SHOREPOWER SAFETY

PERFORMING BASIC ELECTRICAL TESTING BEFORE PLUGGING IN AT THE CAMPGROUND WILL PROTECT YOU AND CAN PREVENT COSTLY DAMAGE TO YOUR MOTORHOME

by ROSS HUBBARD

Traveling in a motorhome allows us the freedom to go just about anywhere and still enjoy all the comforts of home — especially when connected to shorepower. It's so easy to pull into a campsite and just plug in the shorepower cord that most of us don't even give it a second thought. But there's more going on with the campground electrical system than meets the eye.

Problems with brownouts, surges and voltage spikes can be anything from a nuisance to an expensive fix, which is why it's a good idea for motorhome owners to understand the basics of safe electrical systems as well as testing and troubleshooting.

WHAT IS SHOREPOWER?

Shorepower is the same electrical power we use in our homes. The power comes from the utility company lines to the campground; from there, power lines are distributed throughout the park to individual power pedestals at each site. The pedestal might be equipped with one, or a combination of, 15-, 20-, 30- and/or 50-amp receptacles.

Ideally, the campground's electrical system will be properly installed and balanced, and should have the capacity to handle electrical loads at each site without causing any disruption in service. However, electrical conditions at campgrounds can be less than ideal, sometimes due to the accelerated component wear and tear associated with exposure to weather conditions, or even downright dangerous. Therefore, it's important to make sure the electrical system is safe before plugging in your motorhome. But before we get into the testing, we'll cover the basics of electrical safety.

TESTING SAFETY PRECAUTIONS

• When testing electricity, make sure you are not standing on wet ground. Stand on something dry, such as wood, or a rubber mat, and wear rubber-soled shoes. Never test electricity with bare feet.

• Before testing any electrical devices, use a non-contact voltage detector to determine if the device is safe to touch. Shocks can occur when you come in contact with a "live" wire and your body becomes part of the electrical circuit. Electricity attempts to find "ground" through your body.

• Whenever possible, use only one hand when handling testing equipment. If electricity enters both hands and arms, electrical current will cause your heart, which is between the electrical path circuit, to fibrillate and stop its pumping actions.

• When troubleshooting or testing, make sure someone is close by to turn off the electricity in case of an emergency.

TESTING TOOLS

In order to test electricity at the power pedestal we're going to use four tools: a non-contact voltage detector, a receptacle plug-in polarity and GFCI tester, a digital multimeter and a circuit analyzer. If you don't have all of these tools, at a minimum you'll need a non-contact voltage detector and a multimeter.

• Non-contact voltage detector. This should be your first-line tool. We use the Fluke VoltAlert (far right) because it's well made, easy to use and fits in a pocket. Make sure you get a model that can detect low and high levels of alternating current (AC) with a range of 40-1,000 volts.

• Receptacle plug-in polarity and GFCI tester. We like the Ideal #61-501 tester (bottom right) because it's simple to use — just plug it in and match the glowing lights to the key on the tester.

• Digital multimeter that is auto-ranging and measures true root mean square (RMS). In order to accurately measure AC electricity, you'll need a good multimeter with true RMS, such as the Fluke 117 (right). This model's auto-ranging feature automatically adjusts for different voltages, and it has a continuity beeper that lets you know your wires are properly connected. In addition to the probes that come with the unit, pick up a set of alligator clips for testing. Accurately measuring electricity is important; don't be tempted to buy the cheapest meter available.

• Circuit analyzer (below). Priced at around $350, the Ideal Sure Test Circuit Analyzer #61-165 is an expensive tool, but it serves multiple functions. Plug it in to a receptacle and the analyzer displays information about polarity, GFCI function, voltage drop, line quality and "false" or "bootleg" grounds.

Ideal Sure Test Circuit Analyzer

Fluke VoltAlert

Fluke 117 True RMS Digital Multimeter

Ideal #61-501 Tester

PHOTOS: ROSS HUBBARD

POWER PEDESTAL AND RECEPTACLE TESTING

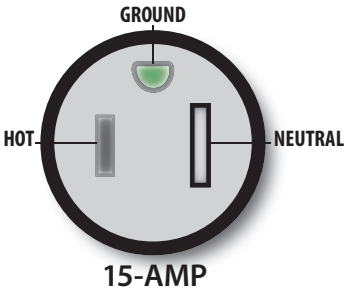
Initially, we'll be testing two things here: if the pedestal is safe to touch and that the pedestal receptacles have electricity. If you can't establish both conditions, you will need to move to another campsite.

