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Clarkson

Facility Electrical Safety

WebEx Lecture
By Eric R. Stromberg

April 16th, 2020

Anybody can design a system that works. Our mission is to design a system that, when it fails, will fail in an orderly manner that will result in a minimum of injury or loss of life

There is no such thing as “safe,” or “working safely”

Grounding Conductors

- There is no such thing any more.
- Let's try calling them "Article 250 Conductors"

Conductors

- The phrase “Grounding conductor” was removed from the 2011 edition of the National Electrical Code
- This is because there are several different types of conductors, eight to be exact, that provide this function, and simply calling the conductor a “grounding conductor” did not point the user to the applicable Code reference. For this reason, all occurrences of the phrase “grounding conductor” in the Code have been replaced with one of the following:

Conductors (cont.)

- Article 250 conductors can be broken up into two groups.
- Connecting the electrical system to the soil. This is, or should be, called “grounding.”
- Creating an Effective Ground-Fault Current Path for the clearing of overcurrent protection during a ground-fault on the system. This is, or should be, called “Bonding.”

Conductors (cont.)

- 1 - Equipment Grounding Conductor -EGFCP
- 2 - Supply Side Bonding Jumper -EGFCP
- 3 - Equipment Bonding Jumper – Load Side -EGFCP
- 4 - Grounding Electrode Conductor -Grounding
- 5 - Main Bonding Jumper Grounding -EGFCP
- 6 - System Bonding Jumper Grounding -EGFCP
- 7 - Grounded Service Entrance Conductor -EGFCP
- 8 - Neutral on a Separately Derived System: EGFCP
- Neutral between transformer and first disconnect
- When System Bonding Jumper is at first disconnect

Objectionable Current

Neutral current that flows on the “grounding system.”
“grounding system,” in this case, means the effective
ground-fault current path.

Objectionable Current (cont.)

The effective ground-fault current path is made up of:

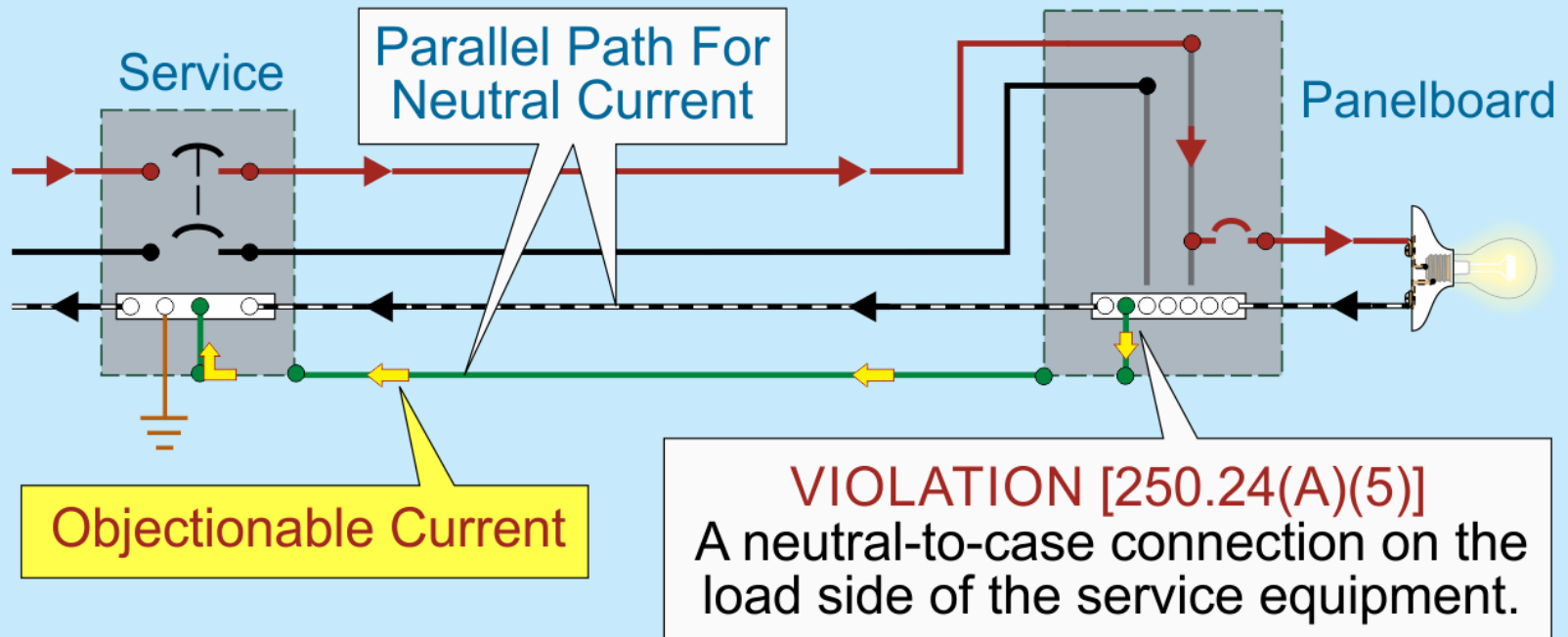
- Equipment Grounding Conductors
- Supply Side Bonding Jumpers
- Main Bonding Jumper
- System bonding Jumpers
- Equipment Bonding Jumpers
- Service Neutrals
- Separately Derived System Neutrals when the System Bonding Jumper is at the first disconnect
- Cabinets/Boxes/Enclosures

Objectionable Current (cont.)

