

## Understanding the 50 Amp Shore Power System

*(All waveforms are representative of RMS voltage)*

Even though the receptacle found in your RV is rated at 120 VAC, the 50-amp shore power is actually a 120/240 VAC four wire service (see Figure 1). The acronym VAC stands for “Volts of Alternating Current” which means the voltage is constantly changing from 0 volts up to 120 volts Positive back down to 0 volts, then it goes to negative 120 volts and then back up to 0 volts. This happens sixty times a second. This is commonly referred to as 120/240 VAC 60 HZ (Hertz), which is shown in Figure 2.

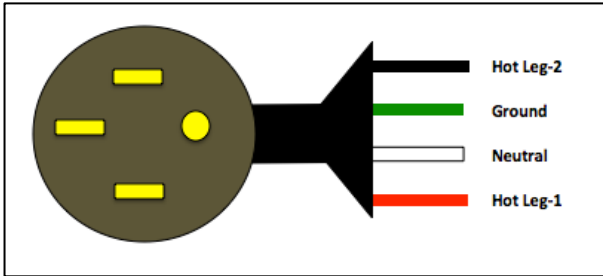


Figure 1

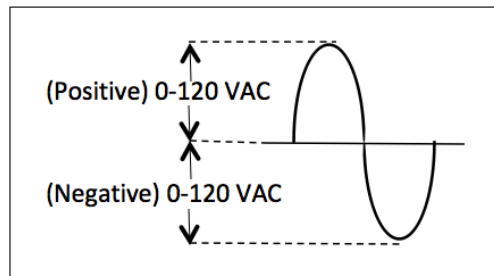


Figure 2

The actual electricity that feeds your 120 VAC receptacle in your RV comes from your 120/240 VAC breaker panel. This panel is supplied with 240 VAC which is made of two 120 VAC legs that are 180 degrees out of phase. This means that when Leg-1 of the 120 VAC is going from 0 to 120 volts positive (see Figure-1). Leg two of the 120 VAC is going from 0 to 120 volts negative (see Figure -2).

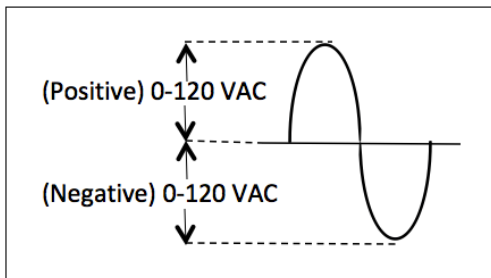


Figure 2 (Hot Leg-1)

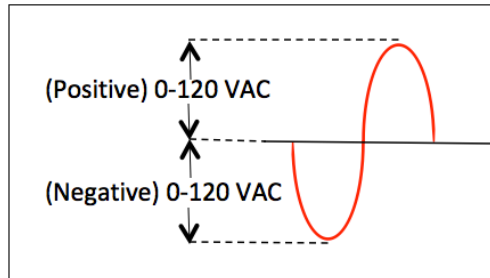


Figure 3 (Hot Leg-2)

To get 240 VAC for the larger appliances like a CheapHeat™ system, rather than going from one hot leg to neutral (120 VAC). Power is now taken from the two opposing hot legs and since they are 180 degrees out of phase, the end result is 240 VAC (see figure 4). Now that the neutral (white wire) isn't used in the 240 VAC configuration, the waveforms reference is from the Red to Black rather than Red to White or Black to White which now generates the waveform as shown in figure 5.

