Q-01a: PM / Troubleshoot / Repair Crane (Retrieval)

SAFETY FIRST

- ☐ Follow all Caterpillar facility safety standards when performing this task.
- ☐ The crane must be locked and tagged during PM check.
- ☐ An electrical hazard exists at the electrical control cabinet. 440v are present inside the electrical cabinet and at the power connections.
- ☐ If the transfer car and crane needs to be moved during the PM check, notify personnel in the area when movement is expected.
- ☐ The area beneath the crane is dimly lit. Use a flashlight as needed.
- ☐ A tripping hazard exists when moving around the rails in the aisle area.
- ☐ An overhead hazard exists due to building joists and frames. Check your overhead clearance when working near the ceiling area.
- ☐ A heat hazard exist during the summer months when working within 10 to 20 feet of the ceiling. Be sure to drink plenty of water before spending an extended amount of time in the area.

EQUIPMENT

- ☐ flashlight
- ☐ Electrician's hand tools
- ☐ metal file
- ☐ ruler
- ☐ feeler gauge
- ☐ cable ties
- ☐ pry bar
- ☐ clean shop towels
- ☐ support blocks
- ☐ lock and tag
- ☐ replacement parts
- ☐ bolt (for disengaging X-brake armature)
- ☐ Welder's clamp

RESOURCES

- ☐ parts book
- ☐ PM Work Order form
- ☐ crane manual

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Preparation

1. Position the transfer car.

- ☐ Turn the air compressor valve fully counterclockwise to the open position. The air pressure must be 50-100psi for transfer car operation.
- ☐ Turn the air compressor power switch to the ON position.
- ☐ At the transfer car Control Panel, ensure that the RAM IN light is green.
- ☐ Using the foot switch, move the transfer car to the aisle where the crane is located. As you move the car, watch for the alignment light; slow the car movement as you approach the alignment light.
- ☐ When the TOP ALIGN light illuminates on the Control Panel, stop the car and press the RAM EXTEND pushbutton. The red RAM OUT light will illuminate. The top of the transfer car is now locked into position.

Note: The JOG ENABLE feature is now enabled. The JOG pushbutton will be used for positioning.

2. Move the crane into the transfer car.

- ☐ Using the Panel Mate touchpad, select MANUAL MODE. Press CONFIRM MODE. Look at the display to verify that MANUAL is displayed.
- ☐ Ensure that both shuttles are centered. Look at JOG SHUTTLE 1 and JOG SHUTTLE 2. If the North or South indicator is blinking, then the shuttle is off-center.

  Example - Shuttle 2 is off-center: You correct the off-center by pressing RECENTER SHUTTLE 2 FROM SOUTH. Shuttle 2 will center.
- ☐ Enable the SAFETY BYPASS.

- ☐ Press JOG BRIDGE EAST SELECT to select the direction for crane movement.
- ☐ Press JOG BRIDGE CREEP SPEED EAST to select the speed of movement. After the crane passes the cabinet door, change the speed to SLOW. Continue crane movement until the crane is positioned 1/3 the way into the transfer car. After the crane is 1/3 way into the transfer car, place the crane into the CREEP mode.

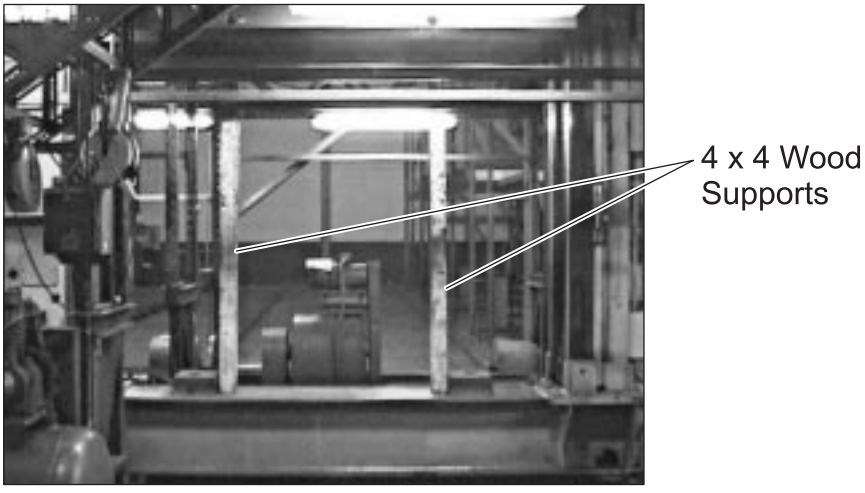
Note: You have a risk of dislodging and/or damaging the collectors if the crane moves too fast. Position the elevator on the support blocks. See the figure below.

