Electrical

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III. Electric Meters & Panels
IV. Branch Circuit Wiring
V. Lights, Outlets, Switches & Junction Boxes
    a. GFCI and AFCI

Photographic examples

Voltage= (V)

- Most homes are supplied with a nominal 120/240 V split-phase (single-phase three wire) service
- Most electric appliances are powered by 120 volts
- Some electric appliances such as Ovens, Cooktops, HVAC systems and Water Heaters are powered by 240 volts

Electrical Service Entrance
120/240 Volts

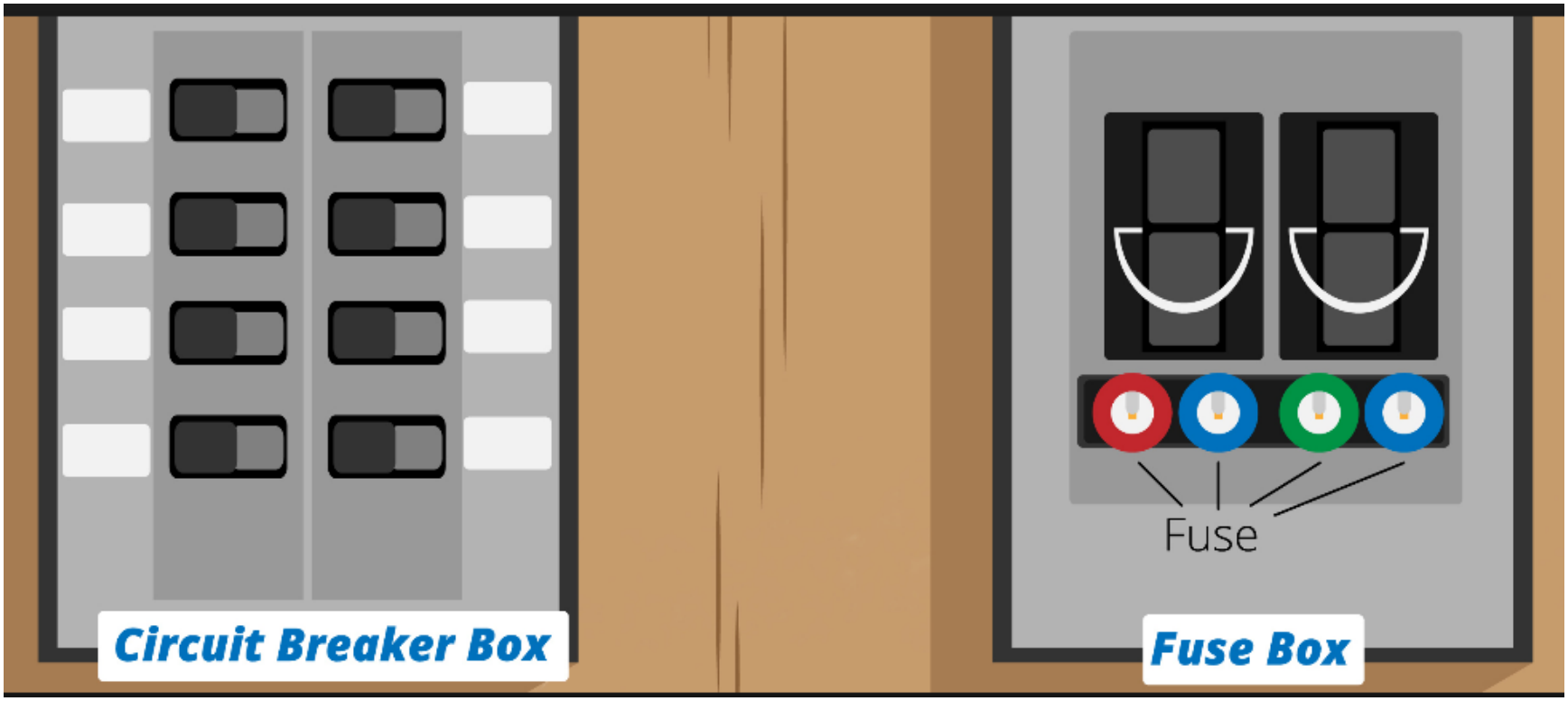
- **Overhead to Underground**
  - Service drop: Wire from the street telephone pole connecting to the dwelling unit by electrical cables that connect into the electric meter.
- **Underground**
  - less susceptible to the impacts of severe weather
  - lower maintenance costs
  - lower transmission losses

