

# Basic Electricity

*by*

## *Thomas Freeman*

**Solitude 375 Section C Site 647**

*Is This You*  
When Dealing With Electrical Systems?



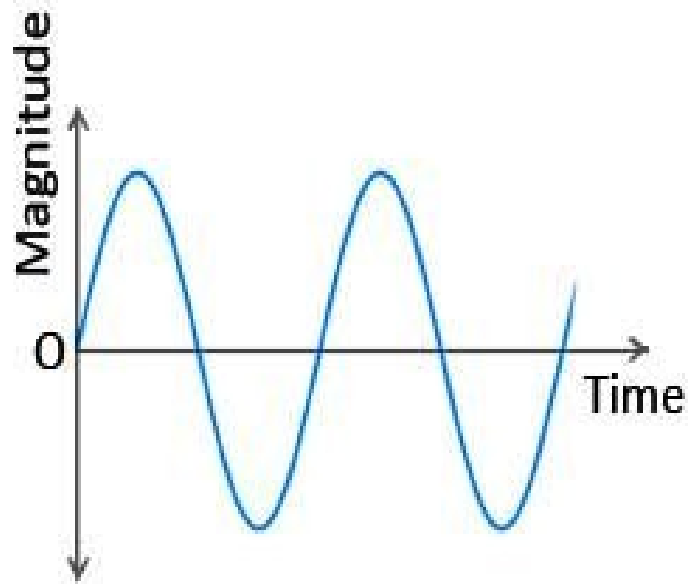
*Is This You*  
When Dealing With Electrical Systems?



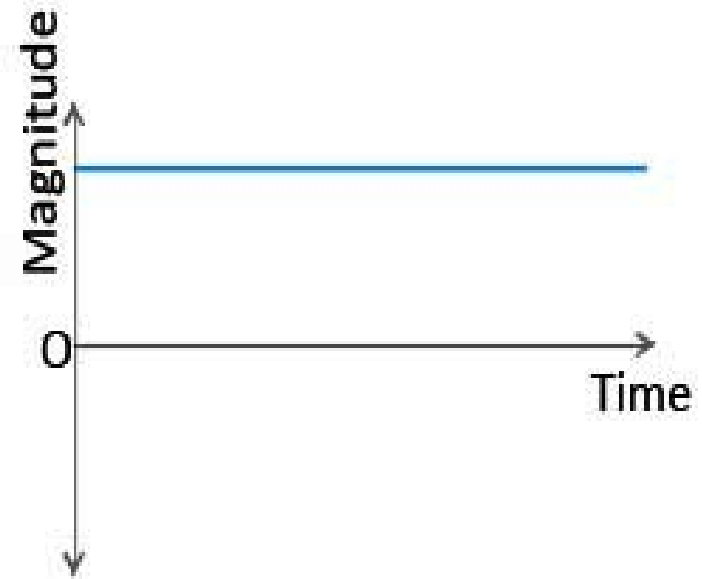
# Basic Electrical Troubleshooting Syllabus

1. AC vs DC
2. Pure vs. Modified Sine Wave
3. Terminology / Symbols
4. Test Equipment
5. How to Use Test Equipment
6. Power Pedestal to You
7. Auto Transfer Switch (ATS)
8. Breaker Panel
9. Fuse Panel
10. Troubleshooting Water Heater
11. LEDs
12. GFCI
13. Residential Refrigerators
14. Questions

# AC vs DC



Alternating Current

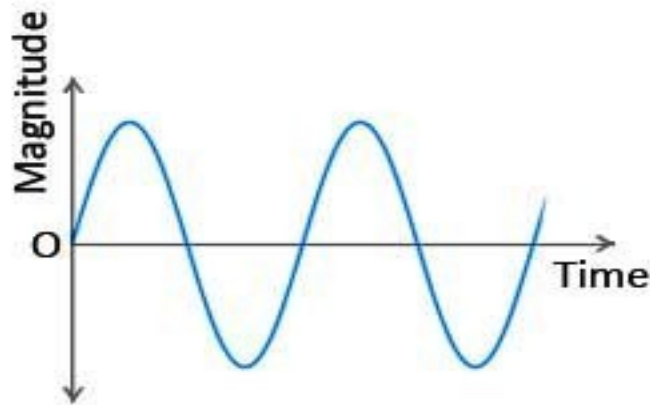


Direct Current

# What's the Difference Between an Inverter and Converter

The Converter transforms AC Voltage to DC Voltage or 110V to 12V

An Inverter transforms DC Voltage to AC Voltage or 12V to 110V

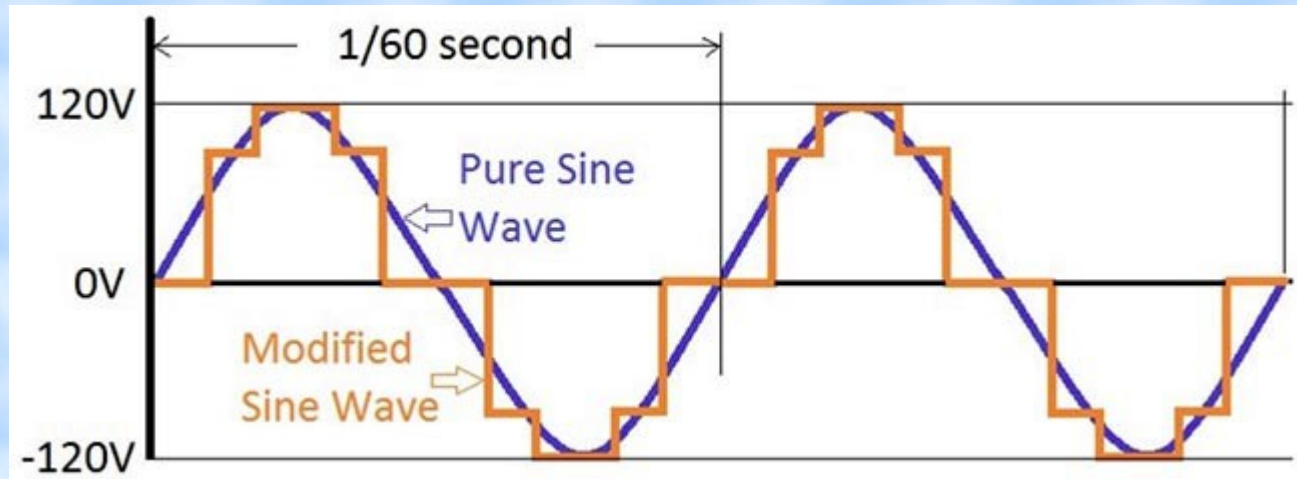


Alternating Current



Direct Current

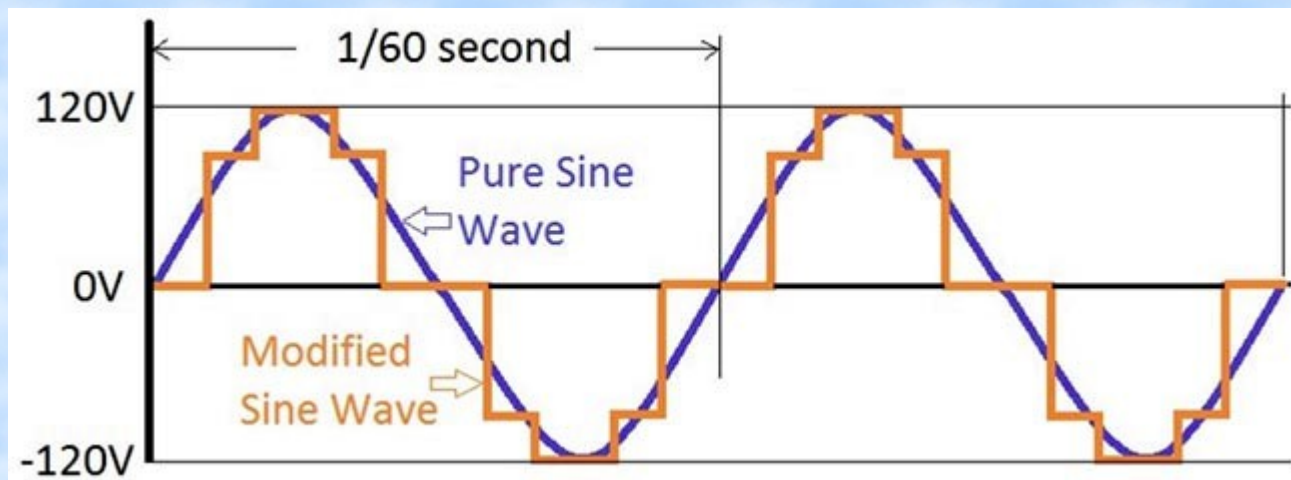
# What's the Difference Between Pure Sine and Modified Sine Wave



# What is a pure sine wave inverter?

Pure sine wave inverters, output voltage in the form of sine waves.

