

BE-03

MECHANICAL MAINTENANCE TRAINING

SKILL DEVELOPMENT GUIDE

Duty BE: Ways and Gibs

BE-03: Replace and Set Tychoway Bearings

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Task Preview

Replace and Set Tychoway Bearings

Linear ball or rolling element bearings, sometimes called roller packs, support and guide the axes of many machine tools used in Caterpillar plants. Tychoway is one common brand of such bearings.

When these bearings become damaged -- typically from wear, shock loads, inadequate lubrication, or contamination -- machine tool axes will not move smoothly or accurately. Looseness may develop that translates into lost motion and out-of-tolerance machined parts. The machine ways that support the bearings may also be damaged.

Mechanical maintenance journeymen or apprentices replace and set up roller packs when bearing performance becomes unacceptable. Sometimes the bearings are also replaced as a preventive measure during a general machine rebuild. Replaced bearings are set up with a preload to prevent looseness as wear occurs. The Mechanical Maintenance Technician must know how to replace and adjust bearings to avoid damaging them or the machine ways, and to ensure long operating life. The machine must move smoothly on the replaced bearing and without looseness from one extreme to the end. Mechanical Maintenance Technicians must be familiar with machine ways, alignment, and geometry to work with roller packs successfully.

How your skills will be checked

The Skill Check will require you to Replace and Set Tychoway Bearings. 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 Tychoway bearing (roller pack) that must be replaced, replace and set the Tychoway bearing.

Task Standards

1. The machine must move on its axis without binding or looseness from one end of travel to the other.
2. Machine ways and Tychoway bearings must not be damaged.
3. The Tychoway bearings must be preloaded according to the machine manufacturer's specifications.
4. All safety requirements must be demonstrated.

What You Will Need

This section contains the safety information, tools, and resources you will need to replace and set a Tychoway bearing.



- Follow all Caterpillar facility safety standards when performing this task.



- replacement Tychoway bearing (or equivalent “roller pack” linear roller bearing)
- dial indicator and mounting hardware
- wrenches
- feeler gauges or shim stock
- shop towels
- general purpose degreaser
- oil specified for the machine lubrication system



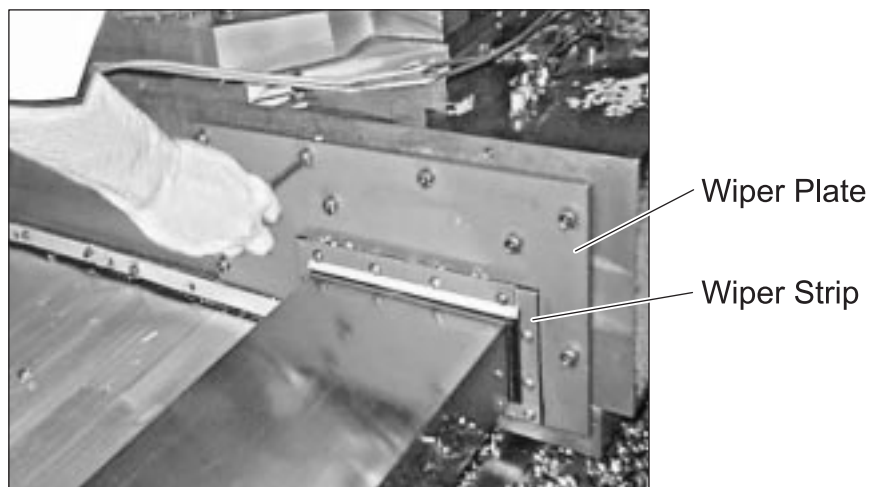
- machine Operator
- machine manufacturer’s prints, instructions, and specifications



Task Steps

Replace and Set Tychoway Bearings

1. Consult the machine manufacturer's prints, instructions, and specifications to identify and obtain the correct Tychoway (or equivalent) bearing.
2. Manually move the machine spindle out of the way and/or the machine axis you will be working on to a convenient position.
3. Using shop towels and degreaser, if necessary, clean chips off the machine way and around the wiper plate.
4. Remove the wiper plate as shown below.



Removing the Wiper Plate

- Remove any individual wiper strips or wiper strip screws that may be necessary to remove the wiper plate. Note screw lengths for later reassembly.

Note: In some applications, wiper strip screws go through the wiper plate and thread into the machine frame or components attached to it. These screws must be removed to take off the wiper plate. Screws that hold wiper strips to the wiper plate do not need to be removed.