Service Drop & Meter

Types of Electrical Panels

Electric Panel Openings

Electrical Fuses / Breakers



Knob and Tube Wiring

Electrical Receptacles (Outlets)

In response to an OIG audit, HUD issued a Notice (PIH 2010-10) to clarify the proper operating condition of electrical outlets (110V/120V). There are two basic types of outlets:

- ***Two-pronged*** outlets (also called "two-slotted") are "ungrounded."
- ***Three-pronged*** outlets. Three-pronged outlets have an additional hole for a ground wire, and are "grounded outlets."

Two-Pronged Ungrounded Outlets

- Found in older construction (pre-1975) housing will usually have ungrounded two-pronged outlets.
- They are an acceptable type of outlet as long as the outlet is in proper operating condition.
- An owner does not need to upgrade the electrical system of the unit (convert two-pronged outlets to three-pronged).

Testing of Outlets to Determine Proper Operating Condition

Two Wire Tester

Two-pronged, Ungrounded Outlets

The traditional method of testing a two-pronged, ungrounded outlet is to plug an appliance into the outlet and verify that the appliance turns on. This simple method is acceptable for determining that the ungrounded outlet is in proper operating condition.

Converting Two-Prong to Three-Prong

Three-pronged, grounded type outlets **should not** be substituted for ungrounded outlets unless you are able to bond the grounding contacts of the receptacle to any one of the following locations:

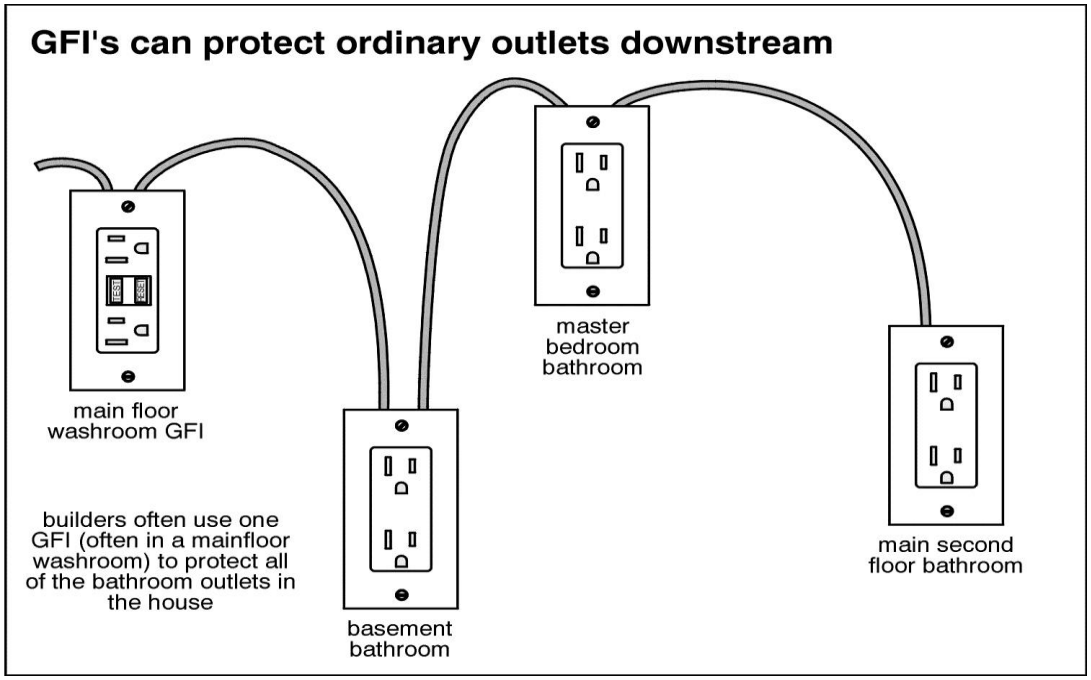
- Grounding electrode system
- Grounding electrode conductor;
- Panelboard equipment-grounding terminal; or
- Grounded service conductor