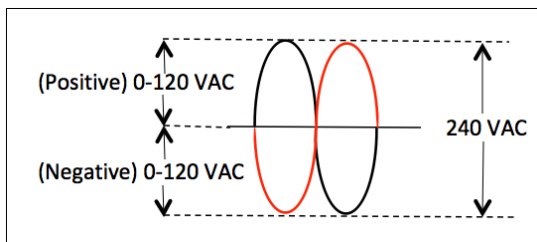


Figure 4

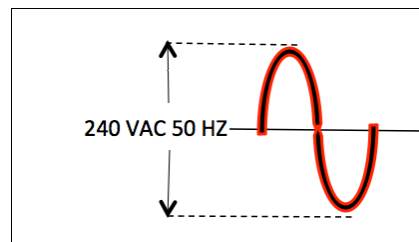


Figure 5 (Equivalent of Figure 4)

Now let's review the four wire 50-amp shore power cord, the cord we are talking about has four 6 gauge wires rated at 50-amps each. Which means the cord has two 50-amps legs at 120 VAC (Hot to Neutral) for a total of 100-amps at 120 VAC or one circuit of 240 VAC @ 50 amps (L-1 Hot to L-2 Hot), or a combination of the two.

Wait! If we have 120 VAC @ 50 amps on the Red to White and 120 VAC @ 50 amps on the Black to White, wouldn't that be 120 VAC @100 amps on the White wire since there is only one white wire? **No it won't**, because the two hot legs are 180 degrees out of phase. When Leg-1 electrons are moving towards Positive 120 volts the Leg-2 electrons are moving towards Negative 120 Volts. This means that when correctly wired (phased) the Neutral leg will see no electron flow, that's why it's called the Neutral Leg, thus no overload.

If the RV park pedestal isn't wired correctly, and the two legs are not out of phase, you **will have 100-amps applied to the white wire that is only rated for 50 amps**. In that scenario you have both Leg 1 and 2 electrons moving towards 120 volts positive and then negative at the same time (see figure 6). Which means you have double the electron flow (Current) going through the white wire when it's only rated for half that load. **End result is an overloaded wire that will overheat and very possibly cause a fire.**

\*\*\*\*\* **DANGER** \*\*\*\*\* **DANGER** \*\*\*\*\* **DANGER** \*\*\*\*\*

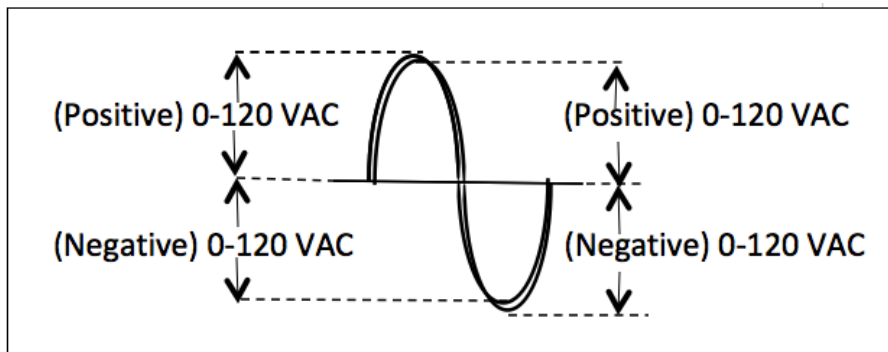


Figure 6

How do you know when you have an incorrectly wired Shore Power Pedestal? There are two simple ways, one is to install a surge protector that identifies incorrect phasing and locks out the power to the RV. The second way is to use a simple voltmeter that is rated to test AC voltage up to 300 volts. If the pedestal is wired correctly when you test from Leg-1 to Leg-2 (not Neutral) and the two legs are 180 degrees out of phase as they should be, the meter will read 240 VAC (see figure 7). When the Shore Power Pedestal is wired incorrectly, the two legs are at the same phase. Then the test from Leg-1 to Leg-2 (not Neutral) will read 0 volts on the meter (see figure 8). As stated previously, this is an **unsafe condition** because you can have a 100 Amp load on a wire that is only rated for 50-amps. All of that being said this means that using a 30-amp to 50-amp pigtail adapter will **NOT** allow you to see 240 VAC in your breaker panel. Because in that scenario your just splitting the same single black hot leg on the 30 amp plug to feed both the red and black on the 50 amp plug.

Its also important to note, that their CheapHeat™ Electric Hybrid Furnace kit is designed so that when it is configured to operate on a 50-amp service, it is not subject to these types of overload problems. Along with its inherent phase protection, it also has multiple high temperature safeties to protect from any overheat conditions. It is also hard wired directly into the main power system of the RV removing the potential fire hazard that can happen when plug in portable electric heaters are used. For more information about their product you can go to [www.rvcomfortsystems.com](http://www.rvcomfortsystems.com) or call Ph.# 425-408-3140.

