

Qualified Electrical Worker's Step-by-Step Guide:

Perform Electrical Circuit Tests on a Three-Phase AC Motor Using Your Digital Multimeter and "Megger"

Introduction

Have you or your technicians ever had to guess about the need to replace an electric motor?



If you are a Qualified Electrical Worker, we invite you to learn how to use your digital multimeter and "Megger" to perform electrical circuit tests on a three-phase AC motor using the following step-by-step guide to reduce your guesswork.

First, verify your Meter Ohms and Voltage functions are operational.

- Perform all the required LOTO procedures as per OSHA and NFPA70E putting the equipment into an Electrically Safe Work Condition. This includes any PPE.
- Set your multimeter (using it as a voltmeter) to AC Volts.
- Test phase to phase and phase to ground for voltage at the motor lead wires where they are terminated at the starting device. Reading should be 0 volts. If the reading is higher than 3-4 VAC, the Ohm and Megger readings may not be accurate.

When there is NO voltage present on the motor leads:

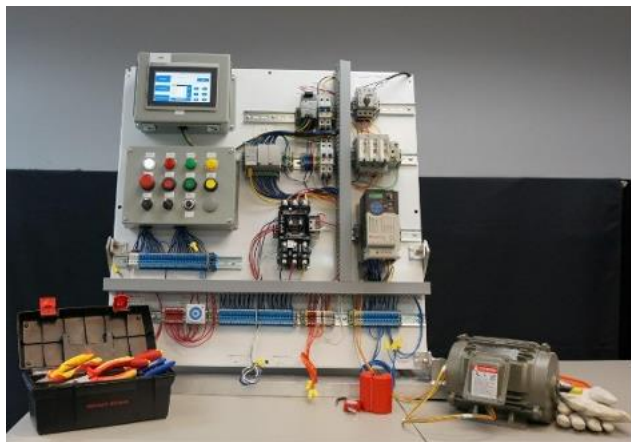
- Identify where the motor leads are connected at the starter and disconnect them from the starter
- Set your multimeter to Ohms and record the motor Ohms, phase to phase. This checks for opens (broken field wire in a conduit, bad motor winding, or an open connection at the motor junction box) or shorts (short circuits can occur at the connections in the motor junction box, within the motor winding, leads in the conduit, and sometimes in the overload relay). The acceptable Ω reading should be the same (balanced) from phase to phase. There isn't a specific number, so the range is from 0.5 to 50 Ohms depending on the size of the wire to the motor and distance to the motor itself.

NOTE: It is best to Megger test when the motor is at normal operating temperature.

- Put on your electrical PPE gloves.
- Verify the Megger is functioning properly by testing the output voltage.
- Set the Meter to Insulation Test, 250VDC for a 230VAC motor and 500 VDC for a 460V motor.
- Connect the Megger RED test lead to the Ground wire or Ground Bus going to the motor.
- Connect the Megger BLACK test lead to motor lead T1.
- Test for 10 seconds or until the reading is stable.

Repeat for all motor leads and record the data values. The acceptable reading is 100 Meg Ohms or higher. From my experience, when the insulation has weakened to this point it will not be much longer before it fails. If the readings are less than 100 Meg Ohms, do this same test at the motor junction box after disconnecting the motor leads from the feeder wires. Always test first from the motor starting device. After all, that is where the motor starting device monitors the current.

TIP: If practical, disconnect the motor from the equipment. This could include removing a belt, chain, coupling, or gearbox. If any readings are not acceptable, retest at the motor junction box.



If all of the above tests are OK, it is probably also OK to operate the motor.

To do so:

- Reconnect the motor leads to the starting device
- Put the equipment into a safe starting condition
- Notify other personnel you are going to start the motor
- Start the motor and record the Amps on each phase and the VAC phase to

phase. The voltage and amperage should be balanced.

If you have questions, we invite you to [contact us](#).