The addition of the ground wire may be a very expensive process. A more cost-effective method is to protect the outlet with a GFCI, which provides protection to the outlet.

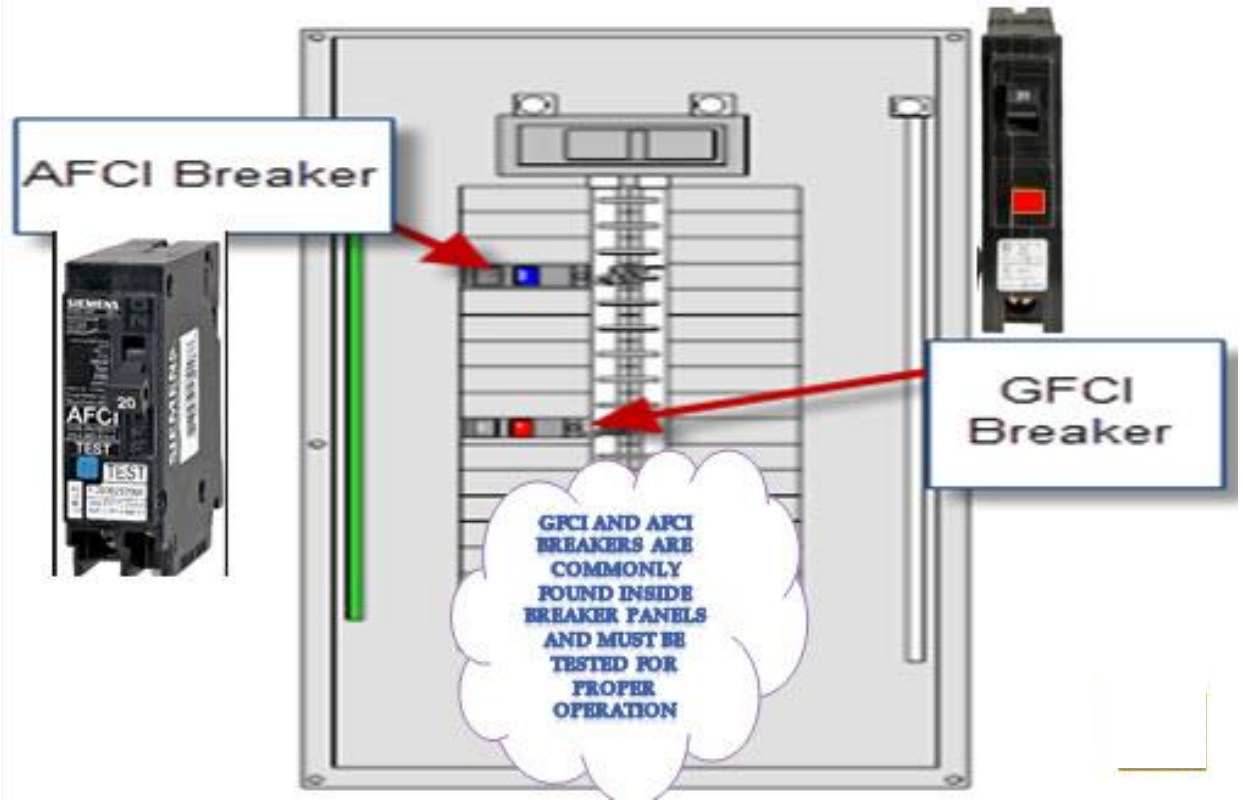
GFCI Outlets

- **A GFCI protection device operates on the principle of monitoring the current imbalance between the ungrounded (hot) and grounded (neutral) conductors It can react as quickly as one-thirtieth of a second.**

