

Q-01b

ELECTRICIAN TRAINING

SKILL DEVELOPMENT GUIDE

Duty Q: Cranes and Hoists

Q-01b: PM/Troubleshoot/Repair Crane (15 Ton)

Issued 01/01/99



Task Preview

PM/Troubleshoot/Repair Crane

A Preventive Maintenance (PM) inspection is performed monthly. Perform this task to ensure that the crane is operating at its maximum performance and to ensure that the all mechanical components are in good working condition.

The Electrician must possess a good working knowledge of the crane system and its components and all types of wear associated with the electrical systems. Above all, the Electrician must possess the knowledge of the safety requirements associated with crane.

If the components are not maintained properly on a regularly scheduled basis, the crane may not be able to hold its rated capacity. If the crane slips or a load drops, personnel and/or equipment in the area could sustain severe injury or damage.

Perform a lock and tag on the electrical disconnect after all power checks are completed. Check the festoon of power cables. Inspect the collectors. Check the condition of the resistors. The electrical components in the control panel(s) are checked for burnt, loose, or damaged connections. Check the condition of the brakes. PM work performed is documented on the PM Work Order form.

How your skills will be checked

The Skill Check will require you troubleshoot, repair and perform preventive maintenance on a crane. 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 Crane Preventive Maintenance Checklist, perform a preventive maintenance, troubleshoot, and repair a crane.

Task Standards

1. The main hoist, trolley, and bridge brakes must show no visible signs of wear.
2. The minimum thickness of the main hoist, trolley, and bridge brakes must not be less than 3/16-inch.
3. The air gap must be approximately the thickness of a nickel.
4. The oil level in the dashpot overload relay must be within 1/8-inch from the top of the oil basin, just below the threads.
5. The up/down limit switches must operate as specified.
6. The collector mechanical components must be in good condition, and the shoes must display no visible signs of wear.
7. The Main Control Panel connections must be snug; wiring and terminals must show no signs of damage.
8. All required safe practices must be demonstrated.

What You Will Need

This section contains the safety information, tools, and resources you will need before performing a preventive maintenance, troubleshooting, and repairing a crane.

SAFETY FIRST

**DON'T TAKE
CHANCES**

- Follow all Caterpillar facility safety standards when performing this task.
- The electrical power to the crane must be locked and tagged after the power on checks have been completed during the PM check. An electrical hazard exists inside the electrical cabinet and at the power connection.
- A tripping hazard exists when moving around the catwalk. Pay attention while moving around and inspecting the various components and when getting in and out of the cab.
- A heat hazard exist during the summer months when working within 10-20 feet of the ceiling. Be sure to drink plenty of water before spending an extended amount of time in the area.



- flashlight
- Electrician's hand tools
- lock and tag
- replacements parts
- feeler gauge (nickel)



- Crane Preventive Maintenance Checklist



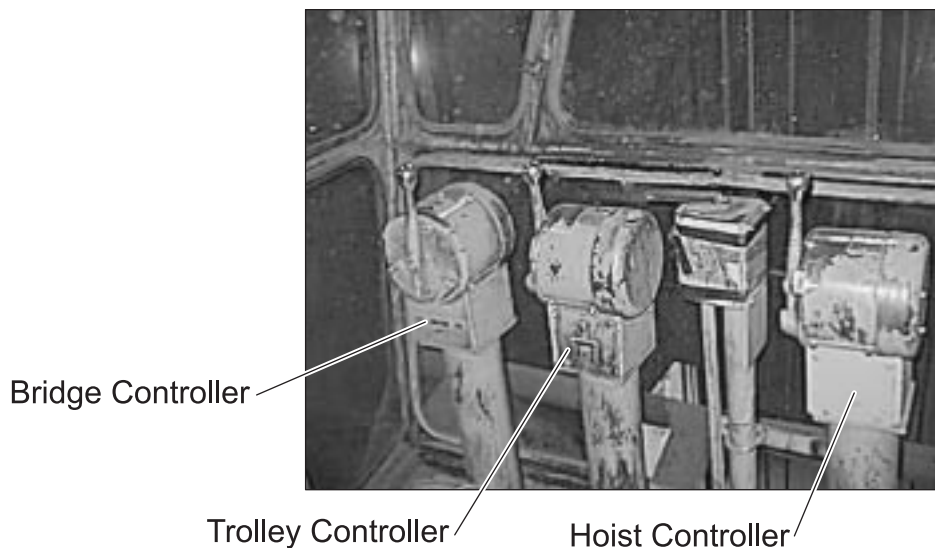
Task Steps

PM/Troubleshoot/Repair Crane (15 Ton)