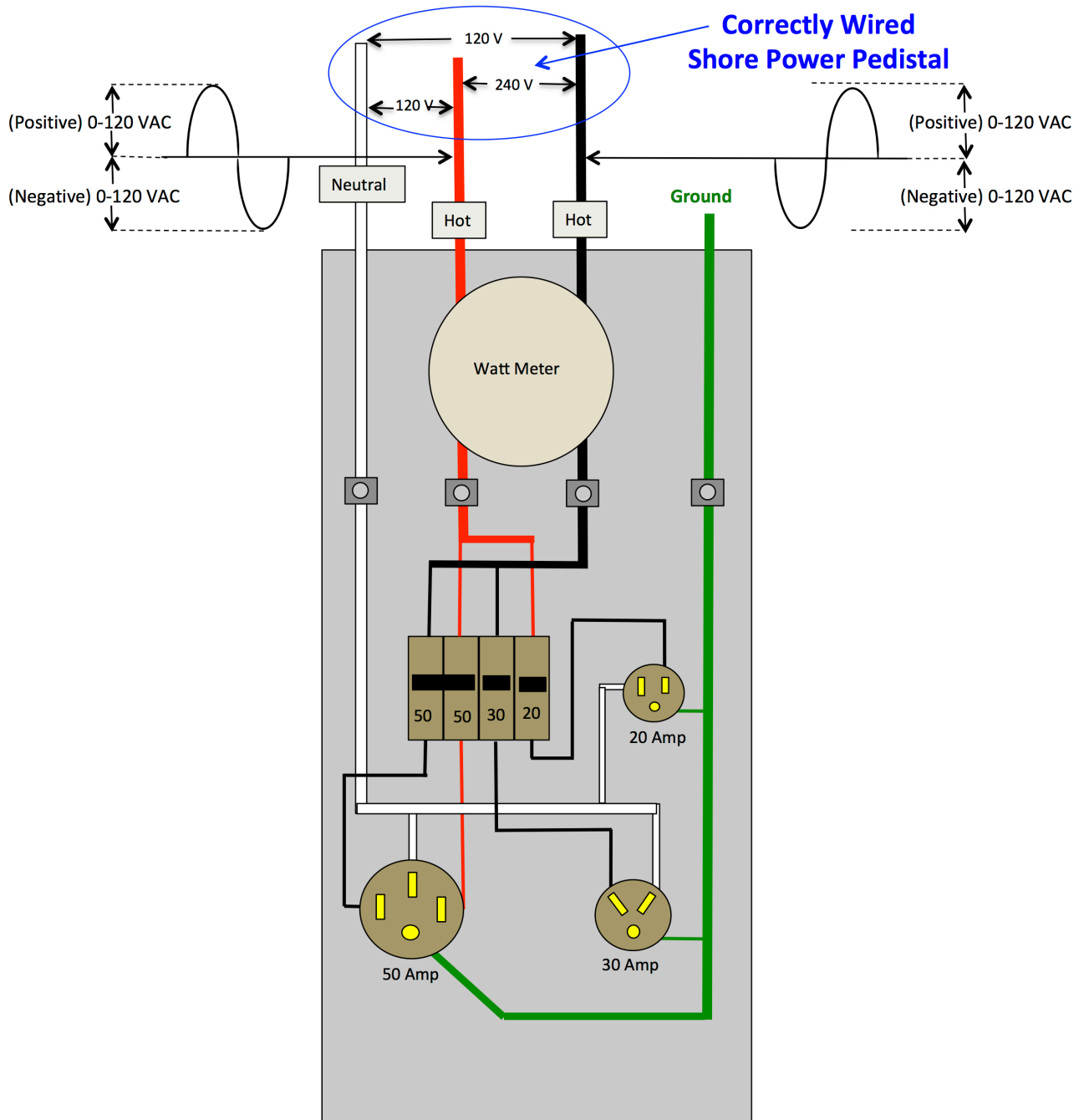


Figure 7

