - Add or remove shims until the spacer and fabricated spacer are securely between the two bearings, and the bearings rotate with ease.
3. Press the outer race of the inner bearing into the bearing bore. See the figure below.



4. Install the snap ring and push the outer race of the outer bearing against the snap ring.
5. Press the outer race of the bearing into place.
6. Determine the shimming required for the bevel pinion.

Note: If the gear box does not have a bevel pinion with 1790 52.10mm stamped on the side, follow the procedures below. If the bevel pinion has 52.10 stamped on the side, to step 7.

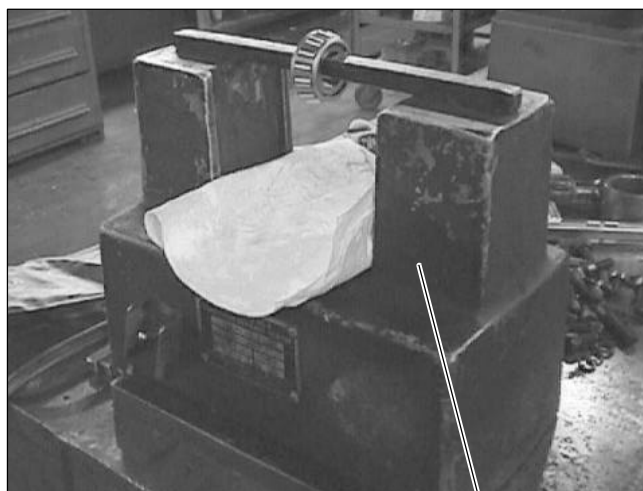
- Place the inner race of the bearing into position and secure in place by means of an appropriate clamp.
- Measure, in millimeters, the distance of X from the face of the inner race of bearing to the centerline of the cross bore for the shaft. See the figure below.



Note: The difference between the value of 'X' and the dimension inscribed on the bevel pinion (52.10mm) is compensated for by means of shims. The value of X must always be greater than the value shown on the bevel pinion, or the assembly will not be possible. See the figure below.



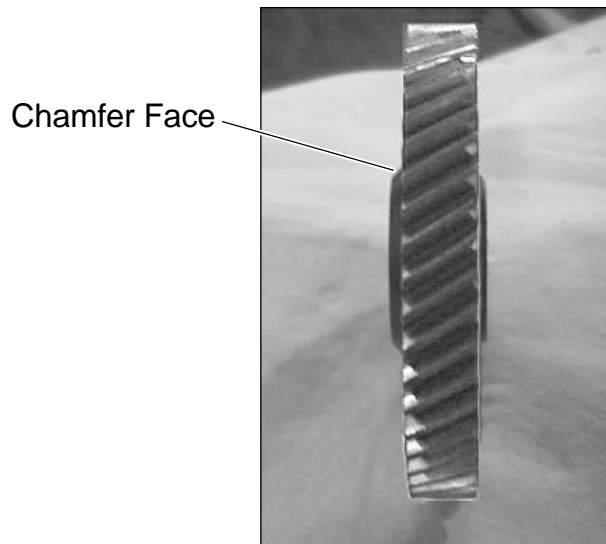
- Install shims as based on the above computations.
 - Press the inner race of the bearing into the bearing bore.
 - Install the spacer onto the shaft.
7. Place the bearing on the induction bearing heater or suitable heater. See the figure below.



Induction Bearing Heater

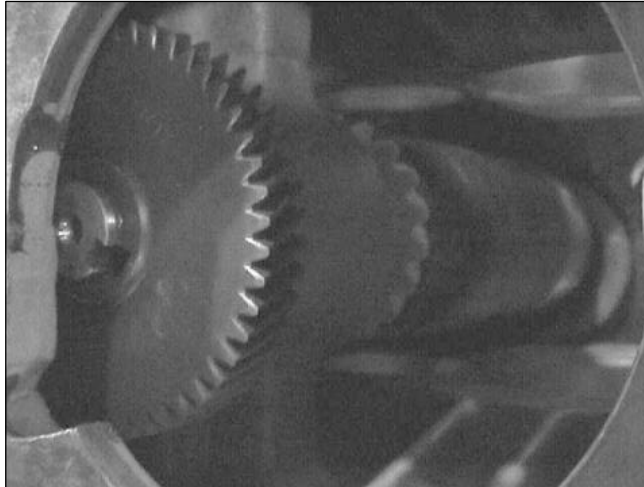
Note: Monitor the bearing while it is on the induction bearing heater. It is possible to burn up the bearing.

8. Place the preheated bearing in its outer race that is installed in the bearing bore..
9. Place the gear on the Induction Bearing Heater.
10. Place the preheated gear in position with the chamfer face towards the bearing, and trap the gear with a wooden or plastic wedge. See the figure below.



