

AC-03

MAINTENANCE MECHANIC TRAINING

SKILL DEVELOPMENT GUIDE

Duty AC: Rotary Actuators
AC-03: Replace Rotary Actuator

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Task Preview

Replace Rotary Actuator

Rotary actuator problems are indicated when:

- the rotary actuator performance becomes unacceptable
- leaks develop from the rotary actuator

Replacing the rotary actuator begins with powering down and locking out the machine associated with the actuator. After the power is removed from the actuator, the hydraulic lines are disconnected. You will then remove the actuator. The actuator is mounted and the hydraulic lines are reconnected as per the original connection to replace the rotary actuator.

Failure to install the actuator correctly could result in the arms not having full travel and/or the position feedback may be incorrect. Hydraulic leak may occur that result in unscheduled downtime due to actuator failure.

How your skills will be checked

The Skill Check will require you to replace a rotary actuator. 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

Upon receiving a ticket to replace a motor, remove the original motor and install the replacement motor.

Task Standards

1. The replaced rotary actuator must function according to manufacturer's specifications, positioning the arm accurately, without looseness, and holding position without slippage.
2. All required safe practices must be demonstrated.

What You Will Need

This section contains the safety information, tools, and resources you will need before replacing a rotary actuator.

SAFETY FIRST

**DON'T TAKE
CHANCES**

- Follow all Caterpillar Facility Safety Standards when performing this task in the plant.
- The hydraulic source that powers the actuator must be locked out while the actuator is removed and replaced.
- The Man Mate must be reduced to a Zero Mechanical State, with all pressure relieved, and all components either on the floor or securely blocked in position.
- A hoist is necessary to support the actuator as it is being removed and replaced; a jack is necessary to support the arm at the terminal device.



- air hose and nozzle
- hoist and sling
- jack or stand for the arm
- Maintenance Mechanic hand tools
- air-powered socket driver and extension



- none



Task Steps

Replace Rotary Actuator

Note: This task was analyzed on the rotary actuator that moves the Man Mate arm from side to side.

1. Blow dirt off the rotary actuator and vicinity.
2. Move the arm out straight or to a position where all four actuator cap screws can be broken loose with a long cap screw wrench.
3. Lock out power to the actuator, as shown below.



Locked Out Power

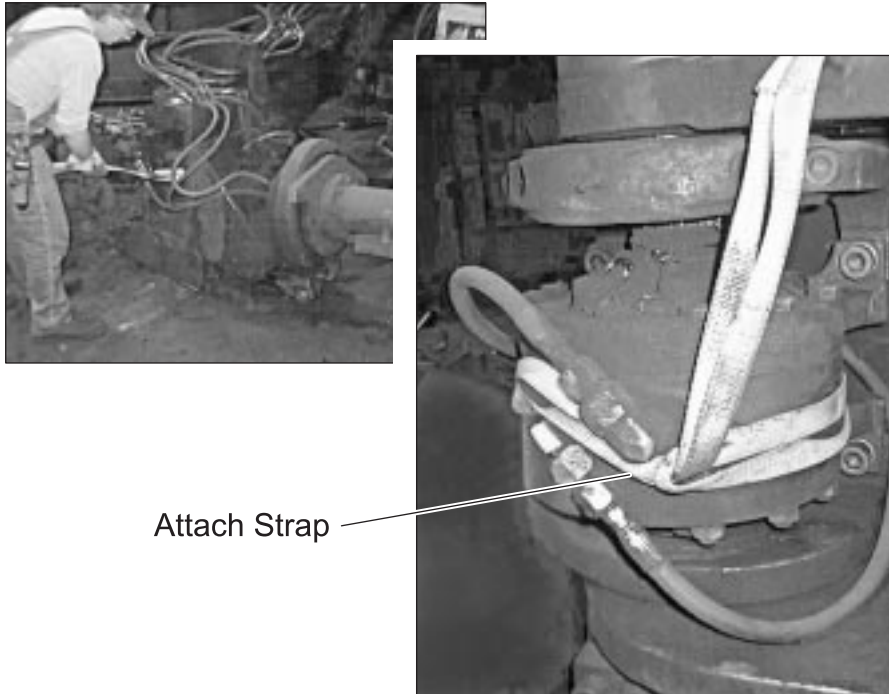
- 4. Break loose the actuator cap screws, as shown below.**



Breaking Loose the Actuator Cap Screws

- 5. Remove the lockout and move the arm around to the side where all four cap screws can be removed.**
- 6. Lock out power to the actuator.**
- 7. Disconnect the hydraulic lines at the actuator.**
 - Plug the actuator ports.
 - Cap the ends of the hydraulic lines.

8. **Wrap a hoist sling around the actuator, as shown below.**



Sling on Actuator

9. **Attach the sling to a hoist.**
- Take up just enough tension to support the actuator weight.
10. **Position a jack to support the outer end (“terminal device”) of the arm.**
11. **Remove the hose rack bolts, and move the hose rack out of the way.**

12. Remove the six bolts holding in the stub shaft, as shown below.

Stub Shaft Flange



Hose Rack and Stub Shaft Flange

13. Loosen and remove the four cap screws (“horseshoe bolts”) that hold the stub shaft bearing half in place.
14. Remove the stub shaft bearing half.
15. Clean out the jack screw holes in the stub shaft flange.
16. Thread two bolts into the jack screw holes and tighten them evenly to pull out the stub shaft.
17. Remove the four actuator attaching cap screws that you broke loose in step 2.
 - A socket extension in the air wrench will be necessary.
18. Use the flat end of a pry bar (“Johnson bar”) under the actuator, and lift it slightly to pull the bottom of the actuator from the recess in the yoke.
19. Pull, turn, and maneuver the actuator out of the yoke.
 - Use an assistant on the hoist control to maintain tension and support the actuator during this operation.