3. Position the elevator on the support blocks.

- ☐ Press JOG HOIST UP SELECT.
- ☐ Press JOG HOIST SLOW SPEED UP.

Note: Slow movement allows the Operator to stop the elevator if any overhang lights are detected in the elevator's path.

- ☐ To lower the elevator down on the blocks, place the transfer car in the SOFT SERVO mode.
- ☐ Press JOG HOIST DOWN SELECT. Next, press JOG HOIST CREEP SPEED DOWN. Lower the elevator until it rests on the blocks. See the figure below.



- ☐ Using the power switch located below the Control Panel, power down the crane.

4. Lock out and tag the crane.

- ☐ Open the door to the transfer car Power Panel. Then shut off the power to the North Main Bay.
- ☐ Close the cabinet door and apply lock and tag.

Sprocket Check

Note: You will need the assistance of a Maintenance Mechanic for this check.

1. Release the brake so the Maintenance Mechanic can check the mechanical integrity of the chain sprockets.

- ☐ Using a flathead screwdriver, loosen the two screws and remove the cover on the Y-brake.
- ☐ Depress the armature (solenoid plunger). On the top of the Y-motor, rotate the shaft in a counterclockwise direction until there is slack in the chain.
- ☐ Ask the Maintenance Mechanic to check for a defective slack chain sprocket. The Maintenance Mechanic will call the Electrician on the radio when there is sufficient slack.

2. Engage the brake.

- ☐ After the Maintenance Mechanic completes the slack chain sprocket check, slowly release the brake until the chain tension is restored.

Note: If it is determined at this time that the Y-brake will be removed, depress the armature and pull down the ratchet spring release rod to release the brake.

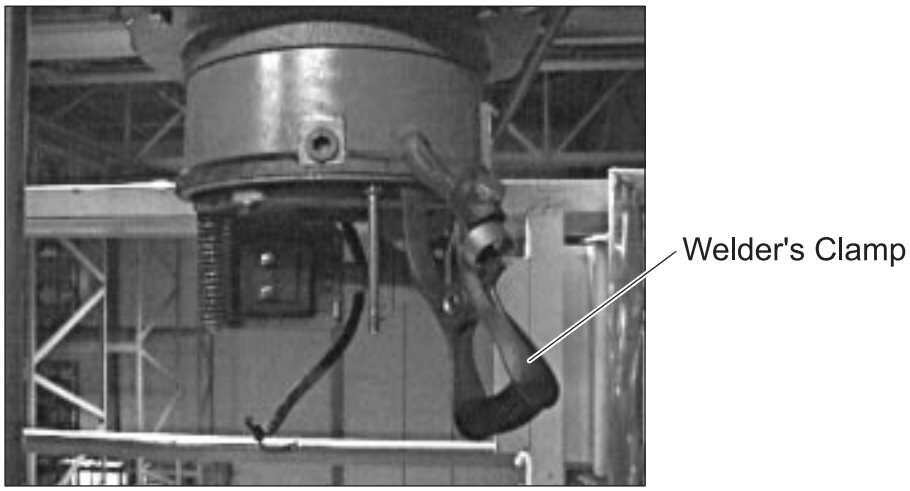
Y-Motor and Brake Check

1. Check Y-brake motor brushes on the north and south sides of Y-motor.

- ☐ Using a 1/2-inch wrench, remove the four bolts securing the cover plate.
- ☐ Remove and inspect the brushes. If the brushes are worn more than 50% of the length of a new brush, replace the brushes. A flashlight may be needed to see inside the motor.

2. Check the mechanical components on the Y-brake support plate assembly.

- ☐ Using a flathead screwdriver, disconnect the two coil leads.
- ☐ Push in on the armature and pull down on the ratchet spring release rod locking the armature in the disconnect position. This action removes the tension from the discs.
- ☐ Position the welder clamp over the housing to prevent the disc assembly and/or broken parts from falling out when the support plate assembly is removed. There are three "vertical below" springs located on the tabs of the pressure plate. These are easily knocked off. See the figure below.