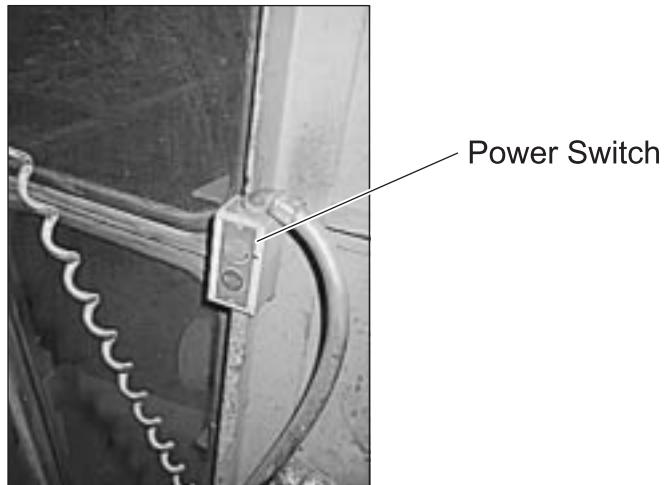
Note: This analysis was performed on the 15-ton scrap yard crane. The 50 and 60 ton cranes have some differences and will be discussed. Use the “Crane Preventive Maintenance Checklist” for all three types of cranes.

Crane Operations

1. **With electrical power off, check each controller for ease of movement and when releasing the handle it springs to the neutral position.**
 - Locate the controls for the 15-ton crane. See the figure below.
 1. The hoist controller handle is located to the far right.
 2. The trolley controller is in the middle.
 3. The bridge controller is located to the left and mounted sideways.



- Locate the power switch just inside the door and to the right. See the figure below.



- Locate the controls for the 50 and 60 ton cranes.
 1. The main hoist controller handle is located to the far left.
 2. The trolley controller is the second from the right.
 3. The auxiliary hoist controller is next to the main hoist controller.
 4. The bridge controller is located to the left and mounted sideways.
- 2. **Push the green button on the power switch to apply electrical power to the crane, and ensure that the crane moves in all directions smoothly, not in a jerking motion.**

3. Check the upper limit switch for proper operation.

- Pull back on the main hoist controller (handle) to raise the main hoist. The crane hook should stop automatically before contacting the deadman weight. See the figure below.



4. Check the main hoist brakes.

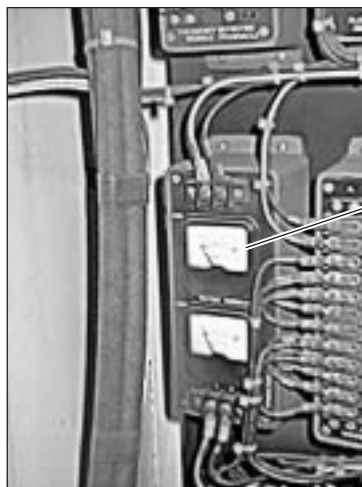
- Push forward on the main hoist controller, lowering the main hoist at maximum speed.
- Release the handle, allowing the brake handle to spring to the neutral position. The brakes cause the hoist to come to a dead stop, with no coasting.

5. Check the magnetorque for the main hoist.

Note: The magnetorque is an electrical brake that uses magnetic force to aid in braking on the hoist.

- Ask an assistant to operate the hoist controls.
- Monitor the magnetorque ammeter.
 1. Monitor the magnetorque ammeter with power on the crane and the hoist at rest. The ammeter should read approximately 10 amps. Record the actual reading on the Crane Preventive Maintenance Checklist.

2. Monitor the magnetorque ammeter when the hoist is raised or lowered. The ammeter should read zero amps. Record the actual reading on the Crane Preventive Maintenance Checklist.
3. Monitor the magnetorque ammeter when the hoist comes to a stop. The ammeter should briefly go to approximately 24 amps, then settle to 10 amps. Record the actual reading on the Crane Preventive Maintenance Checklist.



Magnetorque® Ammeter

6. Check the magnetorque for the auxiliary hoist (50 and 60 ton cranes).

Note: The magnetorque is an electrical brake which uses magnetic force to aid in braking on the hoist.