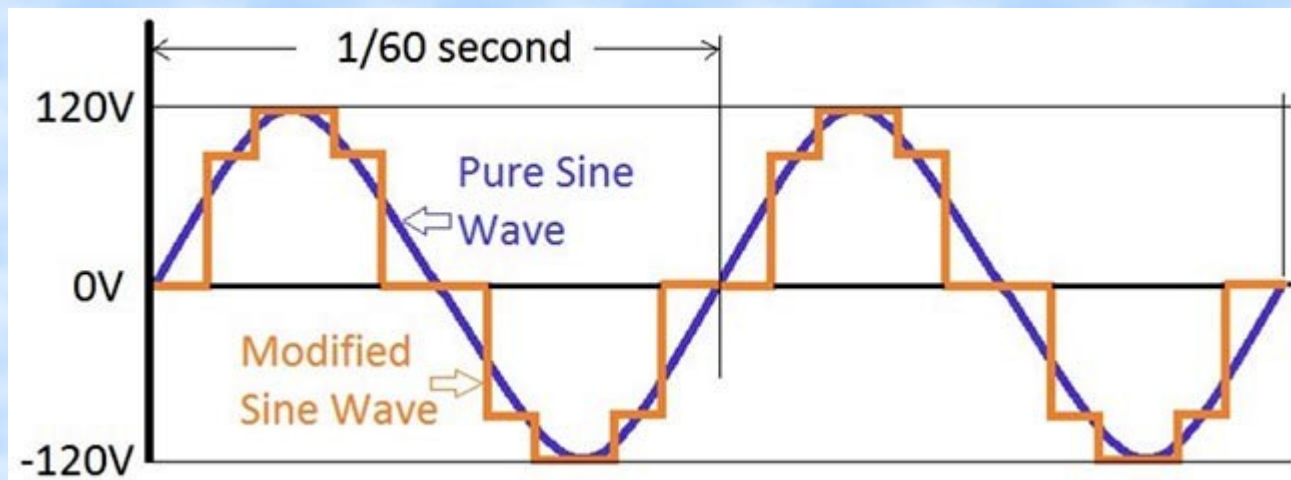
Utilities provide pure sine wave output.





# What is a modified sine wave inverter?

In modified sine wave inverters, the polarity abruptly switches from positive to negative. When looking at the wave, it has a stair-step, square pattern, where the polarity is flipped back and forth. That choppy wave can negatively affect more delicate, sensitive equipment. Additionally, in many cases, you'll hear a hum with devices attached to a modified sine wave inverter.



# What do I need a pure sine wave inverter to run?

1. Appliances with AC motors: Microwaves and refrigerators
2. Medical equipment, such as CPAP machines with humidifiers
3. Sensitive electronics
4. Laser printers
5. Newer TV's
6. Appliances with electronic timers or digital clocks

Your laptop may be ok with a modified sine wave inverter, although some claim that not using a pure sine wave inverter will shorten the lifespan of your laptop's battery.

# What can I run with a modified sine wave inverter?

Modified sine wave inverters can be used in simple systems without sensitive electronics. If there *isn't* an AC motor and it *isn't* a delicate piece of medical equipment, you *may be fine*. Old tube tvs, water pumps, and phone chargers usually operate ok with a modified sine wave inverter.

If you use a modified inverter. Appliances like refrigerators, microwaves, and compressors that use AC motors won't run as efficiently on a modified sine wave inverter.

# Basic Electrical Terminology / Symbols

**E = Voltage**

Measured as Volts

**P = Power**

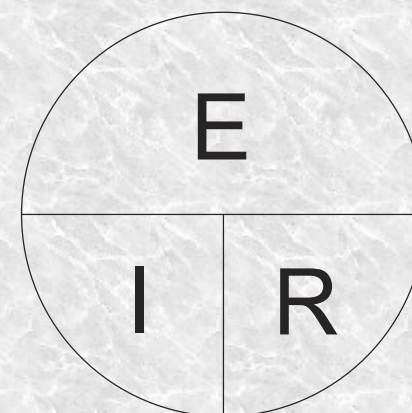
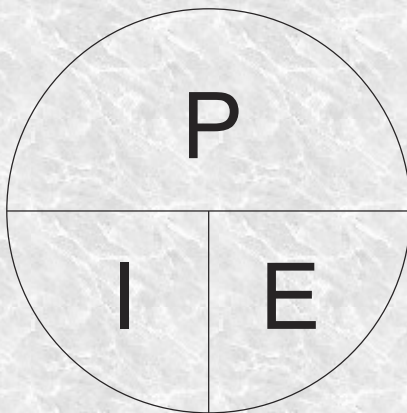
Measured as Watts

**I = Current**

Measured as Amps

**R = Resistance**

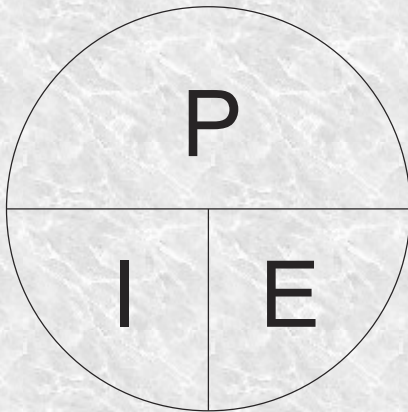
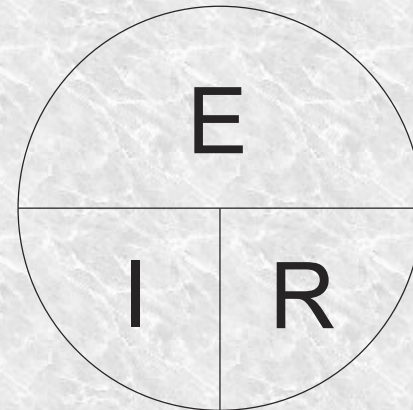
Measured as Ohms



# Basic Electrical Troubleshooting

Voltage 120 VAC and a load of 15 Ohms

$$I = E/R \quad 120/15 = 8 \text{ Amps}$$



$$P = I \times E \quad 8 \times 120 = 960 \text{ Watts}$$

# Basic Electrical Troubleshooting

*What type of meter should I get?*

Basic Volt Ohm Meter (VOM)





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Current Clamp AC/DC



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Proximity Tester (No contact AC/DC)





# Basic Electrical Troubleshooting

*What type of meter should I get?*

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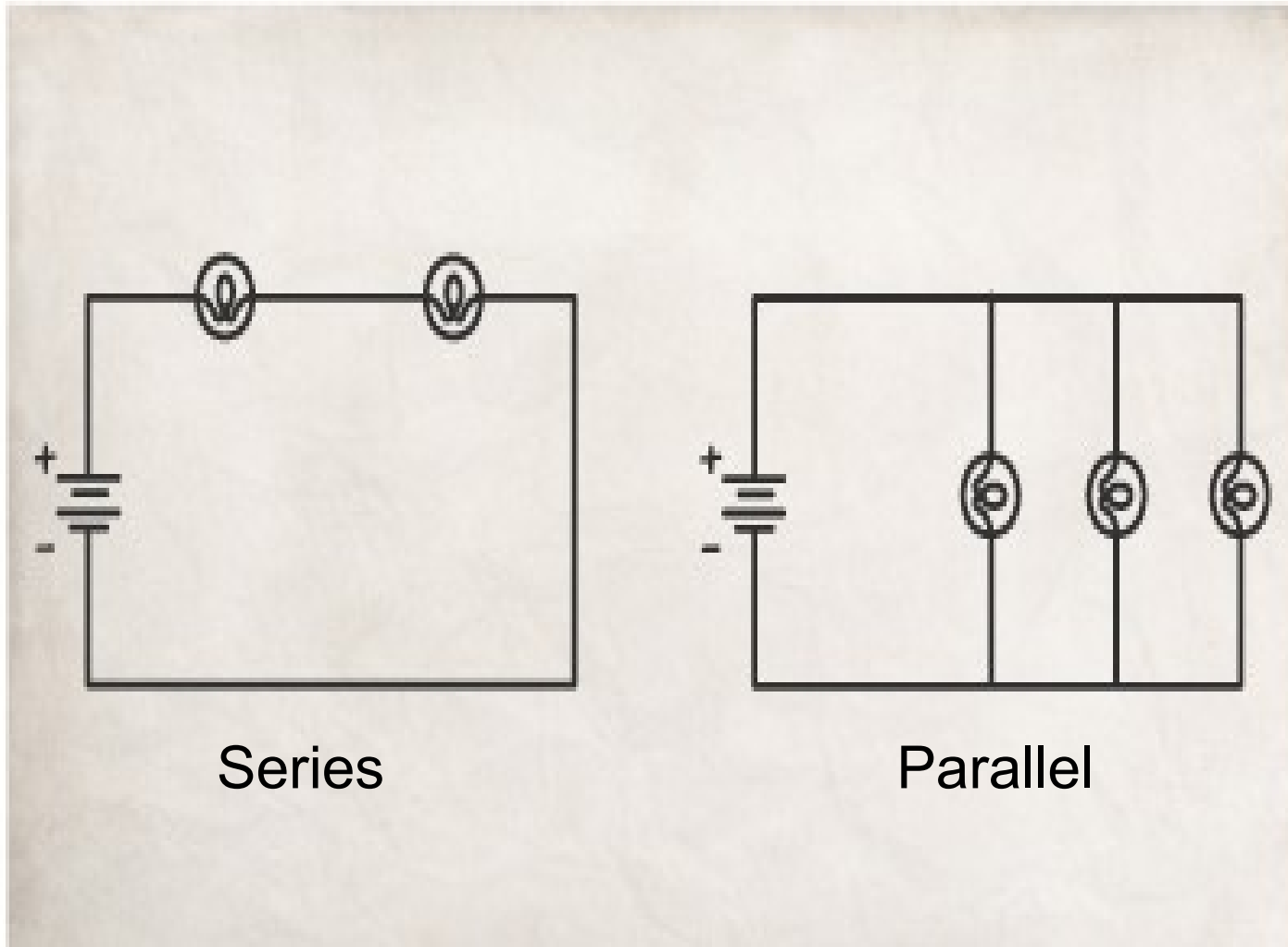
Current Clamp AC/DC