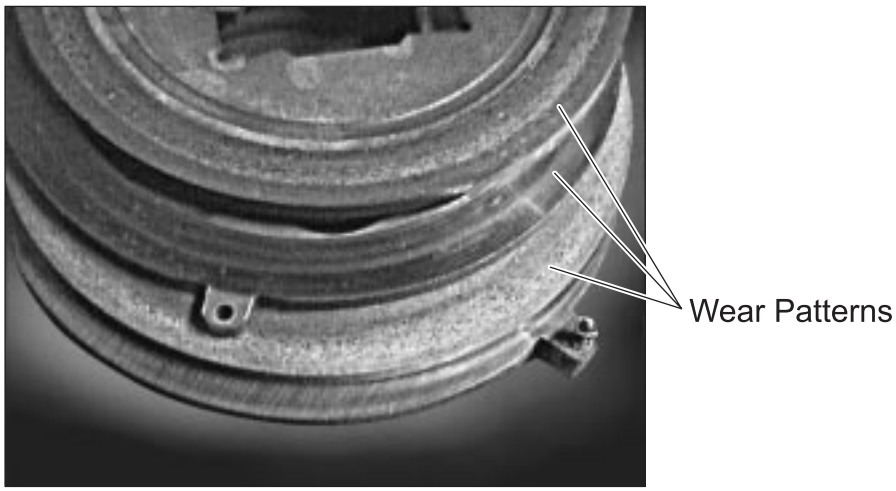
Welder Clamp Positioning

- ☐ Remove the three bolts using a 7/16-inch wrench to remove the support assembly. Lower the support plate assembly from the Y-brake housing.
- ☐ Pull the wire leads out of the plate access hole.
- ☐ Check the mating surfaces of the armature and iron for wear. Make sure that the iron is flat (no visible hammer marks). If the layers are not visible, then the surface wear is excessive. Replace the armature and iron assembly.
- ☐ Check the Stop for wear. The Stop is located above the plunger. Look for notches on the underside of the Stop.
- ☐ Check the armature operation. Depress the armature fully. Let the armature spring back. If the armature springs back to the adjusted position, the condition of the armature is acceptable. If the armature does not spring back, replace the assembly.

- ☐ Check the bolt for movement. The bolt must rotate freely, without binding.

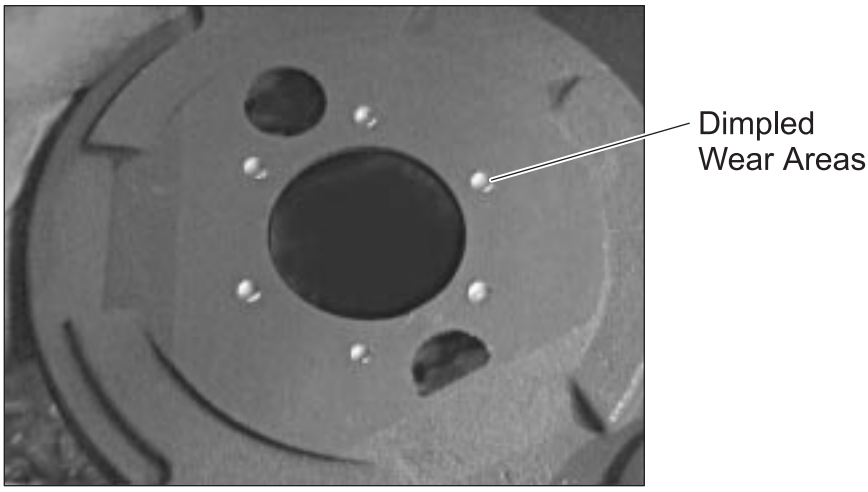
3. Check the condition of the disc assembly.

- ☐ While holding the disc assembly in place with one hand, release the clamp. Slowly lower the assembly from the housing.
- ☐ Clean oil, grease and debris off the surfaces. Next, inspect the components for wear such as glazed surfaces and grooves. See the figure below.



Brake Wear

- ☐ Check the pressure plate for excessive dimple wear. If dimples are worn to the diameter of the rivets on the support plate, replace or repair the plate. See the figure below.



Dimple Patterns

- ☐ If the disc assembly components require replacement, go to step 6.

4. Inspect the seal between the motor and the brake assembly.

- ☐ Inspect for grease and oil. If present, notify a Maintenance Mechanic.

5. Check to ensure that the block is securely mounted.

- ☐ Using a 3/16-inch Allen wrench, tighten the setscrews hand-tight.

6. Replace the disc assembly components.

- ☐ Obtain replacement components, as necessary.
- ☐ If replacing brake discs, ensure that the discs slide over the block without binding. Check each disc individually. If the disc will not slide over the block, file the inside straight edges of the disc as necessary to ensure a fit. Also, check the block for rough edges, file as necessary.
- ☐ Slide the top brake disc over the block; angle slightly so that the disc hangs on the block.
- ☐ Assemble the remaining components.
- ☐ Align the tabs with the brake housing and slide the assembly over the block.
- ☐ Using the welder's clamp, hold the assembly in place.

7. Replace the support plate assembly.

- ☐ Push in on the armature (solenoid plunger) and pull up on the ratchet spring release rod to hold the armature in position.
- ☐ Feed the wire leads through the access hole.
- ☐ Position the mounting plate flush against the housing. Using a 7/16- inch wrench, tighten the bolts wrench-tight in a rotating pattern.
- ☐ Connect the coil leads screwdriver-tight.
- ☐ Remove the welder clamp.
- ☐ Check the air gap. Depress the armature 4-5 times to allow self-adjustment of the wrap spring. Measure the air gap. An acceptable gap is 3/4 to 7/8-inch. If the gap is not within these limits, adjust the L-shaped spring stop until the air gap is set within specifications.
- ☐ Using a flathead screwdriver, install the two screws to secure the Y-brake cover.