Circuit Protected by GFCI



Example of Circuit Protected by GFCI (continued)



Guidance for GFCI when using Tester

- "***Open Ground***" – Mark "Fail", ground wire is not connected to the circuit box ground or earth ground. Exception – if 2 prong outlets have been replaced with GFCI outlets and trip when tester button is pushed – mark "Pass".
- "***Open Neutral***" – Mark "Fail", same as open ground.
- "***Open Hot***" – Mark "Fail", typically, no lights will appear on the tester.
- "***Hot/Ground Reversed***" – Mark "Fail", is a rare find, could actually be open neutral.
- ***"Hot/Neutral Reversed***" – Mark "Fail", no power to outlet, but outlet is unsafe for use.

Testing of Outlets to Determine Proper Operating Condition)

Three-pronged Outlets

A three-pronged outlet must meet one of the following three standards for the inspector to consider the outlet in "proper operating condition".

1. The outlet is properly grounded.
2. A GFCI protects the three-pronged, ungrounded outlet.
3. The outlet complies with the applicable state or local building or inspection code.

Additional Guidance for Testing of the GFCI

If an open ground is identified through the GFCI tester then inspectors cannot depend solely on the GFCI tester. Instead, the inspector should press the “TEST” button on the GFCI outlet, and if the button trips the circuit and shuts off the power through the receptacle, the GFCI is in proper operating condition.

Items to look out for:

- Broken switches and outlets.
- Missing or broken switch or outlet covers.
- Missing junction box covers or exposed wire connections.
- Switches and outlets loose in box
- Switch or outlet boxes not secured in or on wall.
- Outlets or switches with evidence of scorching, sparking, or shocks.
- Broken or frayed wires and un-insulated wires.

Items to look out for:

- Visible loose or improper wiring.
- Light fixture hanging on wires.
- Non-metallic wiring on any surface where it can easily be cut, broken, or otherwise damaged.
- Lamp cord used as a permanent component of the wiring system.

Items to look out for:

- Wiring or cords run under rugs or flooring or through doorways.
- Overloaded outlets or circuits.
- Exposed fuse connections.
- Missing knockouts in service panel.

Overloaded Circuits

Electrical Hazards

- Any exposed copper wiring that presents an electrocution or fire hazard (Not the ground wire)
- Missing protective cover
- Leaking / standing water on or near electrical equipment