- Remove the screws that hold the wiper plate onto the machine frame.
- 5. **Using shop towels, clean out any chips that may have collected inside the wiper plate. Use degreaser, if necessary.**
- 6. **Set up a dial indicator between the machine frame and the way. The indicator plunger or lever sets on the surface the bearings ride on as shown below.**

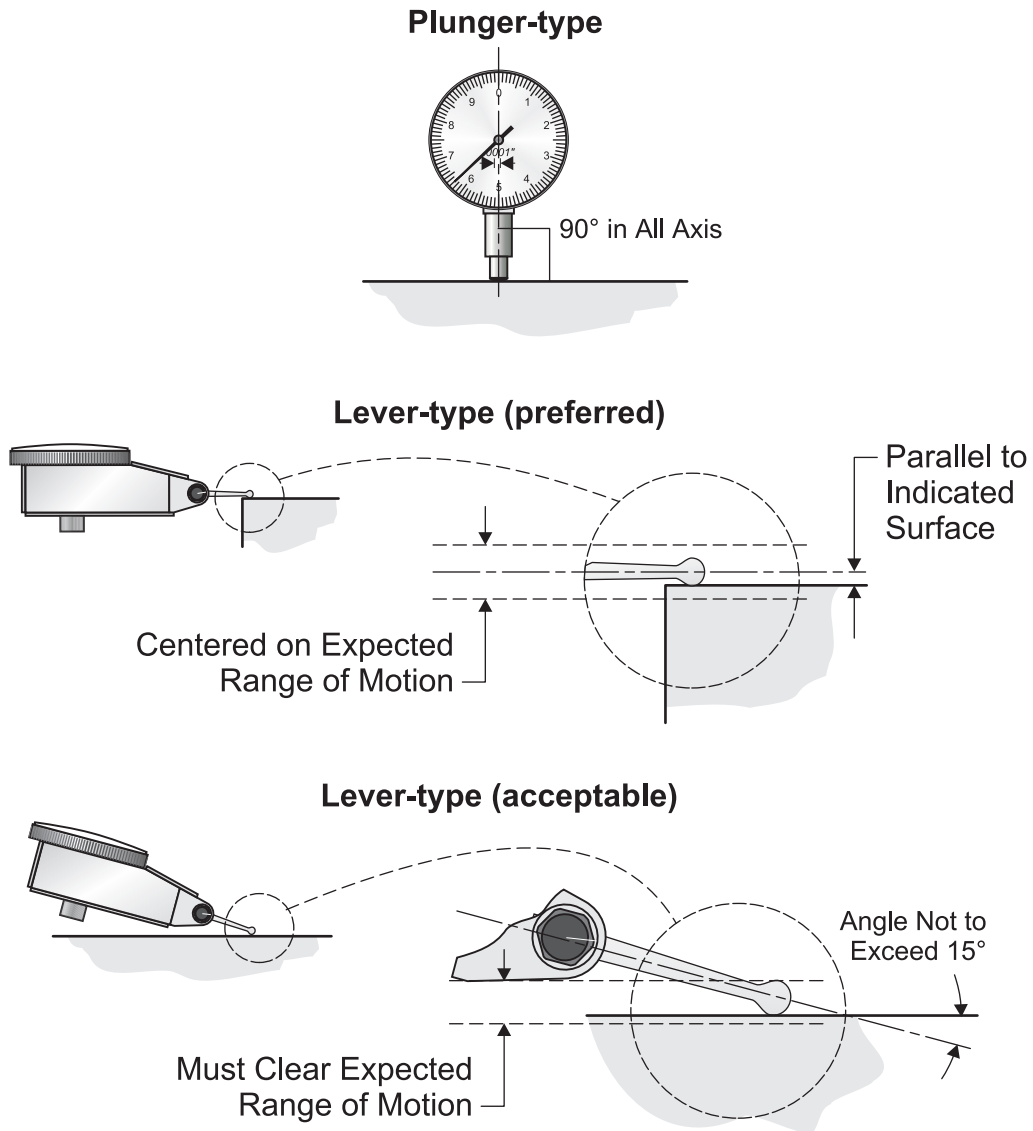


Indicator Mounted to Machine Frame

Indicator Plunger on Bearing Surface

Side by Side Dial Indicator Setup

Note: If the dial indicator has a plunger, the plunger should be perpendicular to the surface being indicated. If the dial indicator has a lever, mount the indicator so the lever is no more than 15 degrees from parallel with the surface being indicated. See the figure below.