Collectors

1. **Disconnect the three power cables and remove the cable ties.**

2. **Remove the endcap from the buss bar.**

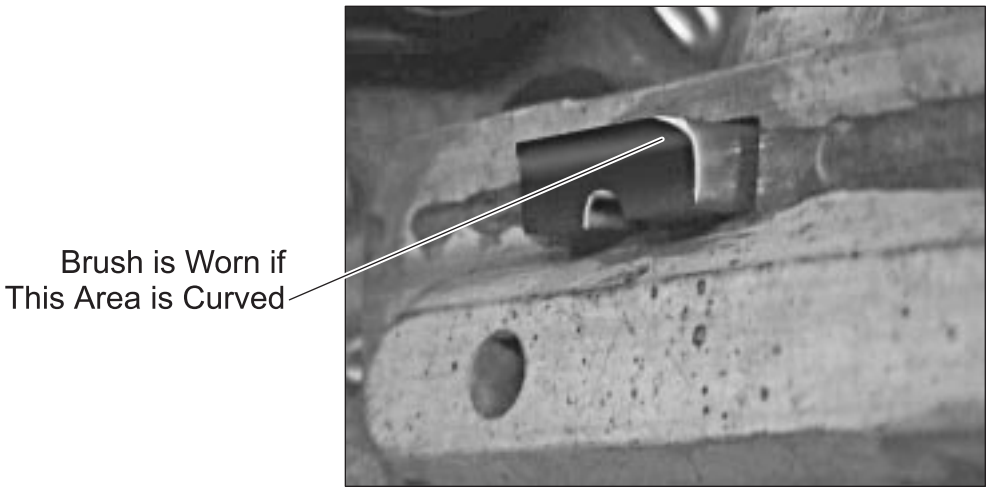
   - ☐ Remove the wing nut securing the end cap in position. Using a 7/16-inch wrench, loosen the nut (located six inches from the left end of the buss bar).
   - ☐ Slide the endcap off the buss bar.

3. **Remove the two tension springs.**

4. **Pull the collector assembly out of the buss bar.**

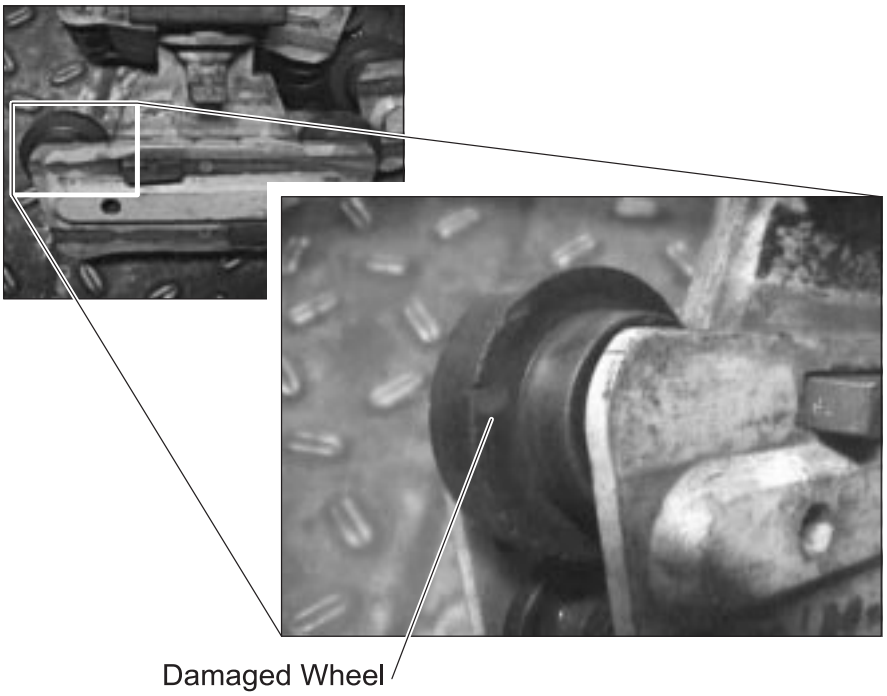
5. **Inspect the collectors.**

   - ☐ Inspect the brushes for wear. If brush wear is past the tapered edge, replace the collectors. See the figure below.