- Ask an assistant to operate the hoist controls.
- Monitor the magnetorque ammeter.
 1. Monitor the magnetorque ammeter with power on the crane and the hoist at rest. The ammeter should read approximately 10 amps. Record the actual reading on the Crane Preventive Maintenance Checklist.
 2. Monitor the magnetorque ammeter when the hoist is raised or lowered. The ammeter should read zero amps. Record the actual reading on the Crane Preventive Maintenance Checklist.

3. Monitor the magnetorque ammeter when the hoist comes to a stop. The ammeter should briefly go to approximately 24 amps, then settle to 10 amps. Record the actual reading on the Crane Preventive Maintenance Checklist.
7. **Ensure the festoon power cables are collapsed to facilitate the visual inspection.**

Power Cable and Disconnect

1. **Pull the handle down to remove power to the main disconnect, and lock and tag the handle in place. See the figure below.**

Main Power Disconnect



- 2. Pull the handle down to remove power to the magnet disconnect. See the figure below.**



Magnet Disconnect

Note: Just removing the power at the main disconnect does not remove power from the magnet disconnect. The magnet disconnect is wired on the line side of the main disconnect and prevents the load from being dropped if the crane loses power.

- 3. Visually inspect the festoon power cable trolley truck for wear or damage.**

- Inspect the festoon cables for signs of wear or damage. See the figure below.



Festoon Power Cable

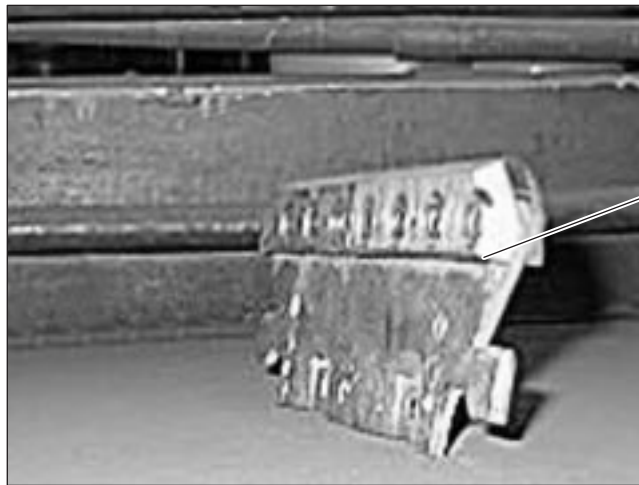
- Inspect the festoon cable trolley for signs of wear or damage.

Power Bars

Note: Disconnect, lock and tag the electrical power to the power bars before servicing the power bars or collectors for each type of crane. The disconnects are located at the following locations:

1. The 15-ton crane's disconnect is located at the monorail mezzanine near the middle of the scrap yard.
 2. The 50-ton crane's disconnect is located south of holding furnace #4.
 3. The 60-ton crane's disconnect is located west of arc furnace #2.
1. **Remove one shoe from the power bar and examine it for wear. See the figure below.**

Note: If one shoe is badly worn, all of them are probably worn.

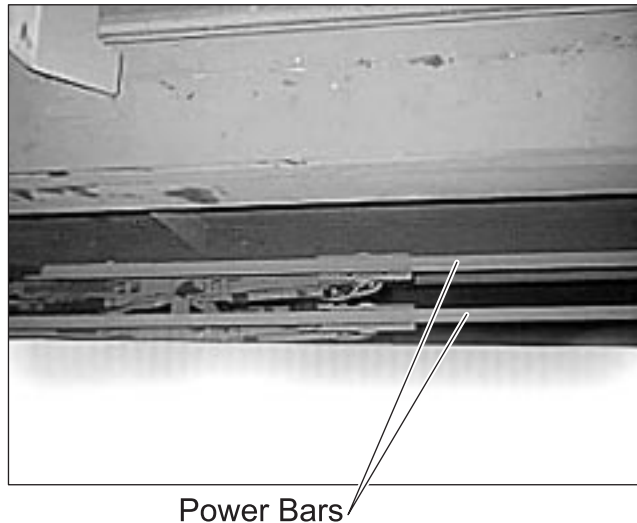


Conductor Shoe

- Change the shoes if time permits. If time does not permit, record the observations on the Crane Preventive Maintenance Checklist.