Mounting a Dial Indicator

- The dial indicator lever or plunger must indicate movement perpendicular to the way surface which supports the Tychoway bearing.

- Position the dial indicator so it will not be bumped as you remove and replace the Tychoway bearing; if possible, indicate on the side of the way opposite the bearing you are replacing.
 - Zero the dial indicator.
- 7. Remove the screw that holds the Tychoway bearing and the tapered adjustment gib in place.**
 - 8. Tighten the jack screws evenly to back the bearing and tapered adjustment gib out of the machine pocket, as shown below.**



Removing the Tychoway Bearing

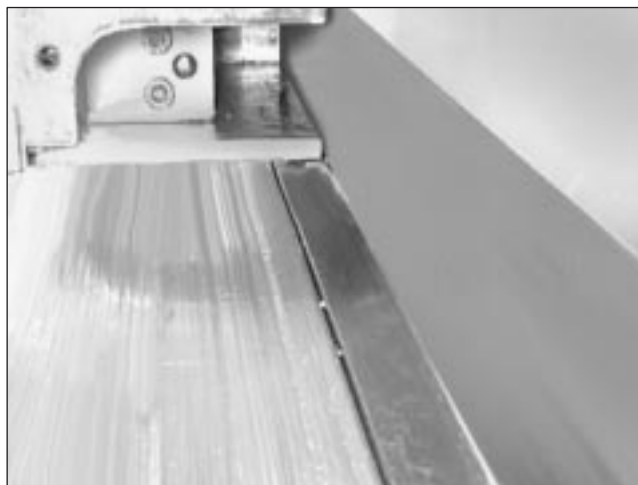
- Any movement of the dial indicator during this process indicates a release of the preload on the bearing.
- 9. Remove the screws holding the Tychoway bearing to the adjustment gib.**
 - 10. Clean off the adjustment gib.**
 - 11. Attach a new Tychoway bearing to the adjustment gib.**
 - If the Buna rubber band holding the rollers into the Tychoway bearing is to be replaced with a metal clip, cut the band, pull it out, and install the clip, being careful not to drop any rollers.
 - Insert the cap screws but do not tighten them.

- Press the bearing and adjustment gib sideways on a flat surface to align them, as shown below.



Aligning Tychoway Bearing and Adjustment Gib

- Tighten the cap screws wrench-tight.
- 12. Using shop towels, clean out the Tychoway bearing pocket in the machine frame. Use degreaser, if necessary. See below.**



Bearing Pocket

- 13. Inspect the surface of the tapered adjustment gib and scrape, if necessary.**

14. Check the lubrication supply to the Tychoway bearing.

- Cycle the machine lubrication pump found on the control panel.



Control Panel

- Verify that oil flows freely into the Tychoway bearing pocket.

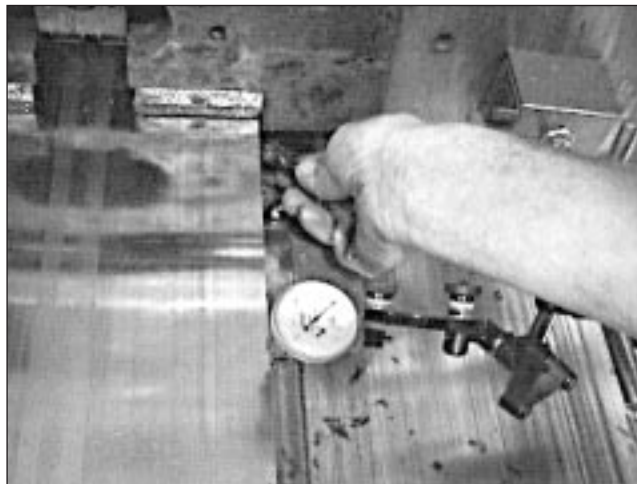
15. Lubricate the bearing as shown below.



Oiling the Tychoway Bearing

- Use the oil specified for the machine lubrication system.
- 16. Back the jack screws out and carefully insert the Tychoway bearing into the bearing pocket.**
- 17. Preload the bearing.**

Note: If the bearing preload must be re-established to factory specifications, follow the manufacturers instructions. You may need to insert a thin feeler gauge or shim stock between the bearing and the way. Tighten the adjustment screw to just grip the feeler or shim. Then remove the feeler or shim and count adjustment screw turns until all clearance is removed (the dial indicator reading begins to change). If preload is specified in thousandths or ten-thousandths, advance the screw the number of turns necessary to provide the preload. In some applications, the manufacturer may specify preload in terms of torque on an adjustment screw.