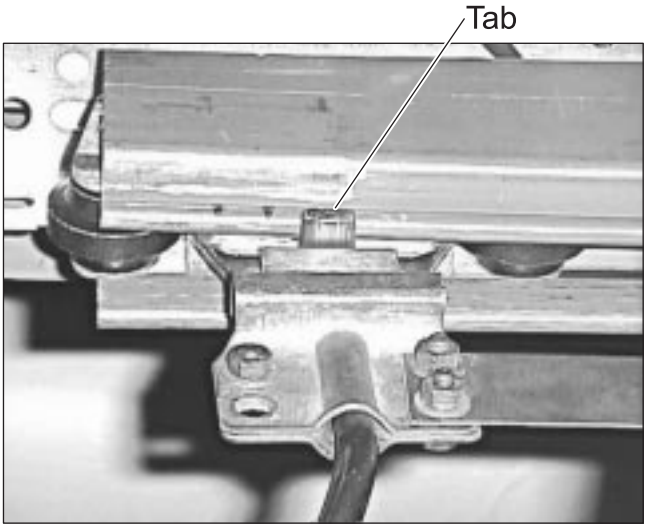
Collector Wear

- ☐ Check wheels for nicks, cracks or wear on edges. If the wheels are damaged, replace the collector. See the figure below.



Wheel Damage

- ☐ Check the tabs for damage. If broken or cracked, replace the collectors. See the figure below.



Collector Tab

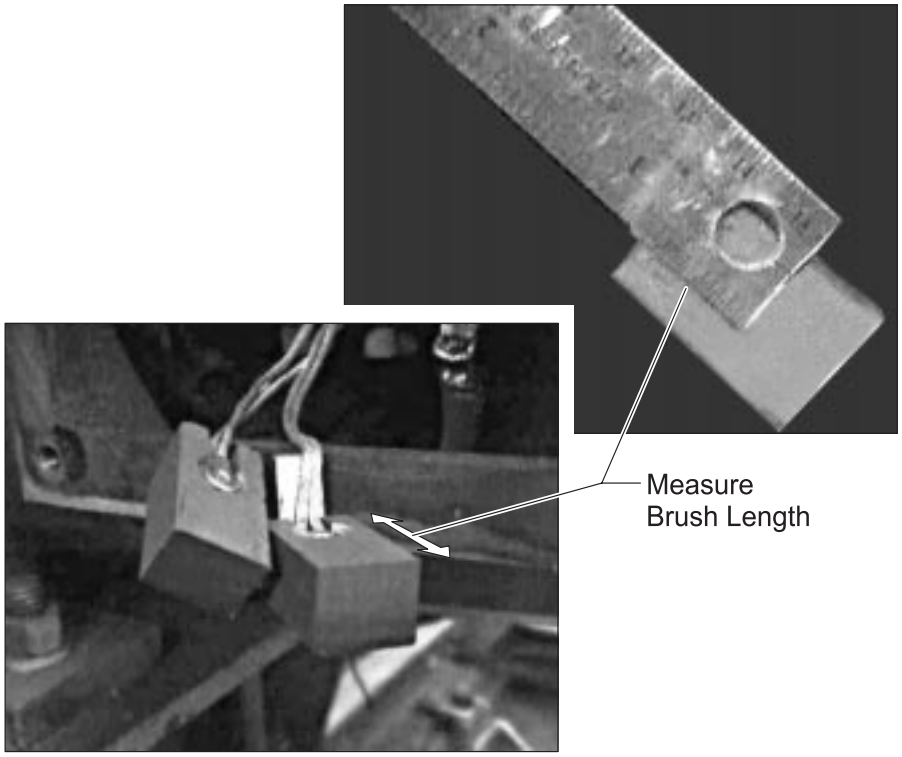
6. Install the collectors.

- ☐ Depress the brushes to allow the collectors to slide into the buss bar.
- ☐ Slide the collectors to the line on the buss bar.
- ☐ Slide the end cap on the buss bar until the wing nut holes are aligned.
- ☐ Using a 7/16-inch wrench, tighten the nut (located 6 inches from the left end of the buss bar). Install the wing nut.
- ☐ Reconnect the chain and attach the tension springs.
- ☐ Using a 7/16-inch wrench, tighten the four nuts on each separator strap.
- ☐ Using cable ties, attach the power cords along the straps. Connect the cords to the mounting bracket on the North L-beam.
- ☐ Connect the power cords.

X-Brake and Motor Check

1. Check X-brake motor brushes on the south side of the motor.

- ☐ Using a 1/2-inch socket, remove the four bolts securing the cover plates on the east and west sides.
- ☐ Inspect the brushes. If the brushes are worn more than 5/8-inch (50% of the length of a new brush (1.125 inches), replace the brushes. See the figure below.



