R-04

ELECTRICIAN TRAINING

SKILL DEVELOPMENT GUIDE

Duty R: Magnetic Controls (120V and below)
R-04: Troubleshoot Machine Grounds

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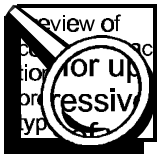


Task Preview

Troubleshoot Machine Grounds

This task is performed before locking out the machine. The machine may be down, or may need to be shut down and turned back on at intervals during the troubleshooting task. An operator may indicate a machine is grounded by a problem such as a fuse or fuses are blown or a circuit breaker tripped. Also, a switch or other peripheral may be grounded because a metal chip crosses a switch or cuts through a conductor. Finally, there is always potential ground problems when there is water in the machine cabinet or peripheral.

When notified of a machine problem, an electrician will isolate the ground with a digital volt-ohmmeter (DVM) or megger. After isolating the ground, the machine is locked out and tagged, and the ground is cleared. When the ground has been cleared, the machine is tested to verify normal operation.

How your skills will be checked

The Skill Check will require you to troubleshoot machine grounds. 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 whenever you are ready for the Skill Check.

Skill Objective

Given a machine that an operator indicates has a blown fuse(s) or a tripped circuit breaker, a grounded switch or other peripheral, or water is in the cabinet or peripheral, troubleshoot the machine grounds.

Task Standards

1. The machine ground is identified.
2. The machine ground is cleared.
3. When tested, the machine operates normally according to the machine operator.

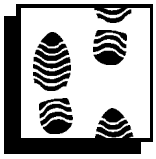
What You Will Need

This section contains the safety information, tools, and resources you will need before troubleshooting machine grounds.

- ☐ You will be working with potentially hazardous electricity. Caution must be exercised. Machines or parts of machines may still be moving.
- ☐ Knowledge of the machine you are working on is pertinent to your safety and the safety of those in the area.
- ☐ Follow all Caterpillar safety standards.

- ☐ digital volt-ohmmeter (DVM)
- ☐ megger (for motor windings)
- ☐ standard electrical handtools

- ☐ Lockout / Tagout for repair after locating problem
- ☐ blueprint of machine



Task Steps

Troubleshoot Machine Grounds

Isolate the Machine Ground:

1. Identify the machine component that is affected by the ground.

   - ☐ Identify all blown fuses, tripped circuit breakers, or malfunctioning input/output devices. Check with the DVM. If the machine is on, check for voltage; if the machine is off, check for continuity.
   - ☐ Consult the machine electrical print, if necessary, to familiarize yourself with the associated components or circuits that may be affected.

Note: Determine if you can troubleshoot the ground with the machine in ZMS. Having the power on may aid you in isolating the ground. Use your best judgment to determine your needs.

2. Starting at the fuse, breaker, or relay wire, isolate the ground.

   - ☐ Inspect the machine conditions, looking for water, damaged conduit, smoke, or any other possible condition that could cause a ground.
   - ☐ Isolate the ground by testing the conductor from the fuse or breaker wire to the nearest terminal point of the affected circuit with the DVM.
   - ☐ Work your way between each terminal point and separate the wires to determine which part of the circuit is grounded. Use a DVM or megger (if a motor is in this circuit) to measure voltage or resistance between each terminal point.
   - ☐ Segregate the affected wire by disconnecting the entire cluster and reconnecting each wire individually until the affected wire is identified.
   - ☐ Note the position of the wires, they should be marked.

Note: Inspect the conductor conditions as you test between terminal points.

- ☐ Look for corrosion built up on a conductor, check for a bad connection at all terminal points, or look for water around a conductor at all locations.

3. Diagnose the cause of the ground.

   - ☐ Once you have identified the location of the ground, you must identify why the ground is occurring.
   - ☐ Diagnosing the cause of the ground usually involves physically checking the wire or component the ground is connected with for damage.

Clear the Ground:

4. Perform a lockout / tagout.

   - ☐ Notify the operator and any personnel in the area that the machine will be locked out.
   - ☐ If the lockout / tagout is already performed, verify to ensure that there is no power before clearing the ground.
   - ☐ Follow all machine lockout / tagout procedures.

5. Perform the required maintenance to clear the machine ground.

   - ☐ If a conductor has been damaged inside of conduit, check for an existing unused conductor already in the conduit and use that. If not, tie on a new line to the old and pull the new line through the conduit.
   - ☐ If the problem is a faulty motor, pilot device, or other peripheral, follow the procedures or notify the appropriate personnel to replace the device.
   - ☐ If root problem can be handled by preventive maintenance, submit a ticket.

Test the Machine:

6. Verify that the machine ground is clear.

   - ☐ Replace fuses or reset breakers and verify that all wiring is reconnected.
   - ☐ Release machine from lockout / tagout.
   - ☐ Cycle the machine and determine if it is operating normally.

7. Document the work history.

Concept Check

Troubleshoot Machine Grounds

Answer the following questions to check your understanding of troubleshooting machine grounds. 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. This task is usually performed before:

    a. determining the symptoms of the problem.

    b. lunch.

    c. locking out the machine.

    d. removing your lock and tag.

2. A switch or other peripheral may be grounded because:

    a. a metal chip crosses a switch.

    b. a metal chip cuts through a conductor.

    c. insufficient supply voltage is reaching the switch / peripheral.

    d. there is water in the machine cabinet.

3. After notification of a machine problem, an electrician will isolate the ground with a:

    a. machine cabinet

    b. DVM

    c. PLC

4. Isolate the ground by testing the _____ from the fuse or breaker wire to the nearest terminal point of the affected circuit.

    a. machine

    b. peripheral

    c. terminal strip

    d. conductor

Answers: (1. c 2. a, b 3. b 4. d)

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

Practice reading electrical prints and identifying the inputs and outputs for the machines in the area.

Practice Objective 1

You should be able to identify a fuse or circuit breaker for a given device on a machine print and locate it in the plant. Be prepared to discuss safe work practices while performing this activity.

Practice 2

Practice segregating a grounded wire from a cluster of wires.

Practice Objective 2

Using a DVM, you should be able to segregate a grounded wire from a cluster of wires.

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.