- Insert the preload adjustment screw and draw the bearing into place; if necessary, use a longer screw to pull the bearing into a position where the original screw can reach threads.
- If the preload on the removed bearing was satisfactory, tighten the adjustment screw until the dial indicator returns to its initial zero reading.
- Set preload to manufacturer's specification if available. If there is none, as a rule of thumb use .0002 - .0003 preload.

- If you have difficulty adjusting the preload, manually run the axis back and forth a short distance to help seat the tapered adjustment gib and the bearing on the way.
- 18. When the desired preload is established, snug down the jack screws.**
- Do not overtighten the jack screws; the threads may strip.
 - If the jack screws are left loose, the bearing may wedge itself tighter between the tapered adjustment gib and the way during axis movement.
- 19. Remove the dial indicator setup.**
- 20. Replace the wiper plate and individual wiper strips.**
- Leave the screws loose until all of them are inserted and threaded.
 - If some wiper strip screws are longer, be sure to install them in the correct holes.
 - Tighten all screws wrench-tight.
- 21. Test the machine axis motion from one end of travel to the other.**
- Check for binding and skewing because of looseness when motion direction changes.
 - If necessary, check the machine axis for misalignment and lost motion.
 - Check the way covers, if any, for smooth and reliable operation.



Concept Check

Replace and Set Tychoway Bearings

Answer the following questions to check your understanding of how to Replace and Set Tychoway Bearings. Circle the correct answer in each question. Then compare your responses with the answers at the bottom of this page. If you have difficulty answering a question, review the Skill Development Guide or ask your Trainer for assistance.

1. For access to the Tychoway bearing, remove the:
 - a. machine way.
 - b. wiper plate.
 - c. ball bearing retainer.
 - d. machine end frame.

2. Before removing the Tychoway bearing, set up a dial indicator to indicate:
 - a. the zero axis position.
 - b. bearing-to-way clearance.
 - c. machine frame misalignment.
 - d. the release of preload.

3. Adjust the Tychoway bearing using:
 - a. jack screws.
 - b. wiper bolts.
 - c. a tapered gib.
 - d. shims in the bearing pocket.

4. Before installing the new Tychoway bearing in the pocket, check that:
 - a. oil flows under pressure to the bearing pocket.
 - b. the inner wipers are in good condition.
 - c. the buna rubber seal is in the right position.
 - d. all rollers are on the outside.
5. If you have difficulty adjusting the preload:
 - a. manually run the axis back and forth a short distance.
 - b. blue and scrape the ways.
 - c. use a laser alignment setup.
 - d. loosen the wiper plate adjustment screws.
6. After adjusting the bearing preload to specifications, tighten the:
 - a. bearing-to-gib screws wrench tight.
 - b. adjustment screw an additional turn.
 - c. jack screws to keep the bearing from wedging tighter.
 - d. bearing straps to keep the rollers in place.

Answers: 1. b 2. d 3. c 4. a 5. a 6. c

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 1

This practice will familiarize you with the documentation on the machine tool and on the roller pack bearings that may be available for it or that must be ordered.

Practice Objective 1

Select the correct Tychoway bearing for a particular machine tool. The selected bearing must match specifications and the bearing presently in the machine.

Practice 2

As part of maintenance, you may be required to determine if a particular Tychoway bearing is in satisfactory condition. In this practice you will go through the steps required to check a bearing.

Practice Objective 2

Remove, inspect, and replace a Tychoway bearing.

1. The machine must move on its axis without binding or looseness from one end of travel to the other.
2. Ways and Tychoway bearings must not be damaged.
3. The Tychoway bearings must be preloaded according to the machine manufacturer's specifications.
3. All safety requirements must be demonstrated.

Practice 3

The bearing preload is important to bearing and way life, and to machine alignment. If one Tychoway bearing is replaced and set with a heavy preload, the machine frame may be racked out of alignment. Another possibility is that other bearings will be overstressed. On the other hand, too light a preload may lead to machine looseness and lost motion. The preload must be right. This practice familiarizes you with preload specifications and the methods for setting preload.

Practice Objective 3

Check and establish the correct preload on a Tychoway bearing.

1. The Tychoway bearings must be preloaded according to the machine manufacturer's specifications.
2. All safety requirements 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.