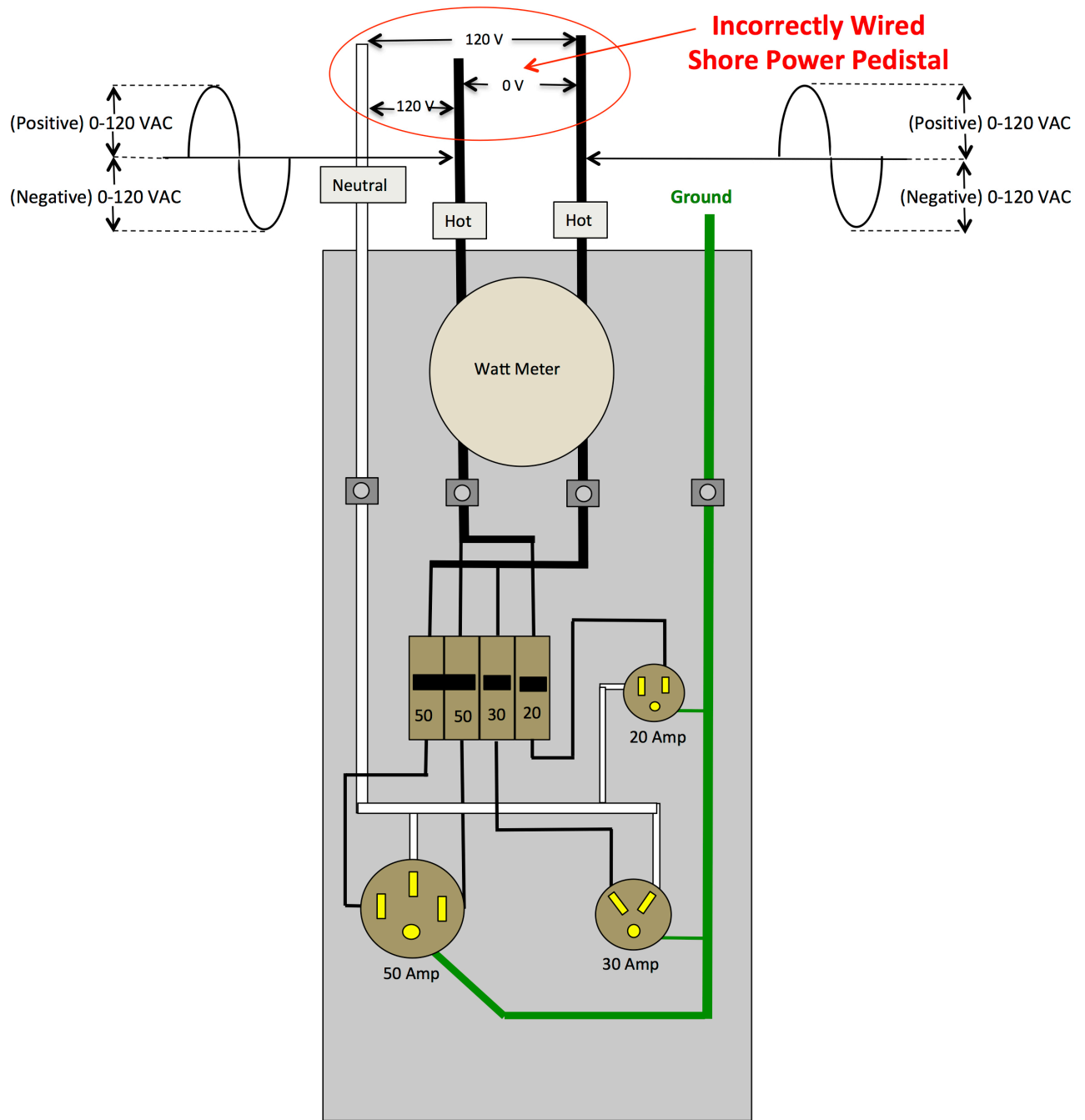


Figure 8