Proximity Tester (No contact AC/DC)

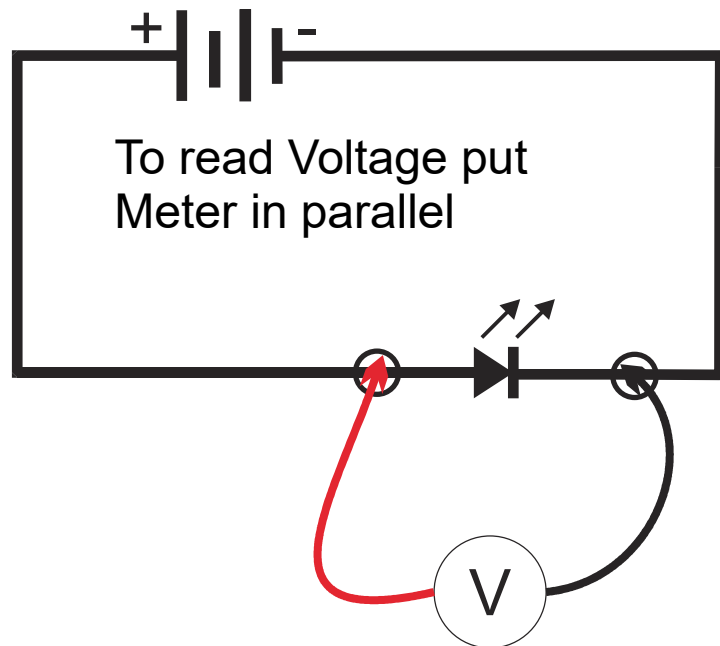
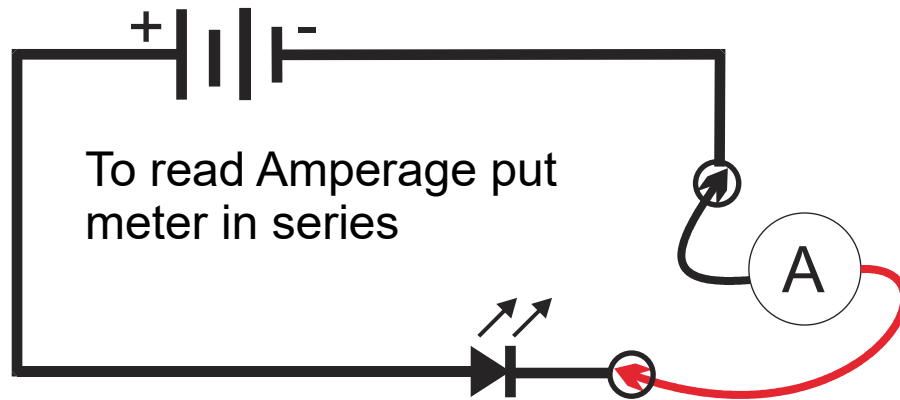
Combination VOM and Clamp



