

Knowledge Domain: Power Supply

Unit: Plug/Cable

Skill: Adding proper grounding

Tools and Parts Required:

- 1) Any incandescent bulb**
- 2) Connecting plate for bulb**
- 3) Wall power terminal**
- 4) Connecting wire**
- 5) Multimeter or AC voltmeter**
- 6) Protective equipment: insulating gloves, closed toed shoes**
Latex gloves can be used for voltages up to 10kV.

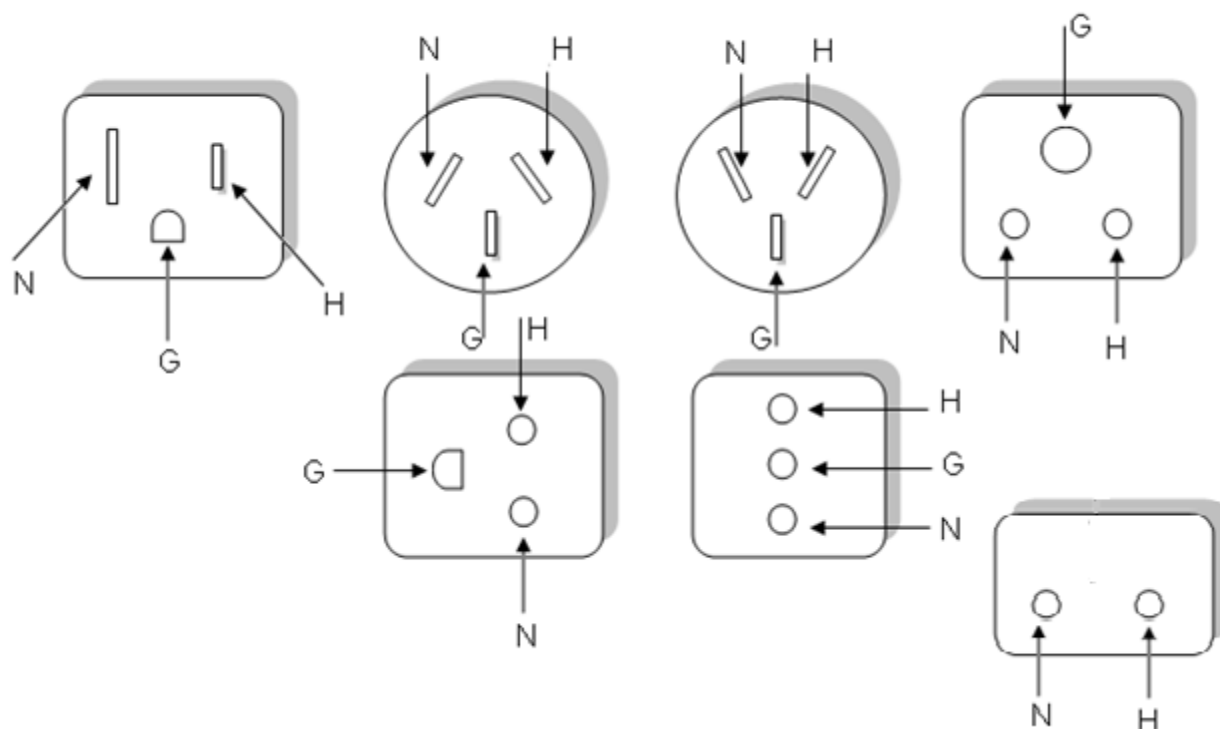
Introduction

Proper grounding is very important. The ground connection increases safety for the patient, technician, and device. The instruments are powered through wall power terminals. Wall power terminals have provisions for providing grounding.

Some medical equipment will not work properly if the power outlet is not grounded. These devices use the ground to help reduce noise.

Example

Different types of wall power terminals used throughout the world are shown below. Different style power terminals may be commonly seen around you. The two power terminals on the right in the picture are European style. Notice that some do not have a ground connection. **G: Ground connection, H: Hot Connection, N: Neutral Connection**



The picture shows an incandescent bulb with connecting plate. This bulb is used to ensure that wall power terminal provides a proper ground connection.

Identification and Diagnosis

Wall power terminals provide grounding. It is important to check this ground connection periodically. It is also important to replace or add a proper ground connection if the original ground connection is faulty.

Procedure

Wear insulating gloves. Wear closed toed shoes. These are important safety measures. Switch your multimeter to AC.