Missing/Broken Cover Plate Exposing Electrical Contacts

Missing or Broken Switch or Outlet Exposing Electrical Contacts

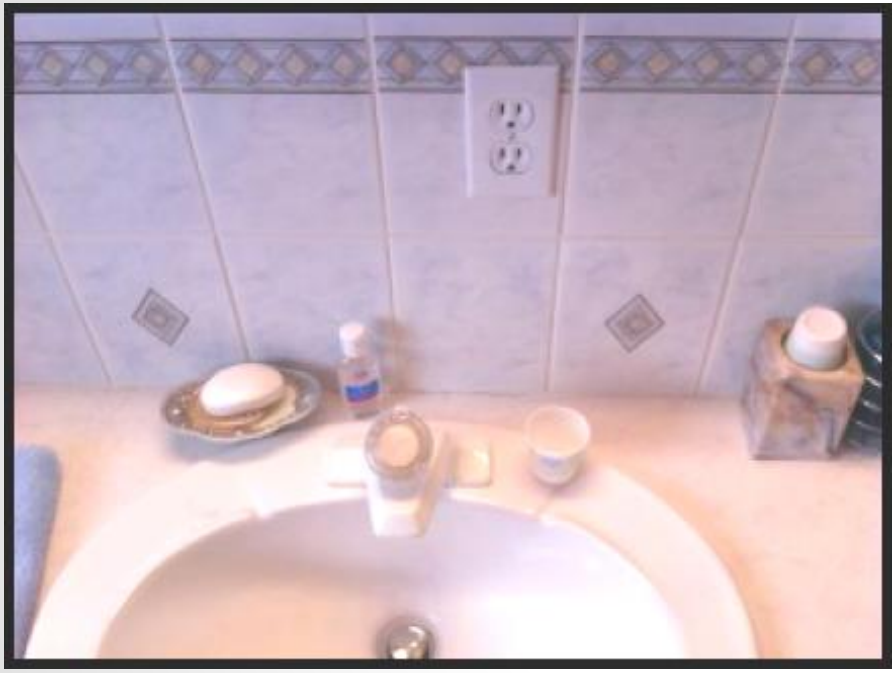
Light Fixtures Hanging from Wiring

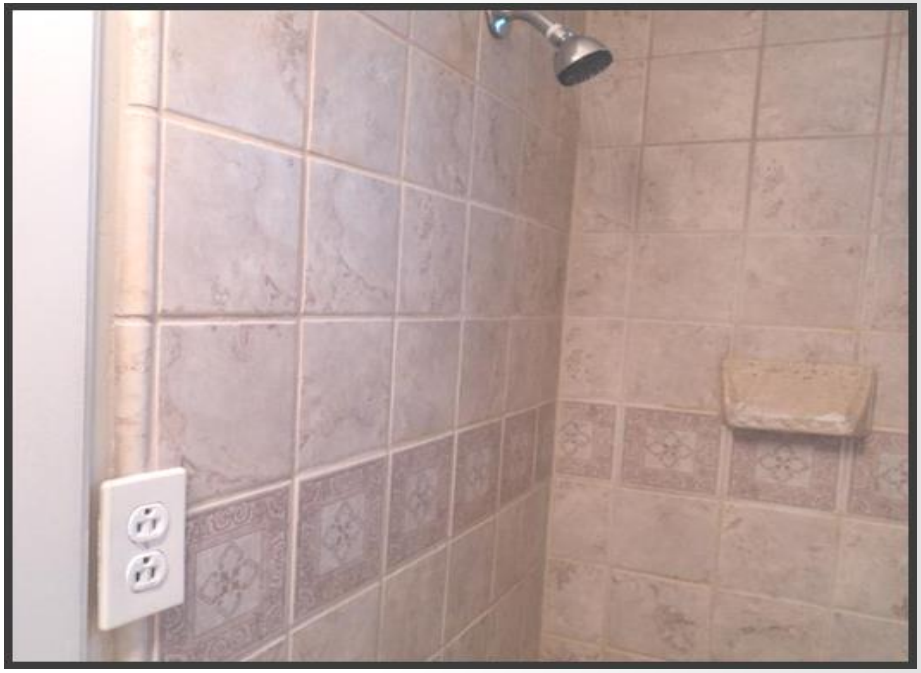
(with no other firm support)

Exposed Wiring that Pose an Electrical Hazard

Missing Protective Covers

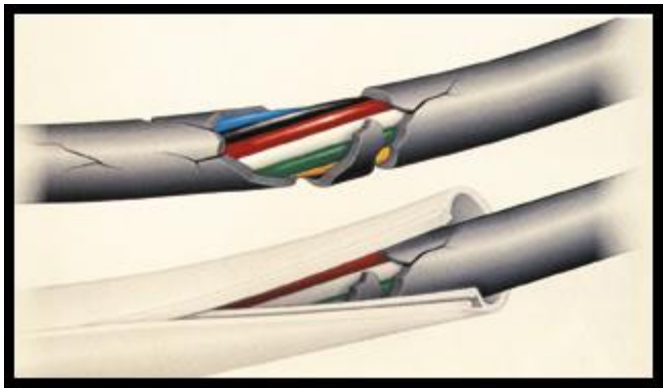
Unprotected Receptacles (No GFCI) Near Water is a Health and Safety Concern





Susceptible to Splashing

Frayed Wiring and Non-Insulated Wiring



Outlets or Switches not Rigidly Secured, Exposing Bare Wires / Connections

Thank You