2. Using clean shop towels, wipe off the brushes.

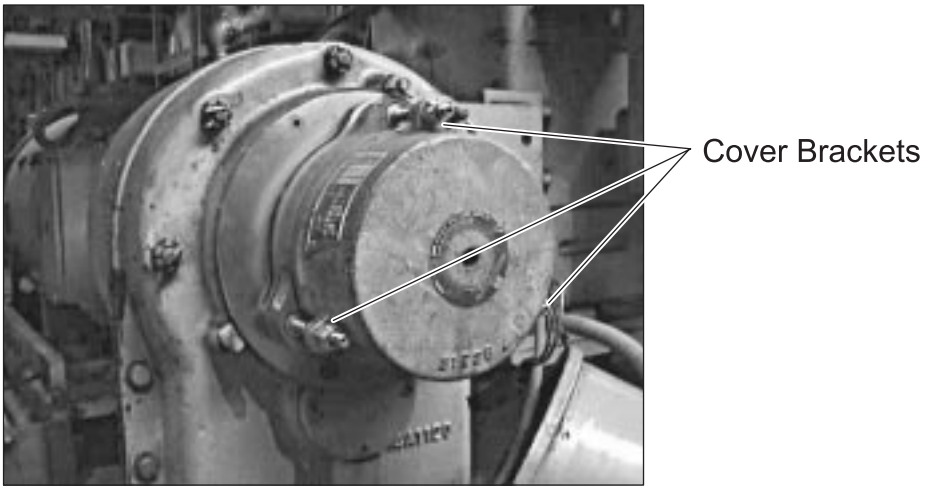
3. Inspect the commutator for carbon dust buildup, burned or gouged segments.

- ☐ If cleaning is necessary, use a commutator stone to clean the segments.
- ☐ Determine if the commutator can be renewed to an acceptable surface. If so, remove the top cover. Jack the crane up until the wheel is not resting on the rail (east end of crane). Enable the drive wheel to allow the wheel to turn. Ask an assistant to use the stone to resurface while you turn the wheel.

4. Replace the covers.

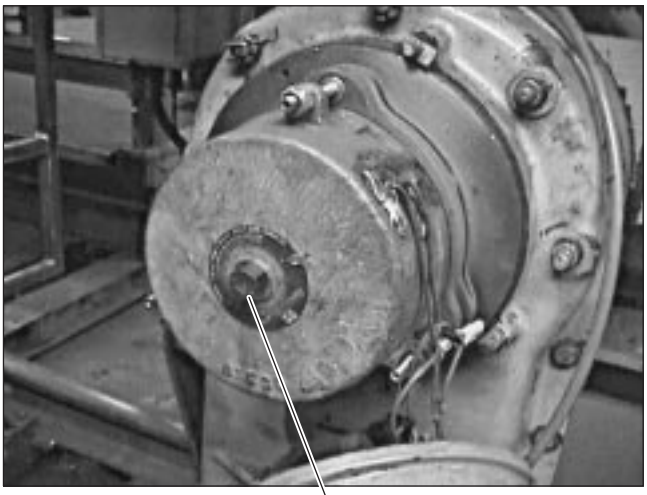
5. Remove the X-brake assembly.

- ☐ Using a 7/16-inch wrench, loosen the three bolts securing the cover brackets. Remove the cover. See the figure below.

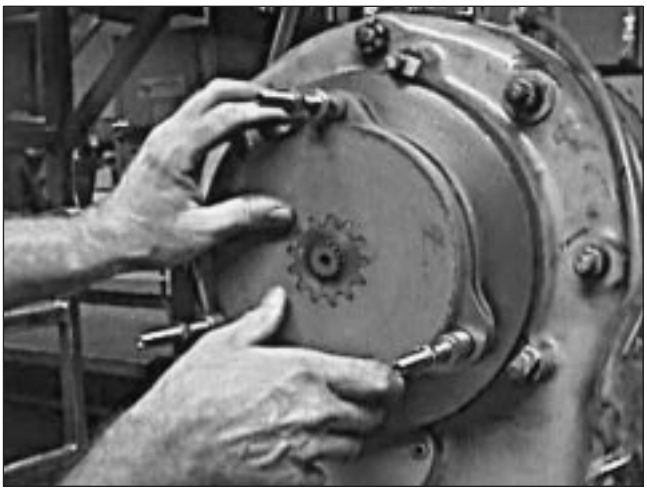


Bolt Location

- ☐ Using an 3/4-inch socket, install the bolt to disengage the armature. The bolt is located at the end of each aisle. See the figure below.

