

Toolbox Talks 2

018: Disconnecting Neutrals, Grounds, and Bonds

Discussion leader duties for this session:

Review the definitions of bonding, grounding, and neutral in Article 100 of the NEC.

Review your lockout/tagout procedures. If your company has a grounding program, review it.

What this Safety Talk covers:

Disconnecting neutrals, grounds, and bonds without creating a shock hazard.

Discussion notes:

Some neutral, ground, and bond facts to think about

- People often confuse neutrals, grounds, and bonds. Each serves a different purpose, and each is defined in NEC Article 100.
- A typical application for a neutral is to serve as the return path for 277V lighting. If the neutral is missing in such a circuit, the electricity will return via the other paths presented to it. This means a person can receive a fatal shock from touching a piece of EMT or other raceway. The fact that it is “grounded” does not mean it’s at zero volts.
- The only useful place for a ground (earth connection) is at the main grounding point, which is typically near the service entrance. Grounding (connecting to earth) does not eliminate differences in potential and does not protect you from shock.
- A typical misapplication for an equipment ground is driving a rod, and then making that your sole “grounding” connection. This serves no purpose, electrically.
- Bonding is the only way to eliminate differences in potential. Various NEC Articles use the term “grounding” where “bonding” was meant.

Cautions

- Don’t mix and match neutrals, grounds, and bonds. For example, if you disconnect a bonding jumper, don’t drive a ground rod as a substitute for that connection. Don’t connect or swap neutral and ground on the load side.
- Before disconnecting a bonding jumper, provide a replacement path around the point of disconnection. Keep metallic objects at the same potential, to prevent shock.

Assumptions

- “Anything that is grounded is safe to touch.” Grounding does not eliminate differences in potential, therefore it doesn’t make something safe to touch. *Bonding* eliminates differences in potential.
- “Disconnecting a neutral breaks the circuit.” Disconnecting a neutral removes the *intended* return path. The electricity will flow through other paths presented to it. You will still have a complete circuit and the lights will still operate, but the return circuit will be through objects such as the raceway, equipment frames, motor bearings, or even people.
- “Ground is the return path.” No, it’s not. The *neutral* is the intended return path.

Review and discussion

1. What is grounding, and how does it differ from bonding?
2. What method do you use to achieve equipotential between metallic

objects? Why can't grounding to this? [Note to presenter: The conductivity of wire, used in bonding, is far greater than that of dirt, used in grounding. Wire resistance is also uniform, while earth resistance is wildly variable. Ohm's Law tells us that the voltage will change when the resistance does. Voltage will also vary among metallic objects if grounding is the only connection between metallic objects].

3. Why doesn't grounding (earthing) make you safe?

4. If you disconnect the neutral on a 277V circuit, can the circuit still be complete? How might this happen?

5. Before you disconnect the neutral to a 277V lighting circuit, what should you do?

6. If no neutral is available, how should you wire a 277V lighting circuit? *[Note to presenter: You don't. These circuits require a neutral.]*

7. Your power tools are running on a GFCI receptacle. This obviously means the equipment ground is good and there is no danger of shock from the equipment you're working on, right? *[Note to presenter: No. A GFCI requires only two wires: a hot and a neutral. It will function without a ground. You can't use the GFCI as any kind of safety test instrument. A GFCI protects only against current flow between the neutral and hot of that circuit. It cannot detect a difference of potential between nearby metallic objects. A disconnected neutral or bond can result in such a difference.]*

8. You're doing a renovation project that involves installing a new service and several stepdown transformers and panels. There's work being done on the plumbing. What danger should this alert you to, and what should you do? *[Note to presenter: With plumbing work going on, it's possible the plumbers have removed the bonding jumper at the water service entrance. Ensure there's a bypass jumper that originates on the utility side of that connection. Don't rely on the piping system to act as the connection for you.]*

9. If your work involves a 277V lighting upgrade, does lockout/tagout affect the neutral? In what way?

10. While doing some installation work, you touch an existing run of EMT and feel a strong tingling that you immediately recognize as some kind of current flow. What is the likely cause, and what should you do to remedy this?

Participant's Signature and Date

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