Depending on the type of non-contact voltage detector you have, you will be alerted to the presence of electricity by a glowing light, beeping or both. Follow the manufacturer's instructions for use and keep your hand as far back as possible from the tip of the unit. Before using the detector make sure its batteries are good and that the unit is operating properly.

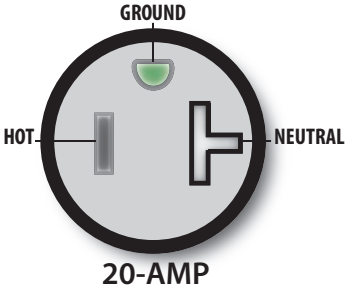
1. Place the tip of the detector on any metal part of the pedestal case. If no electricity is detected, it is safe to touch. If electricity is detected on the pedestal case, there's a problem; notify the campground manager immediately.

2. Place the detector tip into the "ground" socket of the receptacle, then the "neutral," and then the "hot" socket. The only socket you should detect electricity at is the "hot" socket. If electricity is detected on any other socket there's a problem; notify the campground manager immediately.

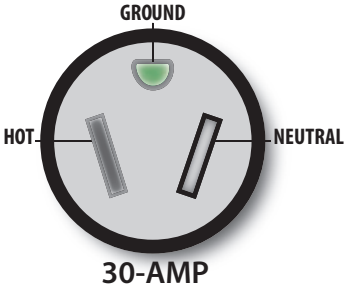
See receptacle diagrams below for hot, neutral and ground socket locations.



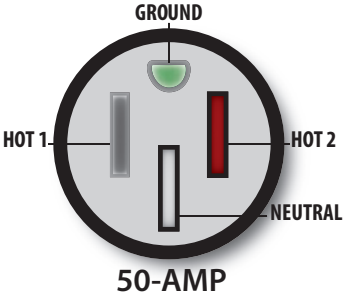
15-AMP



20-AMP



30-AMP



50-AMP

Now that your power pedestal and receptacle testing is complete, it's time to move on to an understanding of AC polarity.

AC POLARITY

AC electricity needs just two wires (for 15-, 20- and 30-amp systems, two wires carry electricity; in a 50-amp system there is an additional wire) to complete its circuit. In a properly connected system, the "hot" black wire and the "neutral" white wire carry current and the "ground" green wire is not connected to electricity unless there is a short circuit.

If the wires are reversed, the electricity is just as happy to travel along the "hot" and "ground" wires as on the proper "hot" and "neutral" wires. And since your motorhome's ground system is connected to the coach chassis and outer skin, any electricity on the ground wire will electrify the motorhome. This is commonly called hot-skin condition (more on that later). If someone standing on the ground touches the motorhome chassis or accessory bolted to the frame or chassis, they become part of the path for electricity to find ground and they will be shocked or electrocuted.

It's possible to get shocked and electrocuted by reversed polarity, which is why it is important that you protect yourself from this danger by testing for polarity before plugging in the shorepower cord.

POLARITY TESTING

First, we'll use a plug-in tester to verify correct polarity. The plug-in tester won't work on 50-amp systems — for that we'll use a multimeter (see 50-Amp Polarity Testing in the next section).

All coach owners should have one of these inexpensive ($5-$10) plug-in testers. The testers have a three-prong plug on one end and on the other they have three LED or neon lights. When checking a 30-amp receptacle, use a pigtail adapter. To use, first turn off the circuit breaker at the pedestal, plug in the tester, turn the circuit breaker back on, and match the lights that are lit to the key on the tester. If any condition other than "correct" is displayed, do not use the receptacle; turn off the circuit breaker, remove the tester and notify the campground manager.

50-AMP POLARITY TESTING

To test 50-amp polarity, you'll need a multimeter (jump forward to the next section, "Using a Multimeter," for more information). If your meter isn't self-ranging, set it to more than 300 volts. You will be inserting probes between the slots (see 50-amp receptacle illustration).

1. Insert one probe in "hot 1" and the other probe in "hot 2." The meter should display between 228-252 volts. Note: Our photos only display 208 volts on the meter because some campground transformers will only produce 208 volts of power. Better transformers will produce 240 volts.
2. Insert one probe in "neutral" and the other probe in "ground." The meter should display 0 (no volts) or less than 2 volts.

If your meter displays any other results, stop, turn off the circuit breaker and notify the campground manager.

Now that we have determined that the pedestal has electricity and is safe to use, we will use a multimeter to measure the voltage at the receptacle.

