KINSLEY
The Energy Solutions Company

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## Ground Fault Interrupters

**Information Sheet # 08**

The designer of an electrical system must meet all code requirements and ensure that personnel are protected against electrical shock when using equipment connected to the system. The electrical circuit must also provide protection from personnel contact.

**This information sheet discusses devices used in an electrical circuit to protect personnel from electrical shock and how they work.**

The device that has been developed to protect personnel from receiving an electrical shock from an electrical system is called a ground-fault circuit interrupter, or GFCI.

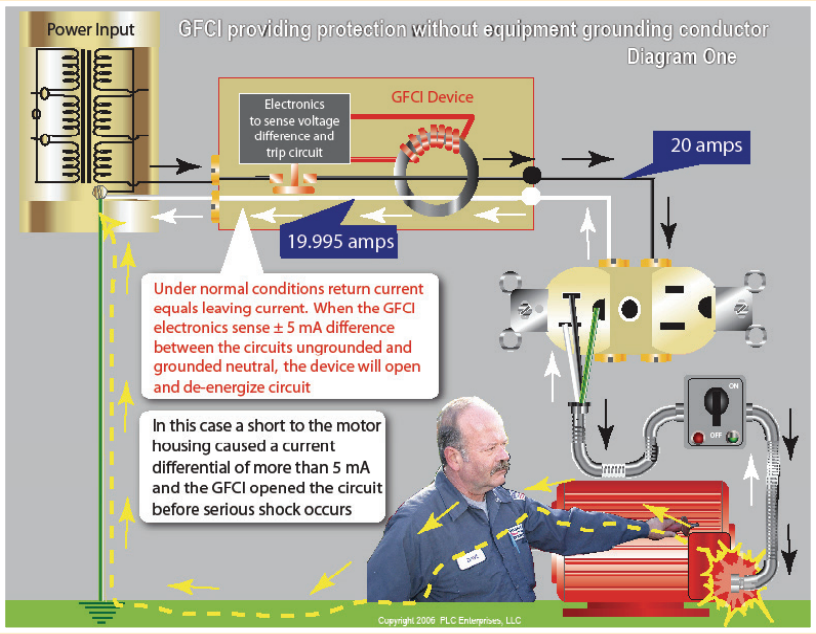
### The operation of a GFCI:

A GFCI is designed to be built into the electrical circuit to detect the difference between a system's grounded and ungrounded conductors. The grounded conductor will be the neutral. While known as ground-fault devices, GFCIs will still detect an imbalance in the circuit and operate without an item of electrical equipment having a grounding conductor. When a typical two-wire electrical circuit is functioning as designed the current flowing back to the power supply will be the same as the current leaving the power supply. The GFCI is designed to detect when there is a difference between the outflow and return currents. A current transformer within the GFCI registers the difference in amperes. When the imbalance exceeds ± 5 milliamperes, the device's solid state circuitry will initiate the opening of the GFCI switching contacts and de-energize the electrical circuit.

A system correctly protected with GFCI devices does not require the connected equipment to have grounding conductors. *(See Diagram One)*

### Notes on GFCI devices

- The GFCI was designed to protect personnel from electric shocks.
- GFCIs work by monitoring the imbalance between leaving and returning currents.
- GFCI electronics will operate with a differential in current as low as ± 5mA.
- A GFCI with an additional current transformer monitors faulty neutral-to-case contacts.
- GFCIs will not protect a person from a shock if the hot and grounded neutral conductors are touched at the same time. The electric shock can be lethal.
- The electronics in a GFCI could be ruined by a high voltage spike generated by lighting. In this case, personnel would not be protected.

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**The following are examples of faults that a GFCI device will or will not detect:**