# Basic Meter Usage



# How to read Amperage with VOM



# Basic Meter Usage



↑ BLOWN FUSE

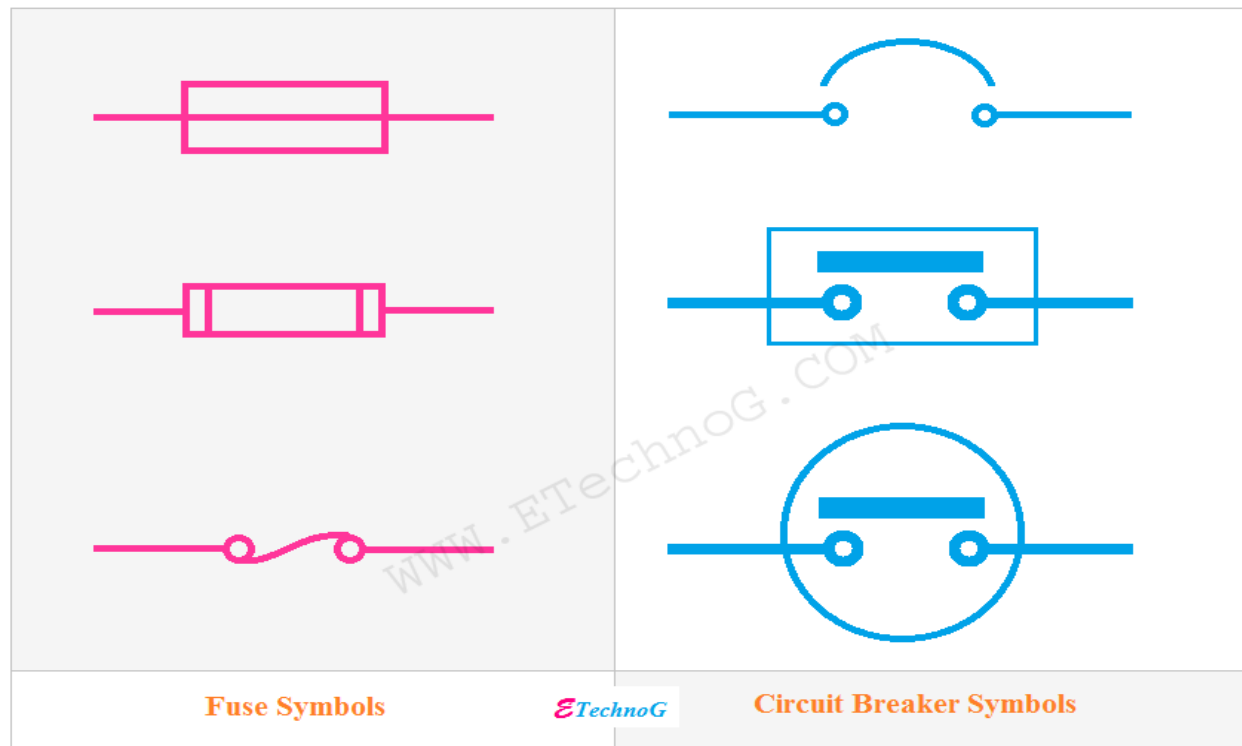


↑ GOOD FUSE

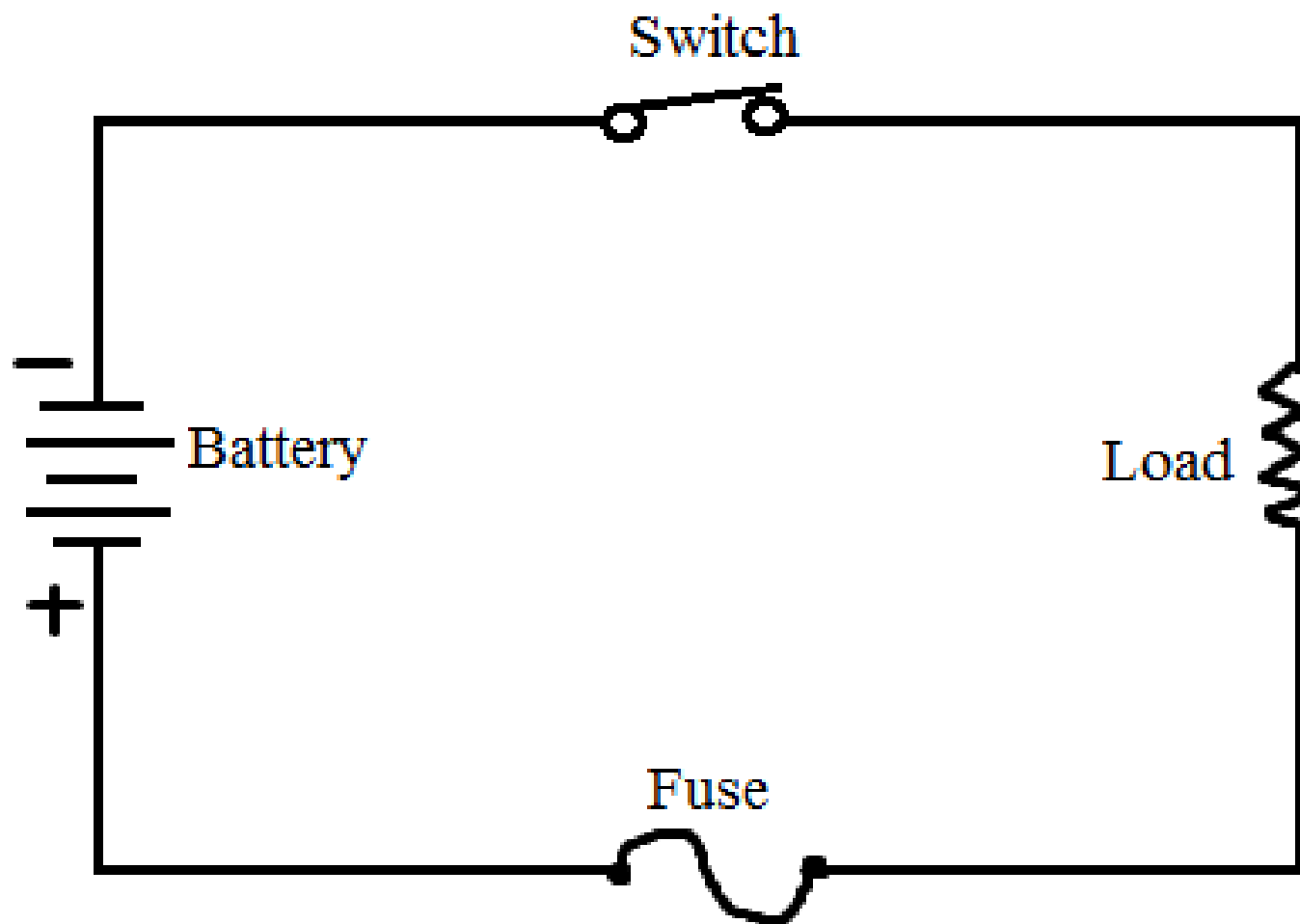
# Basic Meter Usage



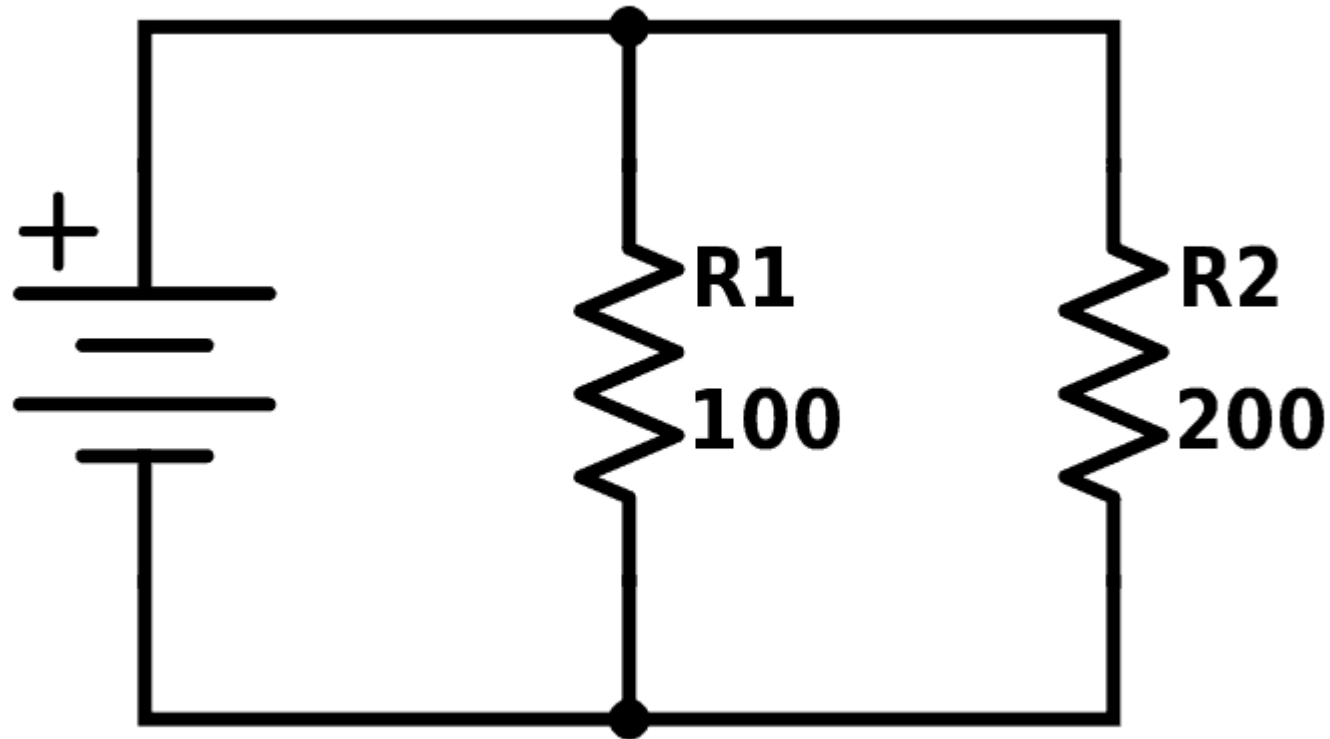
# Basic Meter Usage



# Basic Meter Usage

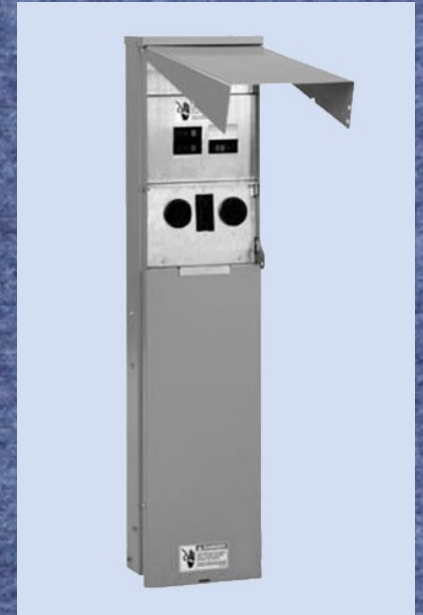
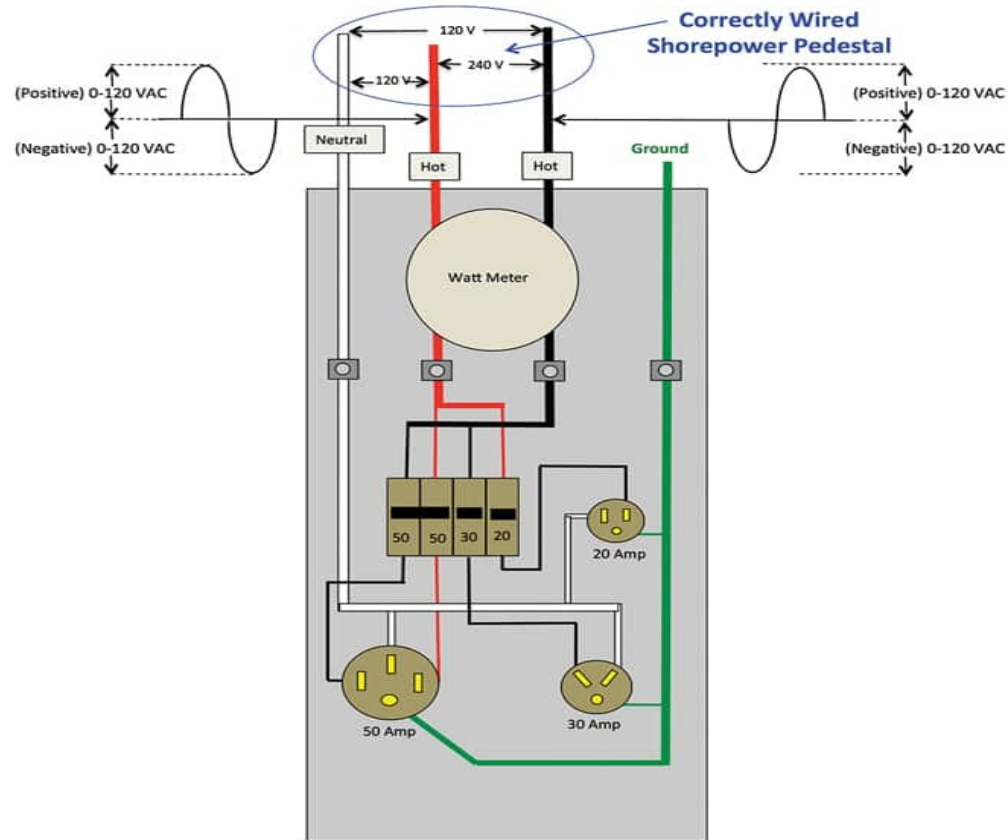