1. Identify the type of wall power terminal.
2. Locate Hot, Neutral and Ground connections of the wall power terminal.
3. Measure the voltage between **N** (Neutral connection) in the wall power terminal and **G** (ground connection) in the wall power terminal. The meter should read very little (a few hundred millivolts or less)
4. Next, Measure the voltage between **N** (Neutral connection) in the wall power terminal and **H** (hot connection) in the wall power terminal. The meter should read the full voltage. This will vary depending on geographical location to 110 or 240V.
5. Next, Measure the voltage between **G** (ground connection) in the wall power terminal and **H** (hot connection) in the wall power terminal. The meter should read the full voltage.

If you do not have a multimeter, you can perform an alternative test. The test uses an incandescent light bulb to identify correct grounding.

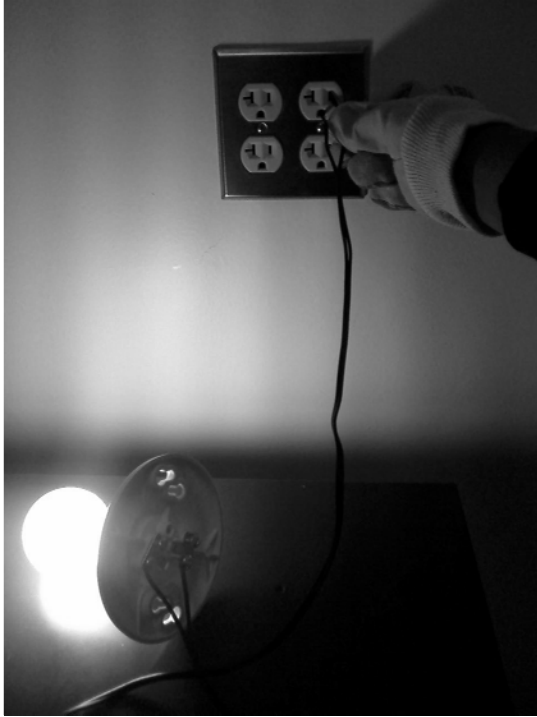
Always perform this experiment with only one hand. Never use both hands for this experiment. You might complete an electrical circuit when you use both hands. You might get a shock. Wear protective gloves and closed toed shoes. Your instructor must monitor you when you perform this for the first time.

1. Identify the type of wall power terminal you are working with.
2. Locate Hot, Neutral and Ground connections of the wall power terminal as given in the example above.
3. Locate connection points for hot and neutral connections of the light fixture. Connect wires to the light fixture. Use solid, stiff wire that has less than 1 cm of removed insulation at both ends.
4. Plug one of the two wires from the light fixture into **N** (Neutral connection) in the wall power terminal. Plug the other wire into **G** (ground connection) in the wall power terminal. The incandescent bulb should not light.
5. Remove the wire from wall power terminal.

6. Next, plug one of the ends of the wire in **N** (Neutral connection) in the wall power terminal. Plug the other end in **H slot** (hot connection) in the wall power terminal. The incandescent bulb should light.



7. Remove the wire from wall power terminal.
8. Next, plug one of the ends of the wire in **G** (Ground connection) in the wall power terminal. Plug the other end in **H** (hot connection) in the wall power terminal. The incandescent bulb should light.



9. Remove the wire from wall power terminal.

If the outlet is not grounded, you may have to install a new ground connection for the wall power terminal. Determine if your hospital already has a grounding pole. The grounding pole will be a small pipe sticking out of the ground with a wire running from the pole to the hospital. It is usually very close to where the power enters the hospital. It is not a good idea to have two poles. If the hospital has one pole, or if a nearby outlet has correct grounding, it is better to run a grounding wire from the existing pole, or nearby outlet, up the wall through the ceiling and across to the other outlet.

If the hospital or clinic does not have a grounding pole, then you should contact an electrician to complete the power installation. If you cannot find an electrician, purchase a piece of iron pipe (or maybe copper) and drive it 6 feet into the ground. The pole should be close to where power enters the hospital and should be exposed above the surface of the ground a couple of inches. Connect a wire to the exposed pole. Run this wire to the outlets for ground.

Exercise

Wear closed toed shoes and insulating gloves.

Using a plug in the classroom or your hospital, identify the type of wall power terminal and locate the connection points for ground, hot and neutral connection.

Use your multimeter set on the voltmeter setting. Refer to the procedure and measure all the mentioned voltages. Compare your readings with the ideal readings.

Repeat your measurements using an incandescent light bulb.

Is the ground connection provided by the wall outlet adequate?

Your instructor must verify your work before you continue.

Preventative Maintenance and Calibration

Check the ground connection before using any instrument. Faulty ground connections need to be re-installed. Some users will disconnect the grounding wire accidentally or intentionally. You should check every outlet in the hospital every six months.