2. Examine the collectors on the power bars.

- Check to ensure that the collectors push the conductor shoes firmly into the power bar. See the figure below.



- Ensure that the springs and linkage are not broken.

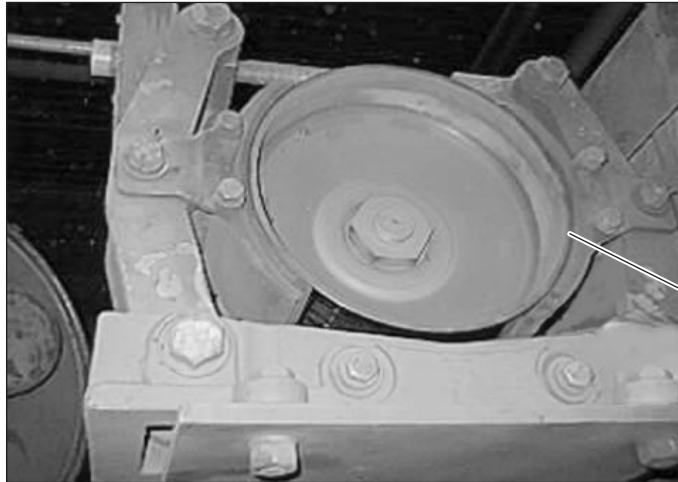
Main Hoist

1. Visually inspect the brake shoes on the main hoist for wear.

Note: The 50 and 60-ton cranes have two 13” brakes; the 15-ton crane has one 16” brake.

- Examine the visible portion of the brake pad.
- Check to ensure that the thickness of the brake pads is within specification.

Note: The brake pads should be a minimum of 3/16-inch thick. If the pads are worn and time permits, change the worn brake pads. If time does not permit, write it down on the Crane Preventive Maintenance Checklist so the work can be scheduled. See the figure below.

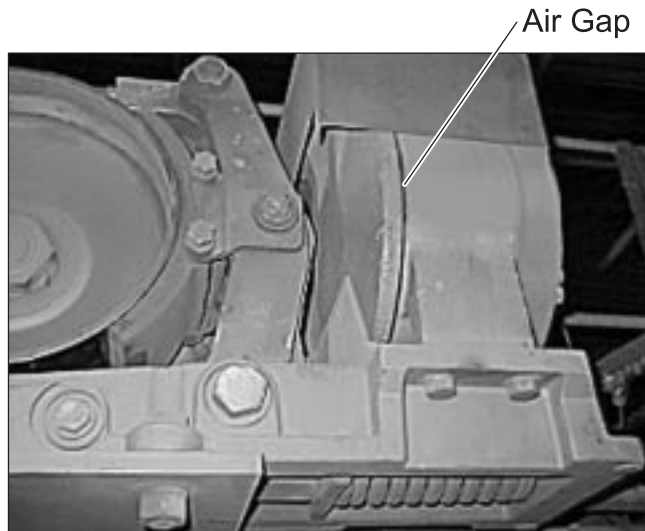


Brake Pad

2. Use compressed air to blow out the air gap on the main hoist brake.

- Ensure that the air gap is adjusted to the proper setting, approximately the thickness of a nickel.
- Use the threaded rod that traverses the top of the brake.

- Make sure that the armature bolt is loose when the adjusting task is complete. (The armature bolt is located on the backside of the coil, above the spring tension bolt). See the figure below.

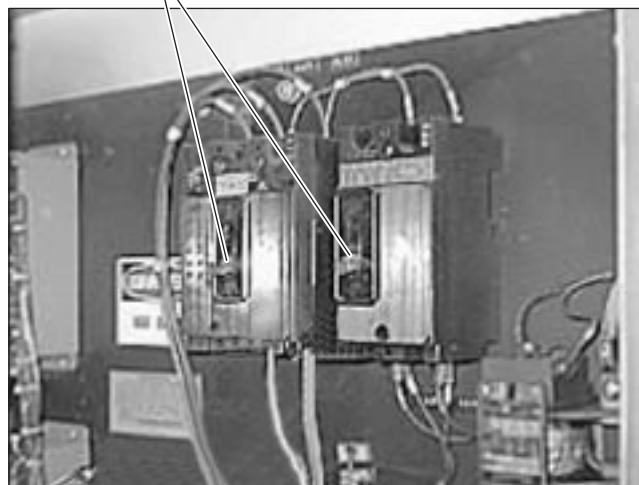


Note: It is better not to adjust the brake than to adjust it improperly. Instructions for the brake adjustment can be found in the file cabinet across from the bathroom in the Plant Engineering office. Files are organized by the machine number.