20. Reverse the removal procedure to install the actuator.

- Use the hoist to support the actuator as you swing it into place.
- Use the round end of the pry bar as a pilot through an actuator bolt hole to help align the actuator while installing the attaching bolts.
- Align the arrow on the end of the actuator with the arrow on the end of the stub shaft to index the actuator splines and the stub shaft splines, as shown below.



Indexing Arrow
on Actuator Shaft

Indexing Arrow on End of Actuator Shaft

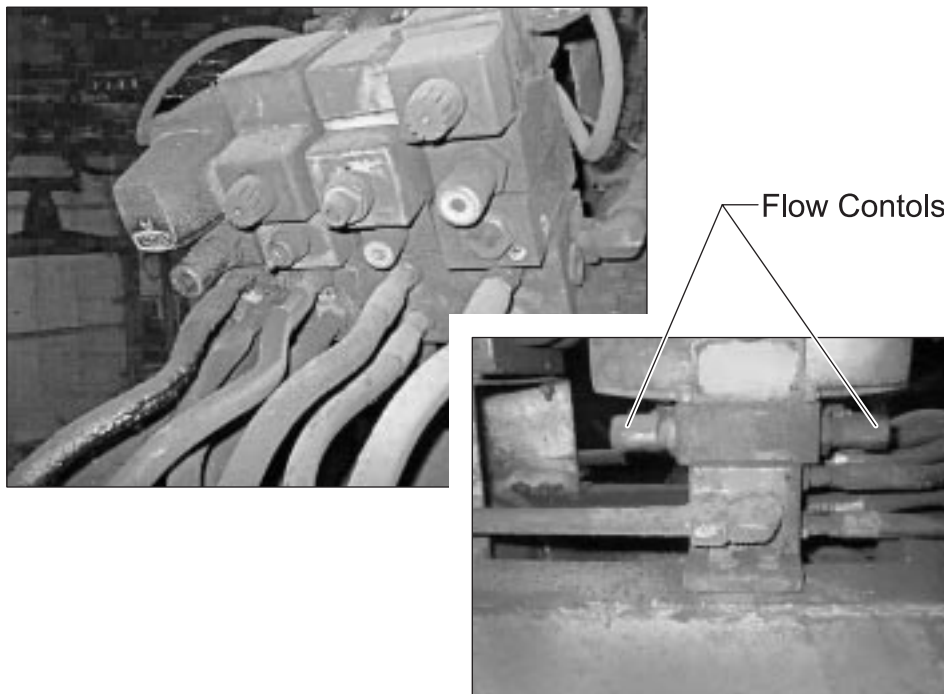
- If necessary to facilitate alignment, turn the actuator shaft to preset it in the same position as the removed actuator shaft.
- If necessary, adjust the position of the arm slightly to line up the bolt and dowel holes in the stub shaft flange. Install the stub shaft bearing half first, and be careful that the arm does not slip off the supporting jack.
- Make sure the hydraulic fittings and threads are clean before connecting the hydraulic lines.

- Route, dress, support, wrap or cover hydraulic lines to prevent rubbing, kinking, twisting, etc.
- Straighten the arm to put it in a position where you can use the long cap screw wrench to apply final torque to the actuator attaching bolts.

21. Lubricate the stub shaft bearing.

22. Test the actuator operation.

- Verify that the actuator moves the arm full range to the stop in each direction.
- Confirm that the arm does not move in null position.
- Ask the operator to approve arm actuator speed. If necessary, adjust both flow controls in the directional control valve to provide acceptable arm speed, as shown below.



Flow Control Adjustment



Concept Check

Replace Rotary Actuator

Answer the following questions to check your understanding of rotary actuator replacement. 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. How is the actuator and the stud shaft aligned?
 - a. Position the arrow on the end of the actuator with the arrow on the end of the stud shaft.
 - b. Position the arrow on the end of the stud shaft to the top of the actuator housing.
 - c. Turn the actuator shaft to the same position as the removed actuator shaft.
2. Why are two bolts threaded into the jack screw holes?
 - a. To provide a place to wrap the hoist sling around.
 - b. To support the actuator during removal.
 - c. To pull the stud shaft out.
3. Adjust _____ in the directional control valve to provide acceptable arm speed.
 - a. both control screws
 - b. both flow controls
 - c. both speed controls
 - d. both arm controls

Answers: (1. a 2. 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 rotary actuator for replacing. During the practice you will:

- Remove the rotary actuator.
- Install the rotary actuator.
- Test the installed rotary actuator.

Your Trainer will observe you as you remove, install, and test the rotary actuator to ensure that the replacement task is performed properly. You are required to follow all the recommended safe practices.

Practice Objective

The replaced rotary actuator must function reliably, positioning the arm accurately, without looseness, and holding position without slippage. 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.