USING A MULTIMETER

If you are unfamiliar with using a multimeter, read the manufacturer's instructions prior to use. On the multimeter, connect the red probe into the red socket marked "volts" and the black probe into the black socket marked "COM" before testing. If your meter is not auto-ranging, set it to more than 200 volts AC when testing 120 volts and the next available position higher than 250-300 volts AC for 240-volt systems.

Next, we will test for voltage, so it doesn't matter which color probe is used in the slots. For safety, hold the meter probes as far back from the metal tips as possible.

15-, 20- AND 30-AMP VOLTAGE TEST

1. Turn the circuit breaker on the pedestal to the OFF position. Insert one probe into the "hot" slot and the other probe into the "neutral" slot. Turn the circuit breaker to ON. The meter should display 114-126 volts.

2. Insert one probe into the "ground" slot and the other probe into the "hot" slot. The meter should display 114-126 volts.

3. Insert one probe into the "ground" slot and the other probe into the "neutral" slot. No voltage should be displayed.

50-AMP VOLTAGE TEST

1. Insert one probe into "hot 1" and the other into "hot 2." Meter should display 228-252 volts.

2. Insert one probe into "hot 1" and the other into "ground." Meter should display 120 volts (between 114-126 volts AC).
3. Insert one probe into "hot 1" and the other into "neutral." Meter should display 120 volts (between 114-126 volts AC).

4. Insert one probe into "hot 2" and the other into "ground." Meter should display 120 volts (between 114-126 volts AC).
5. Insert one probe into "hot 2" and the other into "neutral." Meter should display 120 volts (between 108-130 volts AC).

6. Insert one probe into "neutral" and the other into "ground." Meter should display 0 or less than 2 volts.

When the campground is experiencing peak power use, it is common for the voltage to be lower than normal. As long as the voltage doesn't drop to below the numbers above, you will most likely be fine.

Important: If you noticed a difference in voltage readings when testing between the "hot" and the "neutral" and the "hot" and the "ground," there is a dangerous leakage of electricity to "ground." Do not use the receptacle and notify the campground manager.

GFCI TESTING

If the receptacle is GFCI protected, push the "test" button on the receptacle or the circuit breaker to trip the GFCI. After it trips, push the "reset" button. If the button is spongy or does not trip, the unit is not operating properly and should not be used. You can also use the circuit analyzer or plug-in tester to trip the GFCI if your tester is so equipped, but always test the GFCI at the unit first. If it does not trip, it is not operating properly.

CIRCUIT ANALYZER TESTING

Not everyone has a circuit analyzer, but if you do you could have skipped the plug-in tester and multimeter tests. The analyzer testing is extensive. It tests for voltage drops and correct wiring, such as polarity, bad connections and "false" or "bootleg" grounds where the ground wire is connected "falsely" to an appliance or device, which is a shock hazard. It also tests for true RMS voltage and frequency in hertz. GFCI testing is complete with trip times and amperages, which is handy to check performance specifications.

With 15- and 20-amp receptacles, plug the analyzer into the receptacle and follow the manufacturer's testing procedures. When testing 30-amp receptacles, you'll need adapters in order to plug in the analyzer. For 50-amp service, the analyzer can be used, but two separate adapters are required to test both sides of 240-volt AC service — we do not recommend making special adapters unless you are qualified to do so.

SHOREPOWER AND EXTENSION CORDS AND ADAPTERS

Before you plug in, you need to inspect the shorepower and extension cords. Look for cut and damaged insulation, damaged plug ends, frayed wires and corrosion on the plug ends. Avoid laying the cord in water or draping it over objects, and make sure it's not a trip hazard.

Although extension cord use is best avoided, there are times when you will be happy you have one. When deciding to use an extension cord, common sense plays a big part. Lightweight, small cords should never be used because they are not up to the job and can overheat. RV-rated cords have heavy insulation and large enough wires to handle electrical loads of your coach.

The length of the cord also plays a part; the longer the cord, the more voltage drop you'll experience, so use the shortest cord possible. For 15-, 20- and 30-amp service, use a #10 American Wire Gauge (AWG) cord size; for 50-amp service, use a #6 AWG cord size. Note: Larger AWG numbers equal smaller wires.

SHOREPOWER AND EXTENSION CORD TESTING

Here are two quick tests for detachable shorepower cords and extension cords. The first test will establish if the wires are connected properly and if they have continuity (good connection). Although you may get good continuity displayed with the first test, on the second test flex the plug ends while firmly holding the cord to determine if any electrical changes are displayed. If you see changes with the second test, wires inside the cord or plug end may be loose or broken.