### Neutral-to-case detection will be detected.

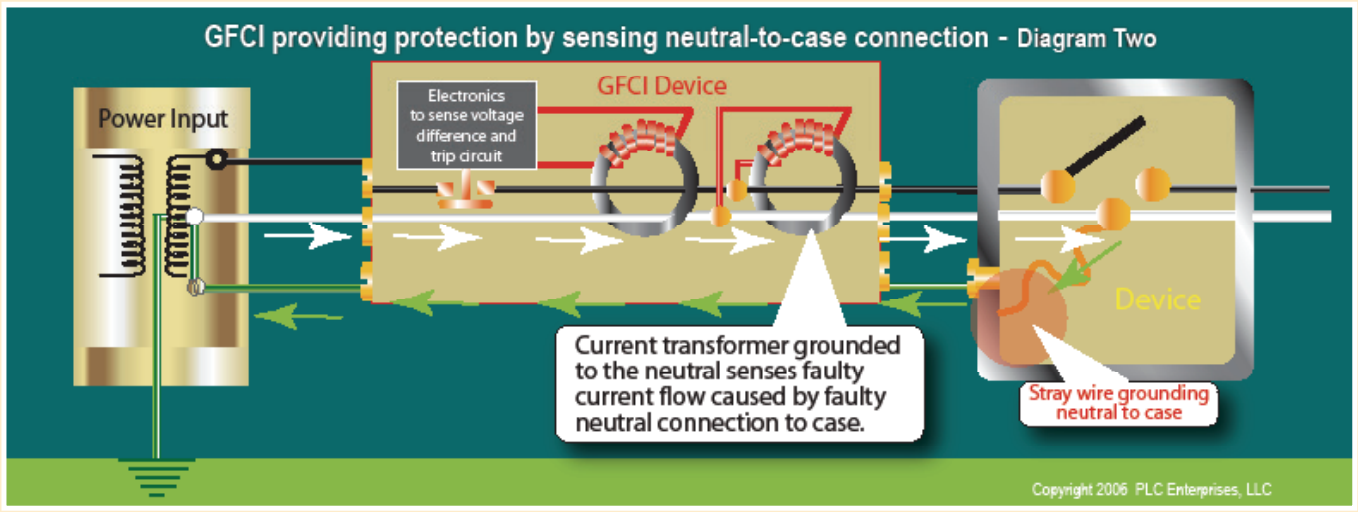
A GFCI device is used to detect instances when a neutral conductor is making a faulty connection to any conducting surface within the system. In this instance, another current transformer within the GFCI will induce a voltage on the circuit conductors. When the GFCI registers a difference between the leaving and returning currents, such as a neutral-to-case connection, the GFCI device will prevent the circuit from being energized by stopping itself from being turned on. Sometimes this can be misinterpreted as a faulty GFCI device because it will trip when no load is turned on. *(See Diagram Two)*

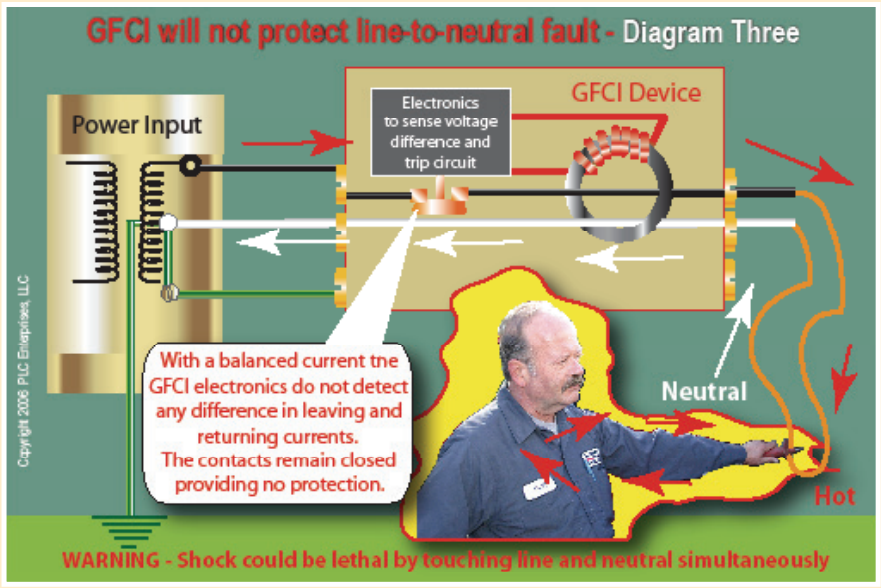
### Line-to-neutral risk of electric shock will not be detected.

If a person working within the vicinity of an electrical device has the misfortune to touch the ”hot” and “neutral” at the same time, he will receive a severe electrical shock that could be lethal. In this instance, even though the system is fitted with GFCI devices, users are not protected because the current transformer in the GFCI device will not register a difference between the outgoing and returning currents from the power source. *(See Diagram Three)*

### Summary:

GFCI devices operate by detecting the imbalances between the outgoing and returning current from a power source. When used in a system, a GFCI will protect personnel from improper grounding of electrical devices. It is important to check the GFCI. Pressing the test button will verify power will be disconnected if there is an imbalance in outgoing and returning currents.




## GFCI Test Button

- The test button should be checked regularly.
- Pushing the test button should turn off power to any connected load.
- Never assume the device is functioning unless it is tested.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