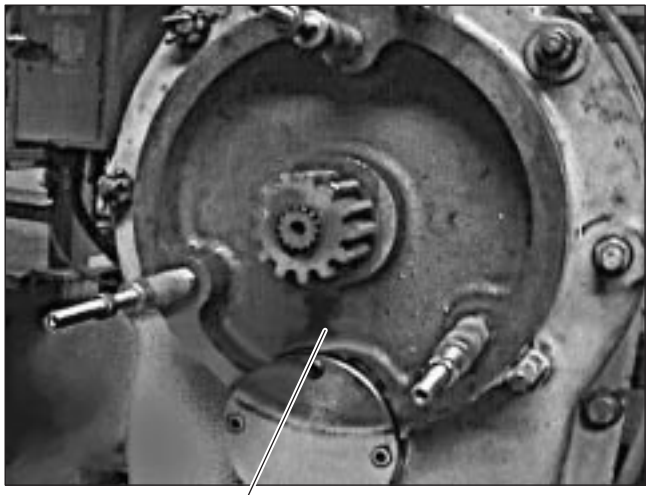


- ☐ Using an 11/16-inch deep well socket, remove the three lock nuts securing the brake coil.
- ☐ Slide the brake assembly off the block. See the figure below.



6. Inspect the brake components.

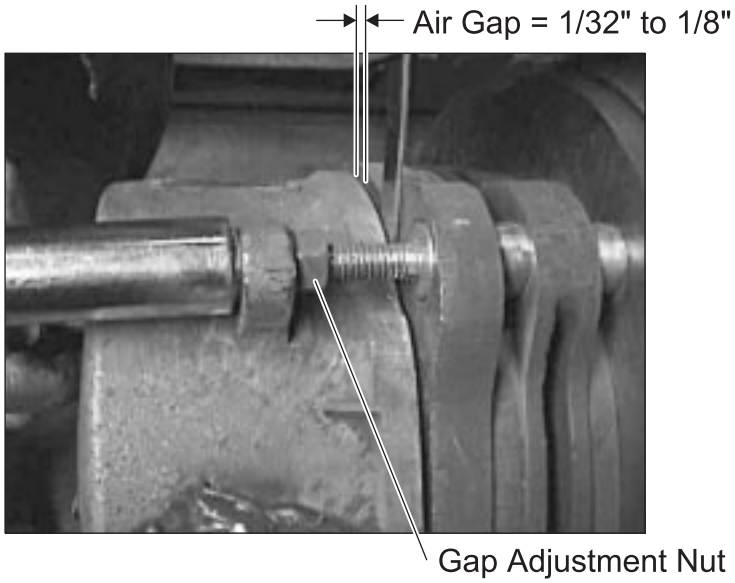
- ☐ Check for seal leaks. Inspect the area around the block for evidence of oil. If a leak is detected, notify a Maintenance Mechanic. See the figure below.



- ☐ Wipe off the brake components.
- ☐ Inspect the brake components for glazing and wear grooves. Replace as necessary. See the figure below.

7. Install the brake assembly.

- ☐ Configure the brake disc assembly.
- ☐ Install the brake assembly on the block.
- ☐ Install the three lock nuts to reconnect the coil.
- ☐ Remove the bolt to engage the armature.
- ☐ Set the air gap. The air gap must be 1/32 to 1/8-inch. Set the air gap as shown below.



8. Replace the cover.

- ☐ Using a 7/16-inch wrench, tighten the three bracket bolts.

Photo Eyes

1. Clean the lenses on all photo eyes and clean aisle markers. The photo eye locations are listed after step 2.

2. Check all fasteners to ensure photo eyes are mounted securely.

Note: If photo eyes are adjustable, refer to the Crane Manual for the adjustment procedure.

- ☐ Two Aisle Obstructor Eyes (Located on the west end of each crane).
- ☐ Overhang Photo Eye (four on North and four on South). To check operation, block the light path on the receiver and check to ensure that the red light on the receiver goes out.
- ☐ Full Bin Detector Lights (one on each side of the shuttle cavity).
- ☐ Shuttle Center Eye (under the shuttle, next to the 3-inch marker eye).
- ☐ Three-inch Marker Eye (located underneath the shuttle).
- ☐ Load On Board Light (located inside the shuttle cavity).
- ☐ Load Measure Eye (North and South end of the shuttle - about 2 inches in from edge).
- ☐ Bank of Eyes (X).
- ☐ Home Photo Eye (on the bridge) and bridge update marker.
- ☐ Aisle Update Markers.
- ☐ Three Photo Eyes (Y) – Upper and Lower Updates Markers and Targets.

Encoders

1. Check the Y-Encoder.

- ☐ Check for dirt and debris on the encoder. Wipe clean, as needed.
- ☐ Check the coupling between the encoder and wheel. Using a 7/64-inch Allen wrench, check to ensure coupling setscrews are hand-tight. Using a Phillips screwdriver, check the tightness of the cover setscrews.
- ☐ Ensure that the wheel turns freely, without binding. Using a pry bar, pull wheel away from the rail; then turn wheel to check for movement. Replace the assembly if wheel does not spin freely.