11. Slide the bevel pinion assembly into the bearing bore, and press them completely together.

12. After the shaft is pressed in the gear, install the key in the gear. See the figure below.

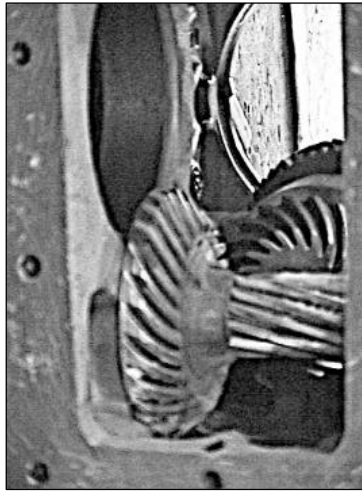


13. Install shims, under the snapping on top of the gear, to eliminate any free float after the bearing and gears are completely cooled.
14. Install the snap ring.

Assemble Bevel Gear and Shaft

1. Determine the mounting position for the output gear and shaft.

Note: The mounting position designation consists of a series of letters and numbers with the suffix A and B to indicate the output shaft and/or flange position. When looking at the helical-bevel reducer from the end opposite the input side, the right side is A and the left side is B. The bevel gear is always on the opposite side of the gear reducer from the output shaft and/or flange position.



2. Install the key in the keyway on the pinion shaft.
3. Place the preheated bevel gear inside the housing on the A side or B side as determined in step 1.
4. Slide the pinion shaft into the bevel gear. The bevel pinion and bevel gear are matched and, if necessary, must be replaced as a set.

Note: For mounting positions V5, H5, V1, V6, V1I, and H6, install a nilos ring on the pinion shaft.

5. Slide the preheated bearing (Bearing Number 32303J2) onto the pinion shaft.
6. Press the outer race of the bearing into the housing.
7. Set the circumferential backlash (tooth clearance) of the bevel gear set to the appropriate, after the bevel gear and bearings are completely cold down.

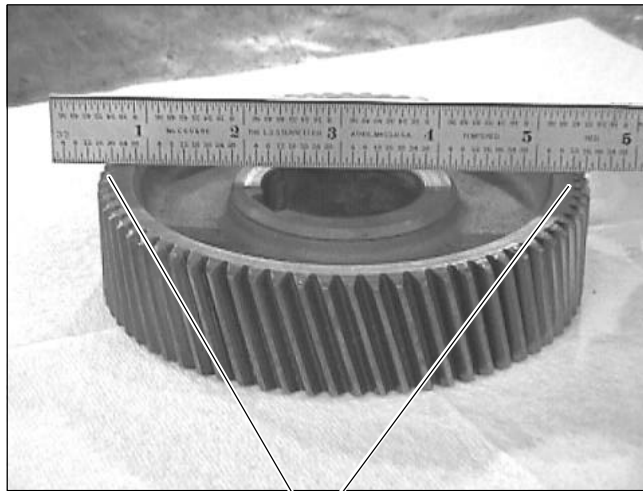
8. Install shims, thrust washers, and snap rings on both sides to achieve the prescribed backlash.

Note: With the proper backlash setting, a sufficient number of shims are installed so that the snap rings can only be installed with difficulty.

9. Install the closing caps.

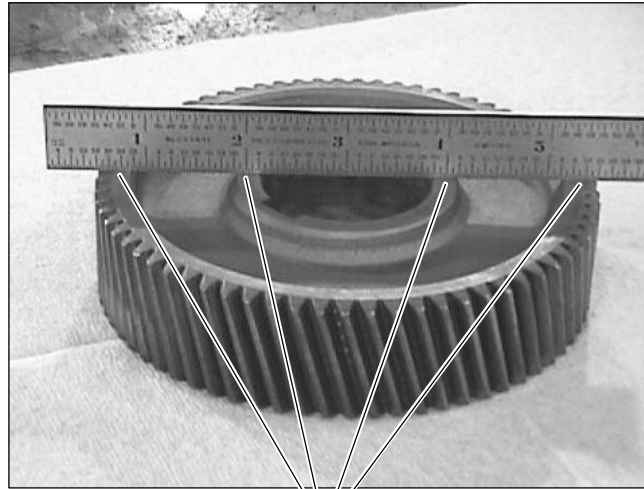
Output Gear and Shaft

1. Preheat the output gear.
2. Determine the correct position for the output gear.
 - Lay the output gear on its side. Lay a ruler across the flat surface of the gear. If the ruler touches only two points of the output gear, this side faces towards the output side of the gear box, the long end of the shaft. See the figure below.



— Straight Edge Touching Two Points

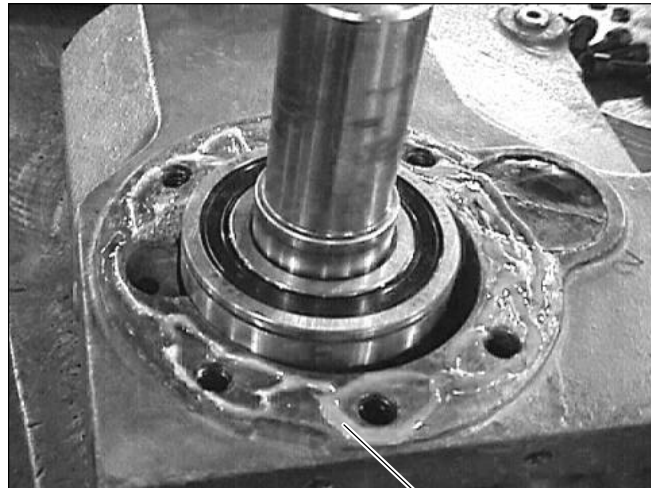
- Lay a ruler across the flat surface of the gear. If the ruler should touch four points, placed this side towards the inside of the gear box, the short end of the shaft. See the figure below.