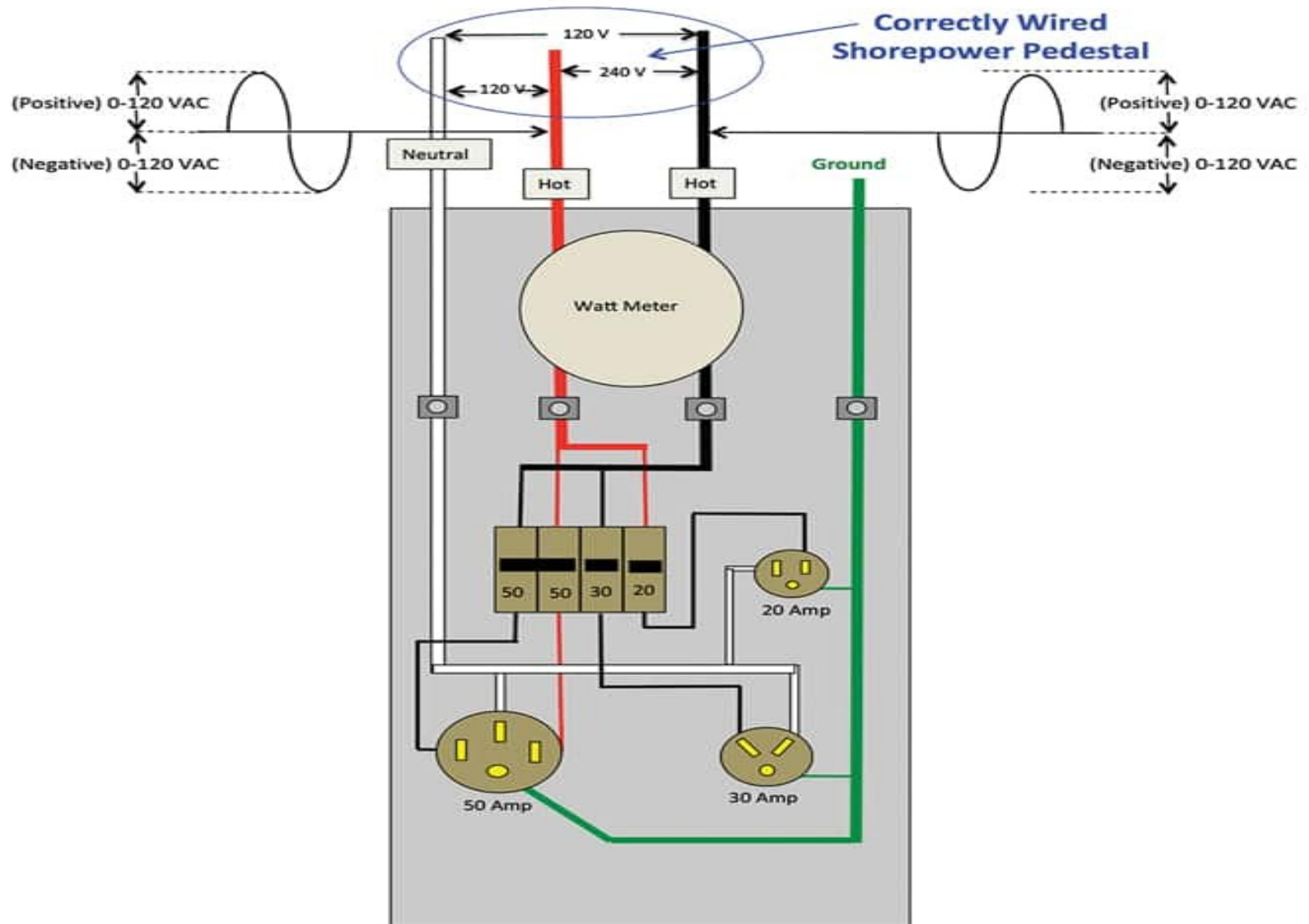
# Basic Meter Usage





# Pedestal Power





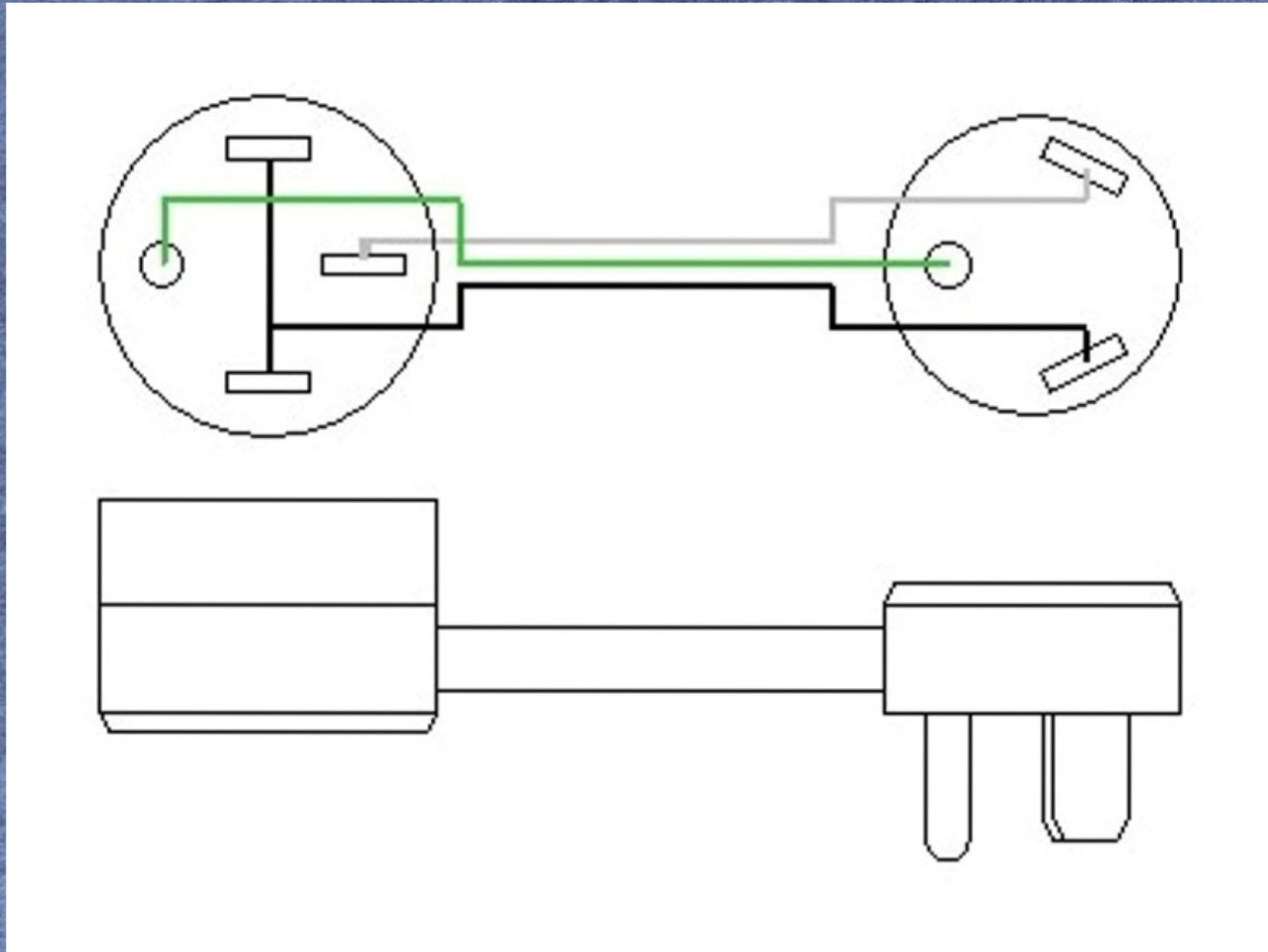


# 50 Amp to 30 Amp Adaptor/Dogbone





# 50 Amp to 30 Amp Adaptor/Dogbone



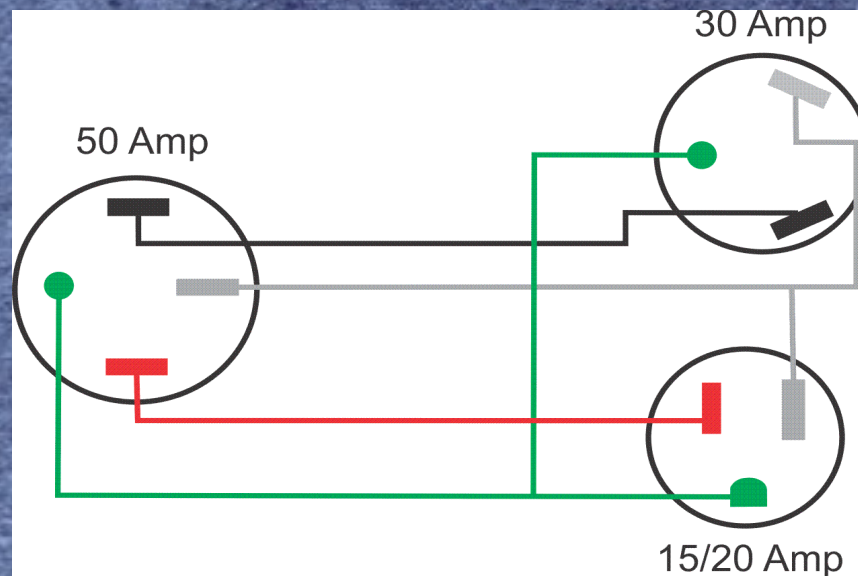


# 30 & 15 Amp to 50 Amp Dogbone 30 & 30 Amp to 50 Amp Dogbone



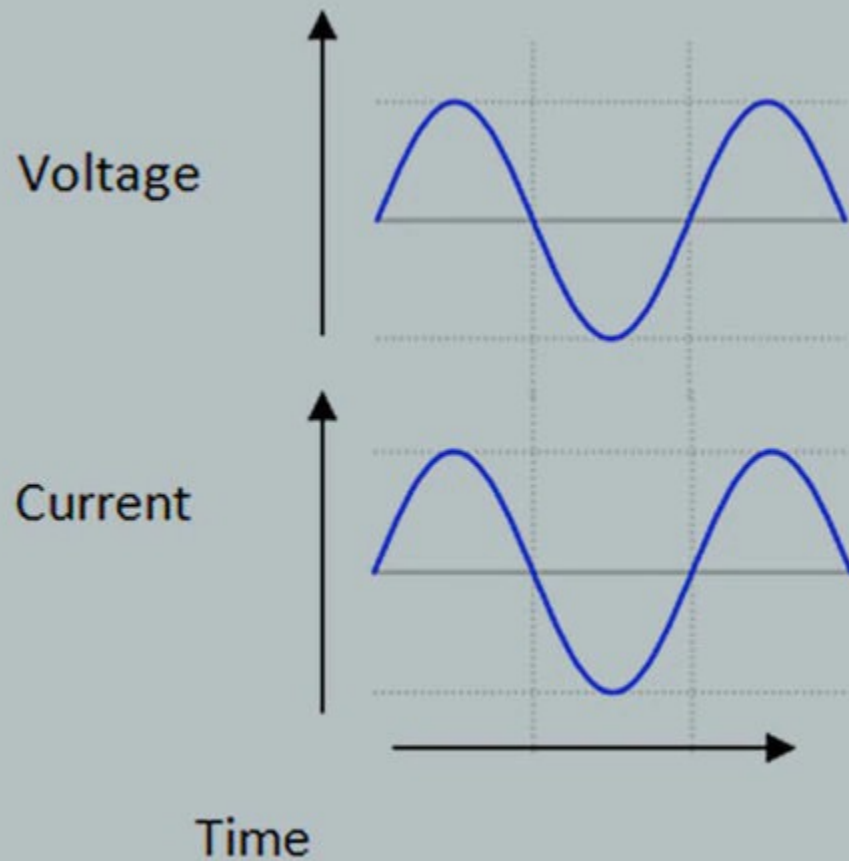