- ☐ Using a 1/8-inch Allen wrench, check to ensure setscrew on wheel is wrench-tight.
- ☐ Check the electrical quick disconnect to ensure that connection is hand-tight.

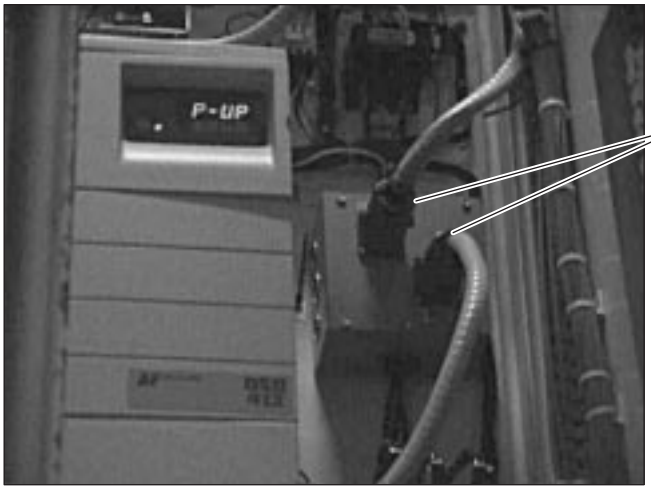
2. Check the X-Encoder.

- ☐ Check the coupling between the encoder and wheel. Using a 7/64-inch Allen wrench, check to ensure coupling setscrews are hand-tight.
- ☐ Ensure that the wheel turns freely, without binding. Using a pry bar, pull wheel away from the mast; then turn wheel to check for movement. Replace the assembly if wheel does not spin freely.
- ☐ Using a 1/8-inch Allen wrench, check to ensure setscrew on wheel is wrench-tight.
- ☐ Check the electrical quick disconnect to ensure that connection is hand-tight.

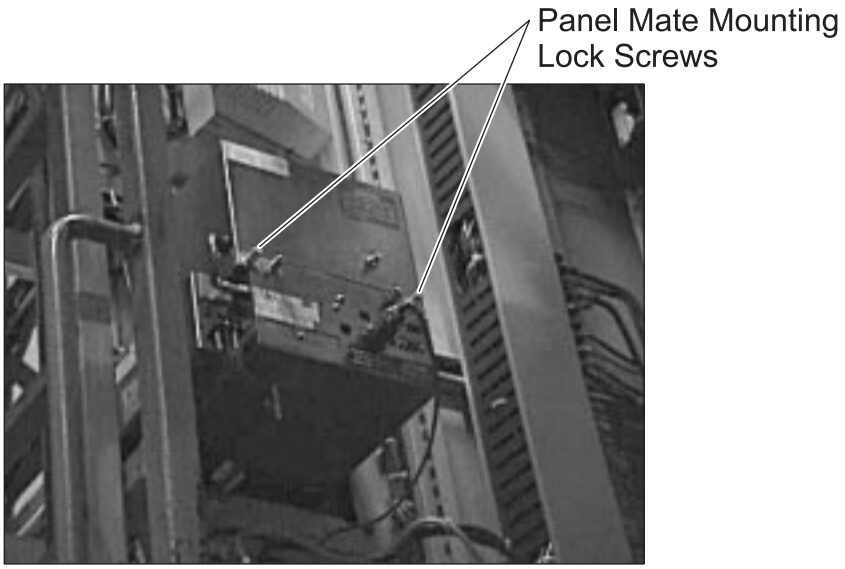
3. Using a 3mm Allen wrench, check the tightness of the Z-Encoder coupling setscrews.

Main Control Panel

1. Check the X and Y-drive quick disconnect couplings for tightness. There are two couplings for each drive. See the figure below.



2. **Check the mounting locking screws securing the Panel Mate to the cabinet door. See the figure below.**



3. **Check wiring and terminal blocks / connectors.**

- ☐ Check for burned or broken components. Replace as necessary.
- ☐ Ensure that all wiring connectors on terminal blocks are hand-tight.
- ☐ Check the plug-in relay.

Toshiba Drives for the Shuttle Operation

1. **Check the terminals inside the drive for tightness.**

2. **Check the Amphonel connectors on the bottom side of the drives.**

3. **Check the mounting bracket and all terminals in the junction box behind the drives.**

Limit Switches

1. Check the speed sensors on the overload limit switch.

2. Check the mechanical brake on the elevator limit switch.

3. Check the mounting bracket and all terminals in the junction box behind the drives.

4. Check the upper and lower limit switches mounted on the SE side of the elevator.

5. Check the Gemco switches. Manually move the shuttle and listen for clicks as the shuttle moves.

6. Check the end travel limit switch on the shuttles.

7. Check for slack chain on the Gemco switch.