1. Disconnect the cord from power. Set the multimeter to CONTINUITY; place one probe on the "hot" blade and the other probe in the "hot" slot. Repeat with "ground" to "ground" and "neutral" to "neutral." All corresponding ends should have continuity.

• If you don't have a continuity feature on your meter, set to OHMS and test as above. The meter should display any numbers that are nearly zero (0) but not OL, which is an open circuit (not connected).

2. Now set the meter to OHMS and connect the probes again to their appropriate connections as in test 1. But this time, wiggle the plug end(s) back and forth. If you see any electrical fluctuation on your meter, the wires may have breaks in them.

If you find good continuity and no broken wires when testing as above, the cord should be safe to use. If you are suspicious of any cord quality, do not use it.

ADAPTERS

There may be times when you need to use an adapter with your shorepower or extension cord. While there are plenty of adapters to choose from, adapters should be reserved for intermittent use, and only when properly matched to the cord and current draw. It may be tempting to cobble some adapters together, but the same basic rules apply for adapters as cords. Adapters should be rated for the power to which they are attached.

HOT-SKIN CONDITION

Before you hook up and go inside the motorhome, there's another important test to perform: Test for hot-skin condition. No, it's not a condition you get driving through Death Valley in the summer; it's when the motorhome chassis and/or accessories attached to a metal frame are electrified by the shorepower because of reversed polarity, bad grounding or other poor wiring problems. If you've ever felt a mild tingle or shock when you touched your chassis, you've experienced hot-skin condition.

HOT-SKIN TESTING

We're going to do two tests: one using the non-contact voltage detector and the other using the multimeter.

Before using the non-contact detector and multimeter, read the manufacturer's instructions for use. Also, do not touch the motorhome chassis or accessory before testing.

1. Non-contact voltage detector. Standing on dry ground with rubber-soled shoes and with the shorepower plugged into the coach and the pedestal circuit breaker on, touch the tester to the motorhome chassis, or metal fittings. If the non-contact tester detects any electricity, do not touch the RV chassis or accessory attached to metal. Turn off the pedestal circuit breaker and disconnect the cord from the pedestal. Further testing with a multimeter is required.

2. Multimeter. With the coach plugged in to shorepower and while standing on dry ground with rubber soled shoes, set your multimeter to AC volts. If your meter is not auto-ranging set to 200 volts. Place the red probe onto the chassis, metal door frame or metal fittings and the black probe to a pipe or a substantial piece of metal not attached to the motorhome and embedded in the ground. Anything more than 1 or 2 volts AC is not safe and you should immediately turn off the pedestal circuit breaker, unplug the shorepower at the pedestal and have the electrical system inspected.

BROWN-OUTS, SURGES AND SPIKES

Now that the testing is done, you are safely plugged in to shorepower and you're inside the motorhome, a cool drink and a little TV is the ticket. But while you're watching the game, the lights in the coach dim and the TV picture gets smaller. What the heck?

You just experienced a brownout. The shorepower voltage dropped significantly and is causing problems. Weather related issues, accidents and campground electrical issues can cause brownouts, but there are devices to protect your motorhome when that happens.

Step-up transformers and similar devices are designed to immediately increase the voltage to compensate for the low voltage. They come in various configurations and some of them also protect the motorhome's electrical system from other problems such as voltage surges and spikes.

Surge Guard 50-Amp Surge Protector

Voltage spikes happen quickly and can deliver a devastating blow to sensitive electronics and electrical devices. Small voltage spikes can and often do go unnoticed, but repeated spikes, no matter how small, can eventually cause damage to electrical devices in the coach.

Surges last a bit longer and are noticed especially in electronics, GFCIs, power strips, air conditioning and refrigerators having problems starting or operating.

Step-up transformers, surge protectors and voltage spike protection devices can be installed at the shorepower pedestal or hardwired to the coach. Investing in these devices will save you money in the long run because it is not a matter of if it will happen, only when and where.

Plug-in type electrical monitors in the motorhome can also help. Choose one that displays voltage, frequency and line condition. After plugging a monitor in, make sure voltages are correct, and the monitor shows 60 hertz. Turn on all of the AC electrical devices in the coach and take a look at the monitor. If the voltage has dropped slightly, that's normal, but if the voltage falls below 108 volts, that is a problem and damage can occur. Hertz should stay between 57-63 hertz. Lower or higher hertz can cause damage to electrical devices.

All of these testing procedures will help you stay safe when using shorepower. The good news is that testing is relatively quick and easy. ◆

Ross Hubbard is an accredited marine surveyor in Southern California. Along with marine surveying, Ross enjoys RVing, camping and boating, and has camped throughout North America.