# 30 and 15 Amp to 50Amp Dogbone



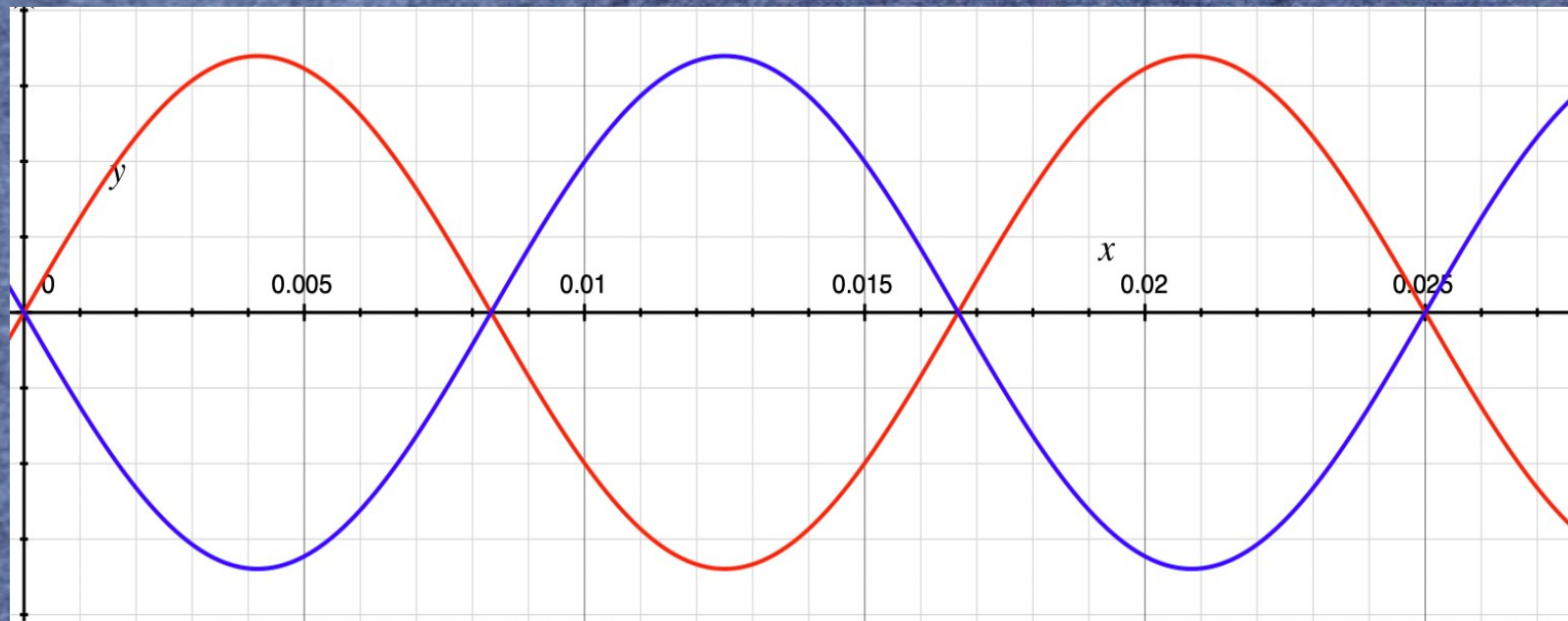


# Single Phase Waveform



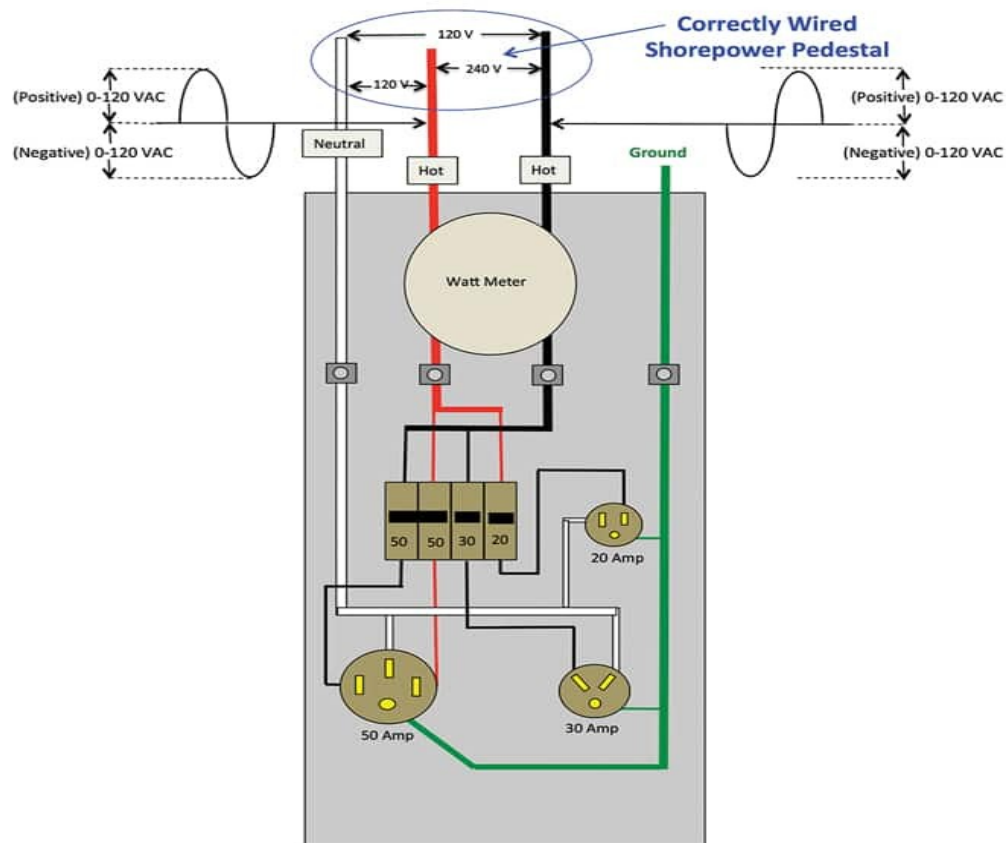


# Two Phase Waveform

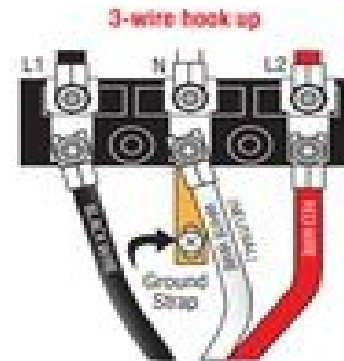




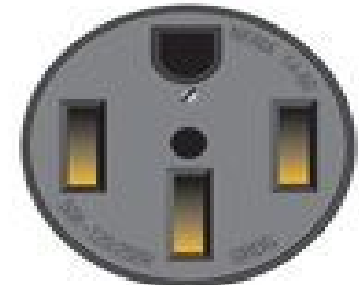
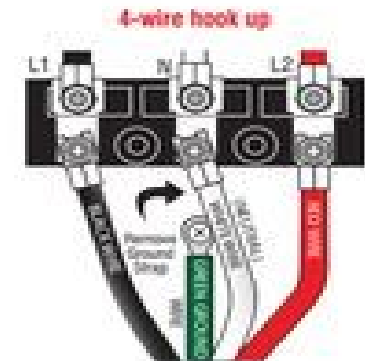
# RV vs House Dryer Connection