3. Examine the contacts on the reversing contractor.

- Shut off both circuit breakers in the main hoist control panel. See the figure below.

Circuit Breakers



- Push up on the contactor. The contacts should not be excessively pitted and should make good contact when closed. See the figure below.



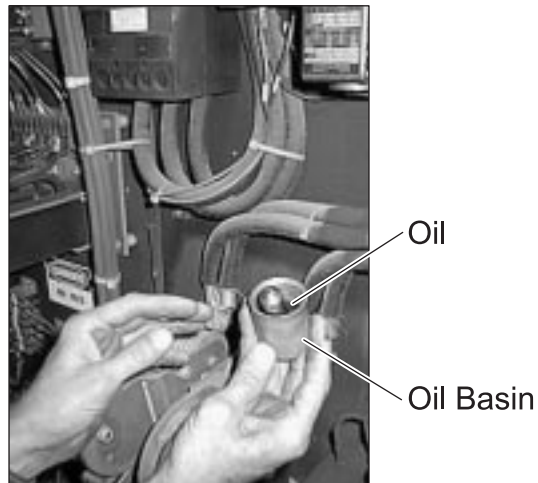
- Manually push the contactors closed one at a time.
- Ensure that the contactor mechanism moves freely and all contacts close simultaneously.
- Release the contactor. It should spring open.
- Turn on both circuit breakers.
- Close the main hoist panel when completed.

4. Check the oil levels in the dashpot overload relays.

- Open the main hoist control panel on the bridge of the crane.
- Locate the oil basin, a cylindrical cup on the bottom of each relay.
- Use channel pliers to remove these basins.

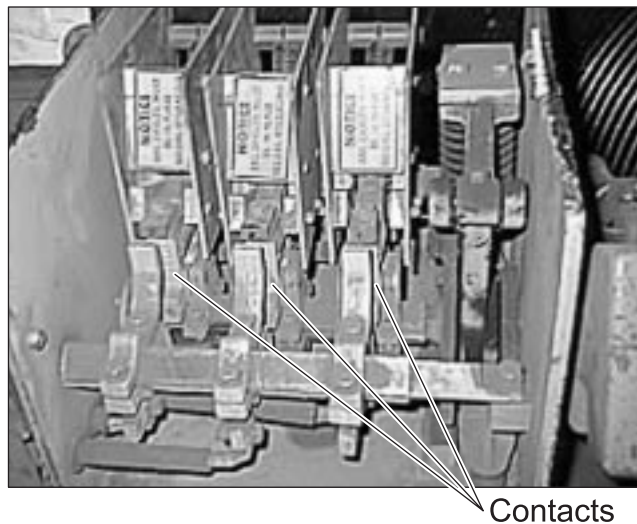
Caution: Don't squeeze the cylindrical cup too hard. If low, the dashpot oil is in the crib under the keyword, oil.

Note: The oil should be light in color and the level should be within 1/8-inch of the top (just below the threads) of the oil basin. See the figure below.



5. Remove the cover off the deadman limit switch.

- Inspect the condition of the arc chutes.
- Ensure that the contacts are not excessively pitted and make contact when closed. See the figure below.



- Pull the arc chutes back for a closer inspection, if the arc chutes obscure the view of the contacts.

6. **Ensure that the contacts on the deadman switch snap open when pushing down on the side of the deadman switch.**
7. **Inspect the wire rope that holds the weight for the deadman switch.**
 - Ensure that the wire rope is not frayed or damage. See the figure below.



Note: If the wire rope is frayed or damaged, write a ticket to have it replaced.

- Pull up the cable slowly to test the deadman switch.
- Ensure that the deadman switch opens when lifting the weight.
- Repeat this test three times. Observe that the deadman switch opened every time.