Code Sections

- Art. 100 Effective Ground-Fault Current Path

Objectionable Current Improper Neutral Connection



Objectionable neutral current will flow on the equipment grounding conductor when the neutral conductor is connected to the metal case of a panelboard on the load side of service equipment.

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Objectionable Current Improper Neutral Connection 250.6(A)

Neutral Current

VIOLATION

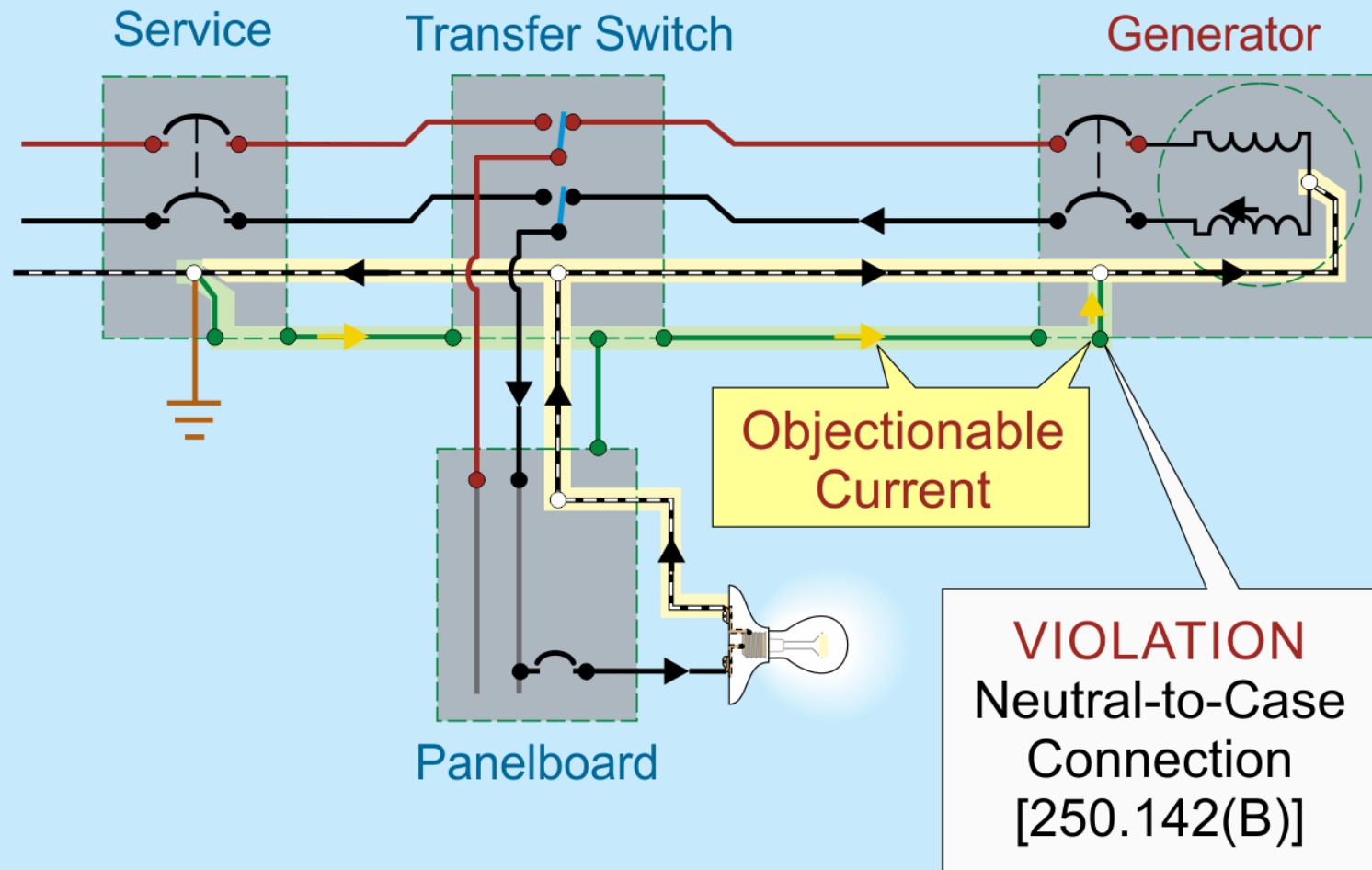
A neutral-to-case connection at both the transformer and the panel creates a parallel path for neutral current.

