Berry Bros. General Contractors, Inc.
Standard Operating Procedures for Checking for Voltage and the Absence of Voltage.

Electrical Testing of Voltage:

1. Turn the dial to ṽ. Some digital multimeters (DMMs) also include m ṽ . If voltage in the circuit is unknown, set the range to the highest voltage setting and set the dial on ṽ.

Note: Most multimeters power up in Autorange mode. This automatically selects a measurement range based on voltage present.

2. First insert the black lead into the COM jack.

3. Next insert the red lead into the VΩ jack. When finished, remove the leads in reverse order: red first, then black.

4. Connect the test leads to the circuit: black lead first, red second.

Note: ac voltage does not have polarity.

Caution: Do not let fingers touch the lead tips. Do not allow the tips to contact one another.

5. Read the measurement in the display. When finished, remove the red lead first, black second.

Electrical Testing for Absence of Voltage:

OSHA and the NFPA 70E Standard for Electrical Safety in the Workplace both direct workers to de-energize all live parts to which an employee may be exposed, unless live conditions are required for troubleshooting.

Before you take a single measurement, first determine:

- Will you be troubleshooting or testing for the absence of voltage?
- What tools will you use to verify the energized or de-energized state?
- What personal protective equipment (PPE) will be required?
    - What is the voltage of the circuit?
    - What is the Flash Protection Boundary?
    - How much incident energy is possible at your working distance?
- Is your lockout/tagout complete?
- Is your test tool functioning properly?

Tools to use

A) Low-voltage proximity or non-contact voltage testers

These little tools are good for a first test, but should always be followed up with a direct-contact meter. At Shermco Industries, we issue each of our technicians a proximity tester like the one shown in Figure 1 to keep in their top pocket or somewhere it can be easily seen, if it lights up in the presence of voltage.

Keep in mind that proximity tester readings can be thrown off if:

- the insulated test point touches grounded metal;
- the cable being tested is partially buried;
- the user is isolated from ground;
- it is used inside a metal enclosure.

Proximity testers also won't detect shielded cable. To better understand why proximity testers have these limitations, read the Fluke application note on the subject, "Understanding capacitive voltage sensors." The key word is "proximity."

Proximity varies not just by distance, but also by the strength of the voltage field. And "distance" has to account for everything between the tester and the electrical source, including the air, insulation, breaker material, twist locks and so forth. The real issue is that proximity testers may indicate voltage, or they may not, depending on specific circumstances. For absence of voltage testing, a different, completely reliable test method is required.

B) Digital multimeter

Multimeters are the best standard tool for making accurate contact measurements to determine if a circuit is live. However: Turning the multimeter dial to the wrong function (amps instead of volts, for example) is one of the most common mistakes people make when using a multimeter. Older models that are not auto-ranging could be put into a range that is too high, making the voltage appear much smaller than it really is.

Any direct-contact meter can be dangerous if connected to a circuit higher than it is rated for. In my travels around the country, several facilities have had fatalities due to an electrical worker troubleshooting a 2.3- or 4.16-kilovolt motor starter control circuit. The CPT is often mounted on the side of the drawout unit and the terminals cannot be seen clearly. The technician is trying to test the 480-volt circuit and comes into contact with the medium-voltage circuit instead.

OSHA states that test equipment, and their accessories, shall be rated for the circuits they'll be connected to. The NFPA 70E contains similar statements.

Personal Protective Equipment

Wear the appropriate PPE for the environment until it is proven de-energized.

Lockout/Tagout

Electrical workers are required by OSHA to place equipment in an electrically safe work condition in 1910.333(b) and the NFPA 70E in Article 120, which involves Lockout, Tagout, test operating, testing at the point of contact, and grounding, if necessary. Grounding may or may not be practical on low-voltage systems, but should be done whenever possible.

Verifying the operation of the voltage tester

Before beginning the absence of voltage test, check the test instrument to ensure it is working properly.

- Wearing proper PPE, measure a voltage similar to the voltage of the equipment about to be tested. This would include whether it is AC or DC and approximately the same magnitude.
- Now test the circuit that is supposed to be de-energized.
- Once testing is complete, re-verify the meter is still functioning properly by going to the same known voltage source and making another measurement.

This is known as “live-dead-live” testing and is mandated by OSHA when voltages are above 600 volts. It is also required by the NFPA 70E in Article 110.9(A)(4), “Operation Verification. When test instruments are used for the testing for the absence of voltage on conductors or circuit parts operating at 50 volts or more, the operation of the test instrument shall be verified before and after an absence of voltage test is performed.”