Auxiliary Hoist (Not Applicable On 15-Ton Scrapyard Cranes)

1. **Inspect the brake pads. The minimum thickness of the brake pads is 3/16-inch.**
2. **Blow out the air gap on the brake and adjust the air gap.**
3. **Ensure that the oil is at the proper level in the dashpot overload relays in the auxiliary hoist control panel.**
4. **Check the auxiliary hoist contactors for proper operation.**
5. **Check the deadman arc chutes and contacts.**

6. **Ensure that the deadman switch operates properly.**
7. **Check weight on the deadman switch.**

Trolley (North/South Motion)

Note: On the 15-ton scrapyard cranes, this brake is hydraulic and has no air gap. Proceed to steps 3 and 4 for the 15-ton crane.

1. **Inspect the brake pads. The minimum acceptable thickness of the brake pads is 3/16-inch.**
2. **Blow out the air gap on the brake and adjust the air gap.**
3. **Ensure that the oil is at the proper level in the dashpot overload relays in the trolley control panel.**
4. **Check the trolley contactors for proper operation.**

Bridge (East/West Motion)

Note: On 50 and 60-ton cranes, the brakes are hydraulic and do not have an air gap. Proceed to steps 3 and 4 for the 50 and 60-ton crane.

1. **Inspect the brake pads. The minimum thickness of the brake pads is 3/16-inch.**
2. **Blow out the air gap on the brake and adjust the air gap.**
3. **Ensure that the oil is at the proper level in the dashpot overload relays in the bridge control panel.**
4. **Check the trolley contactors for proper operation.**

General Checks

1. Use compressed air to blow the dirt off the resistor and saturable reactors. They are located above and to the side of the electrical panel. See the figure below.



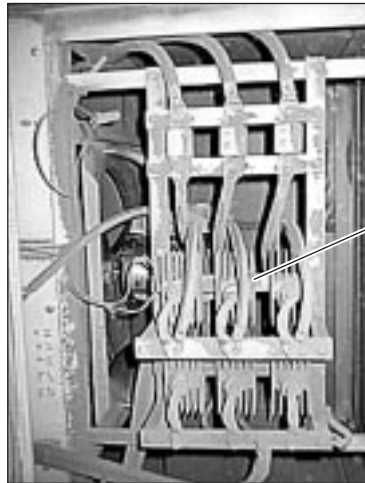
Resistor and Saturable Reactors

- Ensure that all connections on the saturable reactor are securely fastened.

Note: Looseness is a common problem with these connections.

- Inspect the resistors for burned segments.

2. Use compressed air to blow the dirt out of the Syntron DC power supply, only on the 15-ton crane.



Syntron[®]
DC Power Supply

Warning: Make sure that the magnet disconnect is off while performing this procedure.

- Inspect the condition of the contacts on the three contactors in the magnet control panel.



Concept Check

PM/Troubleshoot/Repair Crane

Answer the following questions to check your understanding of performing a preventive maintenance, troubleshooting, and repairing a crane. 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. The oil level in the dashpot overload relay must be:
 - a. half full of the oil basin.
 - b. at the top of the oil basin.
 - c. within 1/8-inch from the top of the oil basin.
 - d. within 3/16-inch from the top of the oil basin.
2. Use a nickel to measure the:
 - a. brake pads.
 - b. the air gap.
 - c. magnetorque contacts.
 - d. reversing contactor contacts.
3. The minimum thickness of the brakes must be:
 - a. 3/16-inch.
 - b. 7/32-inch.
 - c. 1/4-inch.
 - d. 9/32-inch.

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

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 crane for performing a PM. During the practice you will:

- Perform an operational check on the bridge, trolley, and hoist controls.
- Check the main hoist.
- Check the auxiliary hoist (50 and 60-ton cranes) if applicable.
- Check the trolley (north/south motion).
- Check the bridge (east/west motion).
- Check the power bars.

Your Trainer will observe you as you inspect the hook, the main and auxiliary hoist, trolley, and bridge to ensure that this task is performed properly. You are required to follow all the recommended safe practices.

Practice Objective

The major components will be inspected for serviceably, signs of wear, cracks, or breakage. The main hoist, trolley, and bridge brakes must show no visible signs of wear. The minimum thickness of the main hoist, trolley, and bridge brakes must be 3/16-inch. The air gap must be approximately the thickness of a nickel. The oil level in the dashpot overload relay must be within 1/8-inch from the top of the oil basin, just below the threads. The up and down limit switches must operate as specified. The collector mechanical components must be in good condition, and the shoes must display no visible signs of wear. The Main Control Panel connections must be snug, and wiring and terminals must show no signs of damage. 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.