Objectionable Current →

Neutral Current

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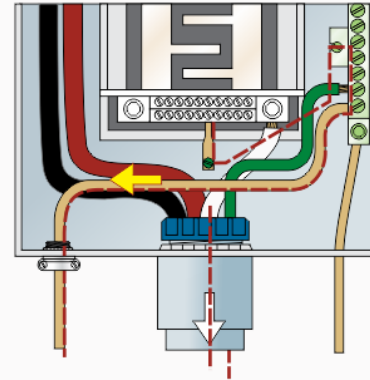
Objectionable Current, Improper Neutral Connection 250.6(A)



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Separate Buildings or Structures Objectionable Current

Parallel
Neutral
Current
Paths



VIOLATION

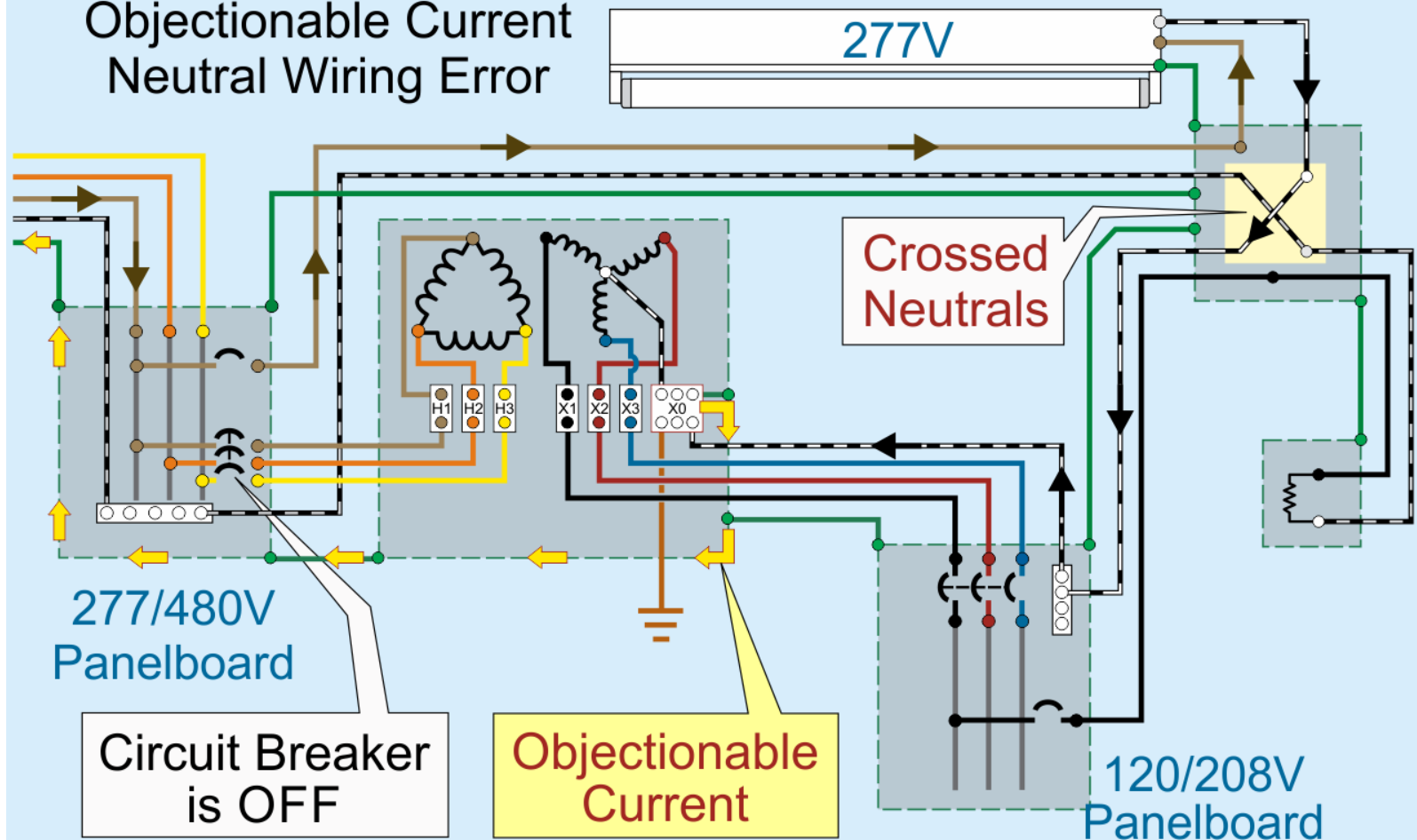
An improper neutral-to-case connection causes dangerous neutral current on metal parts.

Separate
Building

The equipment grounding conductor and metal water pipe carry neutral current.

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Objectionable Current Neutral Wiring Error



DANGER: The 120/208V panelboard (de-energized) can have dangerous voltage from the 277V lighting circuit because of the crossed neutrals.

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Objectionable Current Fire Hazard

**DANGER
FIRE HAZARD**

Objectionable Current

Neutral current flowing through loose fittings can cause the temperature to rise, igniting surrounding combustible materials.

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Objectionable Current, Equipment Failure

