

Why separate the ground and neutral wires at a sub-panel?

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A common myth about home electricity is that electrons leaving a grounded power supply are trying to get back to the ground and electricity only takes the path of least resistance.

The fact is that electricity wants to return to the source. In most homes this is the transformer on the service line, and it returns to the transformer via a neutral conductor in the home's main panel. Electricity will take any conductive path back to its source, primarily using the path with the least resistance.

Grounding electrodes in home system are utilized to divert excessive voltages on lines from static or lightning. Grounding conductors are utilized in the case of a ground fault, providing a path back to the transformer via a neutral conductor in the main panel, and then from the transformer to the overcurrent device (breaker), clearing the fault.

Now that we understand how the ground travels, it's time to discuss why grounds and neutrals should not be bonded in sub-panels.

If a ground fault occurs, it needs a low resistance path (preferably the ground wire) to the main panel which transfers current to the transformer and back to the main panel's breakers to clear the fault. With ground and neutral bonded, current can travel on both ground and neutral back to the main panel.

If the load becomes unbalanced, and ground and neutral are bonded, the current will flow through anything bonded to the sub-panel (enclosure, ground wire, piping, etc.) and back to the main panel. Obvious shock hazard! Remember, electricity will take any path back to the source.

Therefore, all neutral wires in sub-panels should be attached to bar that is isolated from the panel and other ground wires, and all ground wires should be attached to a bar directly attached to the panel to prevent that current from flowing through items that occupants have a potential to come in contact with.