Older Homes and Electric Ranges

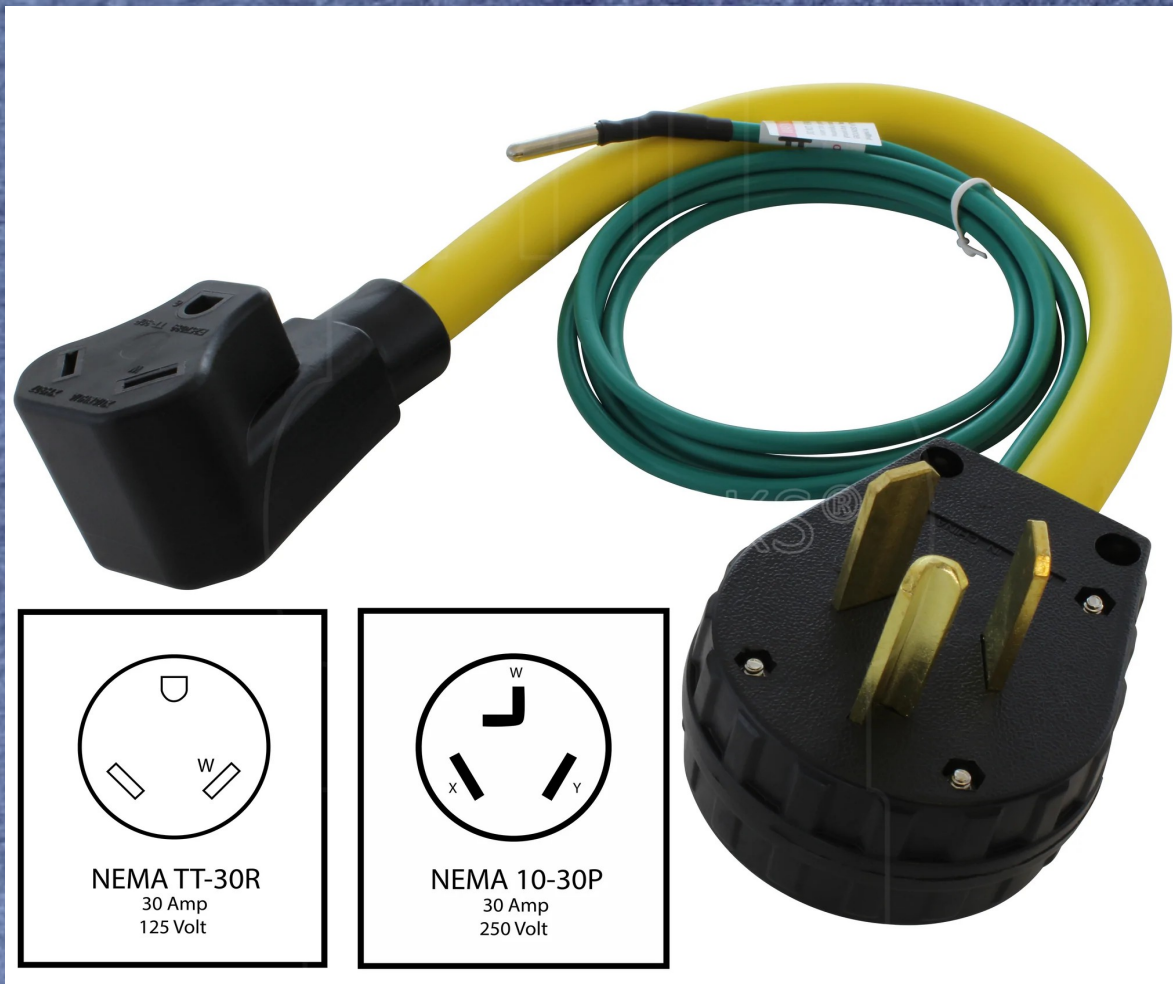


Newer Homes and Electric Ranges





# 30 Dryer to 30 Amp Dogbon





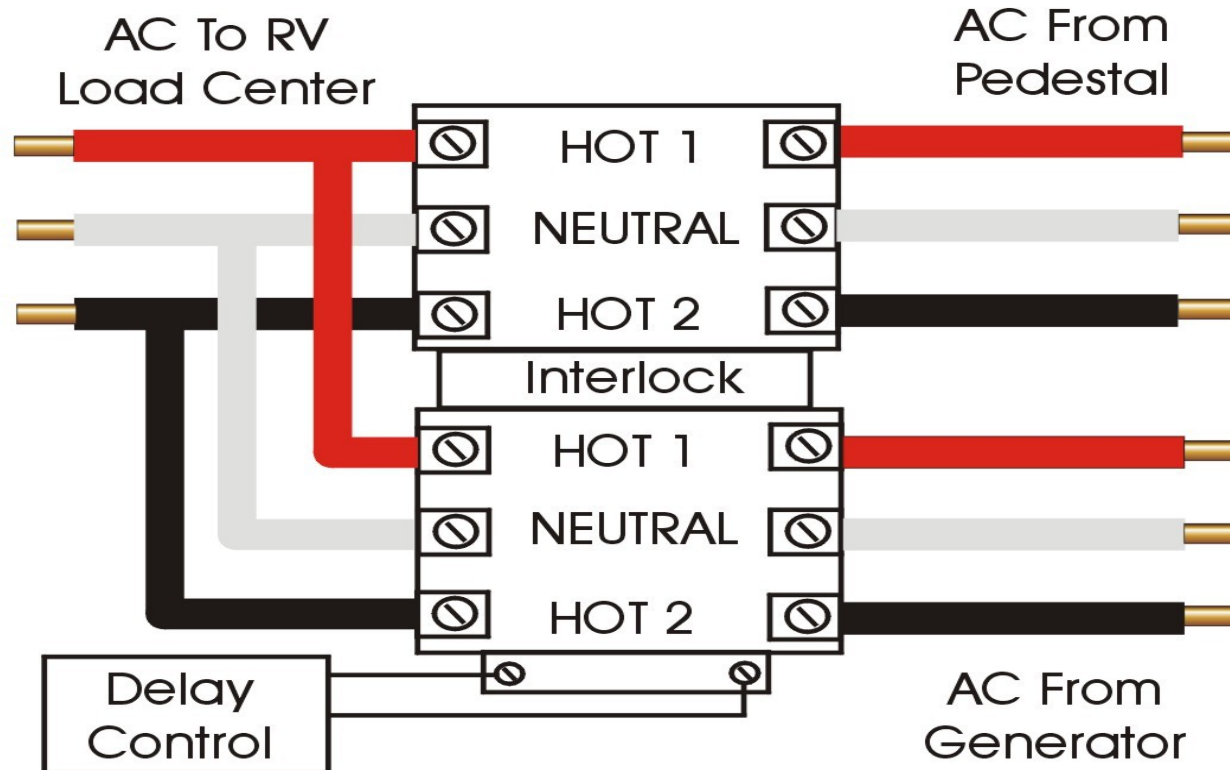