— Straight Edge Touching Four Points

3. Jam the bevel gear with a wooden or plastic wedge to prevent rotation.
4. Install the key in the keyway on the output shaft.
5. Determine the correct position of the output gear.
6. Position the preheated gear inside the housing with the flat side facing towards the bevel gear, and slide the shaft into the gear.
7. Set the housing on its side and support the shaft.
8. Install the spacer.
9. Lubricate the bearing, and press on the bearing (Bearing Number 6208J2).
10. Apply flange sealant to the flange surface.
11. Install the sealing flange or output flange, and secure the flange with the socket head screws.
12. Turn the housing upright.

13. Press the bearing on the opposite end of the shaft. Be sure to lubricate the bearing before installation.
14. Apply flange sealant to the gear box housing surface. See the figure below.



Flange Sealant

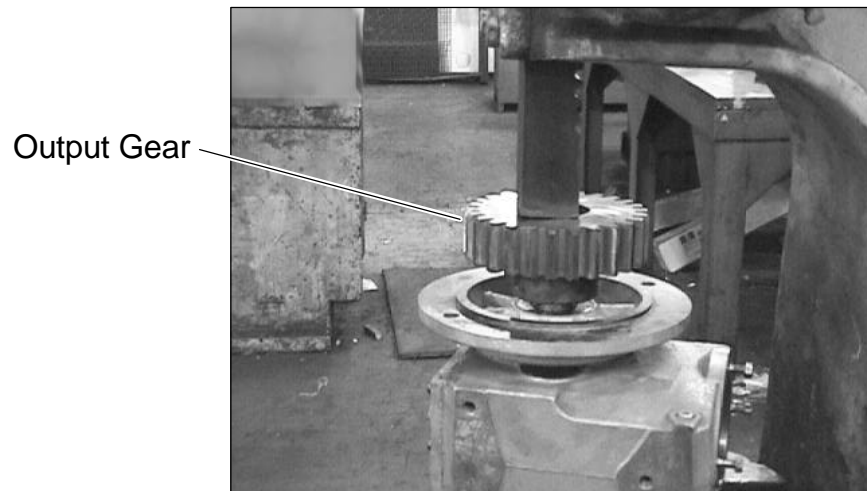
15. Install the sealing flange, and secure the flange with the socket head screws. (Provide surface sealing.)
16. Install shims to eliminate any free float.
17. Install the thrust washer and snap ring.
18. Install the closing cap.

19. Install the oil seal in the sealing flange or output flange.



Output Flange

20. Install the output gear.



Output Gear

21. Request a Lubricator to fill the gear box with Lubricant 2004.



Concept Check

Rebuild Gear Box

Answer the following questions to check your understanding of rebuild a gear box. Circle the correct answer in each question. Then compare your responses with the answers at the bottom of this page. Some of the questions may have more than one correct answer. If you have difficulty answering a question, review the Skill Development Guide or ask your Trainer for assistance.

1. Replace the bevel pinion and bevel gear as a set.
 - a. True
 - b. False
2. The Machinist made spacer (56x38x23.010mm) is used to:
 - a. determine the shim requirement.
 - b. slide into the bearing bore of the gear box.
 - c. represent the bearing bore of the gear box.
3. What is the distance (in millimeters) from the face of the inner race of the bearing to the centerline of the cross bore of the pinion shaft?
 - a. 51.10mm
 - b. 51.20mm
 - c. 52.10mm
 - d. 52.20mm

Answers: (1. a 2. a,c 3. b)

Next Step

If you are ready to demonstrate the task now, ask your Evaluator or Trainer to schedule the Skill Check. However, if you need to practice some of the steps first, continue to the next section.



Practice

The following practice will help prepare you for the Skill Check. Ask your Trainer to set up the practice for you. After you complete a practice, ask your Trainer to check your work.

Practice

Your Trainer will designate a gear box for the rebuilding activity. You will be asked to select the required repair kit. During this practice you will:

- disassemble the gear box.
- clean and inspect the gear box components.
- reassemble the gear box.

Your Trainer will observe as you disassemble, clean, and reassemble the gear box to ensure that the gear box is assembled properly. You are required to follow all the recommended safe practices associated with handling cleaning solvents. All cleaning solutions must be disposed of per HAZMAT regulations.

Practice Objective

The gear box must be reassembled using the specified parts. All screws must have Loctite 242 applied. All flange and seals must have flange sealant applied the surfaces. All cleaning solutions must be disposed of per HAZMAT regulations. All safe practices must be demonstrated.

Next Step

Continue to practice until you are ready for the Skill Check. When you are ready to demonstrate the task, ask your Evaluator or Trainer to schedule the Skill Check.