# Surge Protection



# Auto Transfer Switch

## 50-Amp Generator Transfer Switch

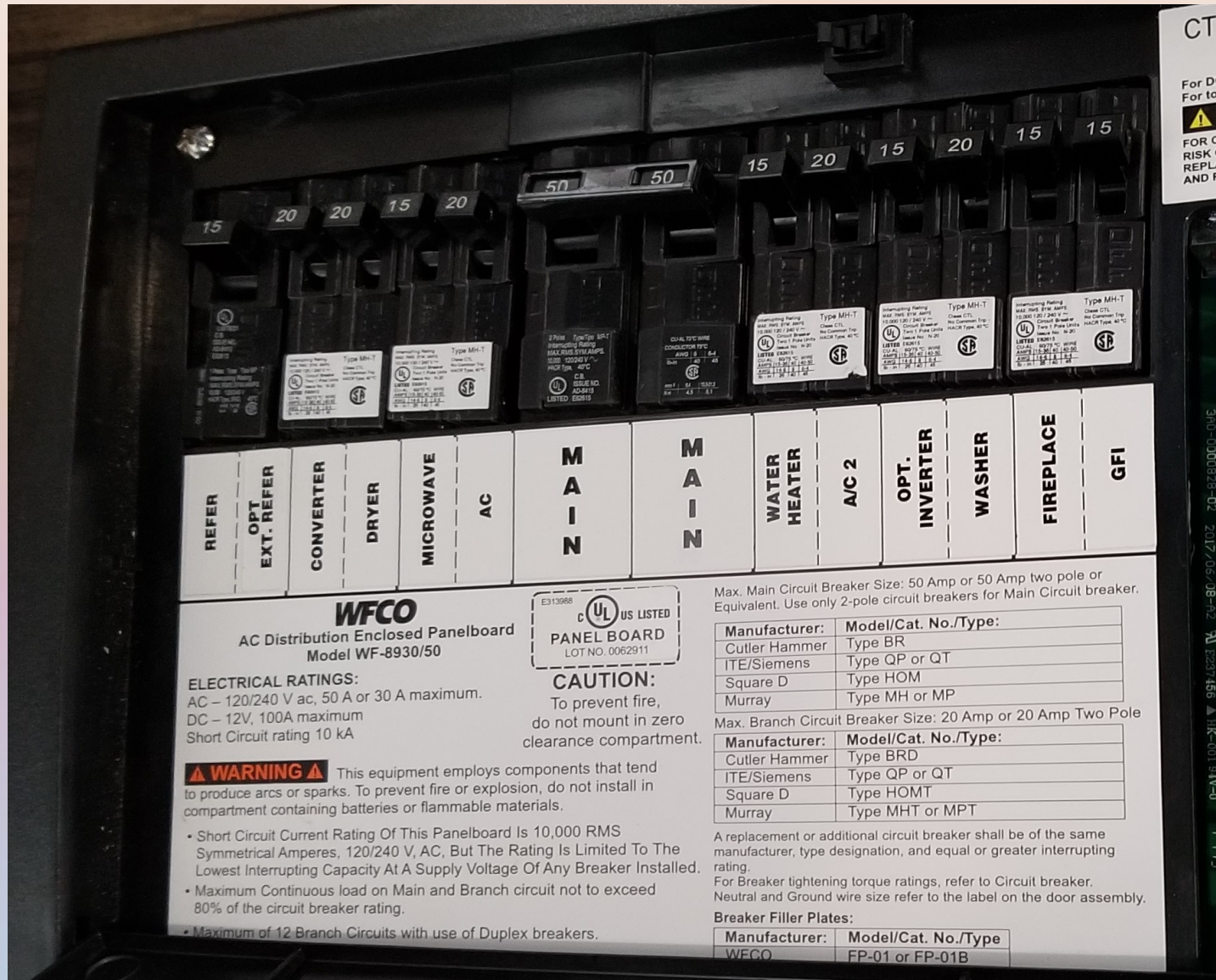
Mike Sokol - RVElectricity



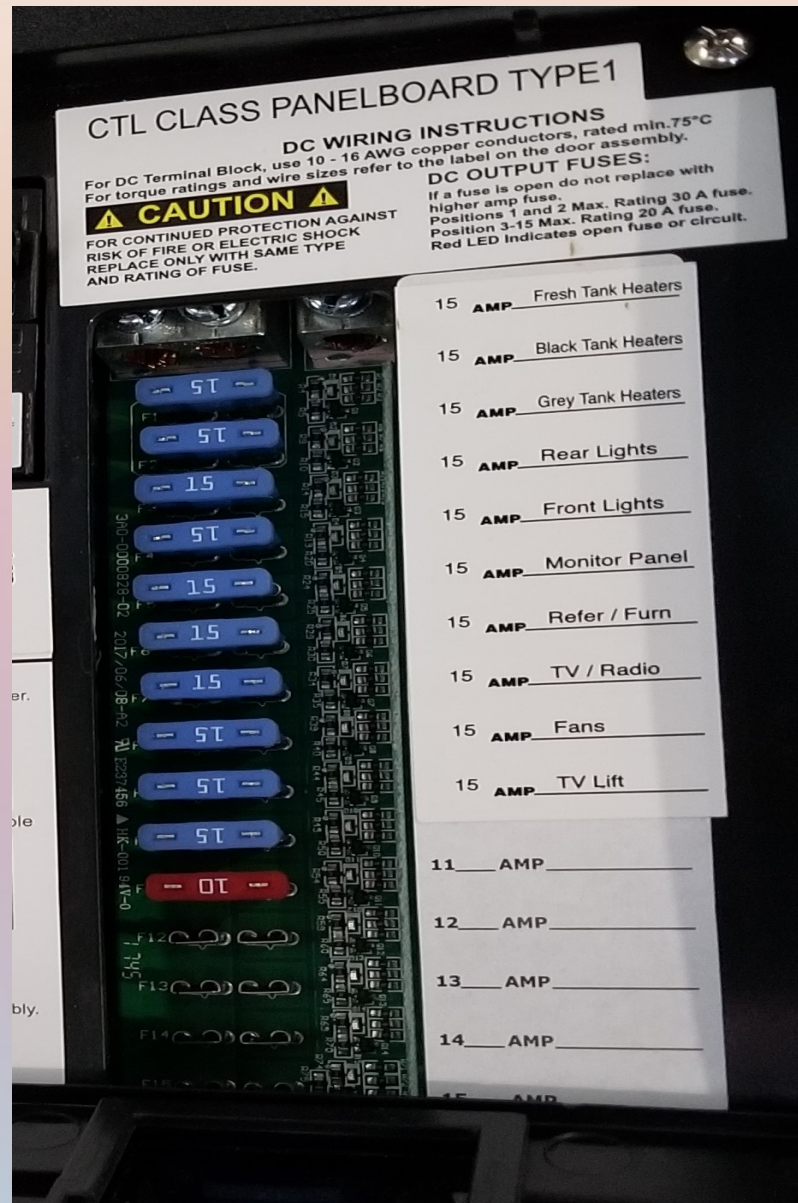
[illegible]



# RV Breaker Panel 50 Amp

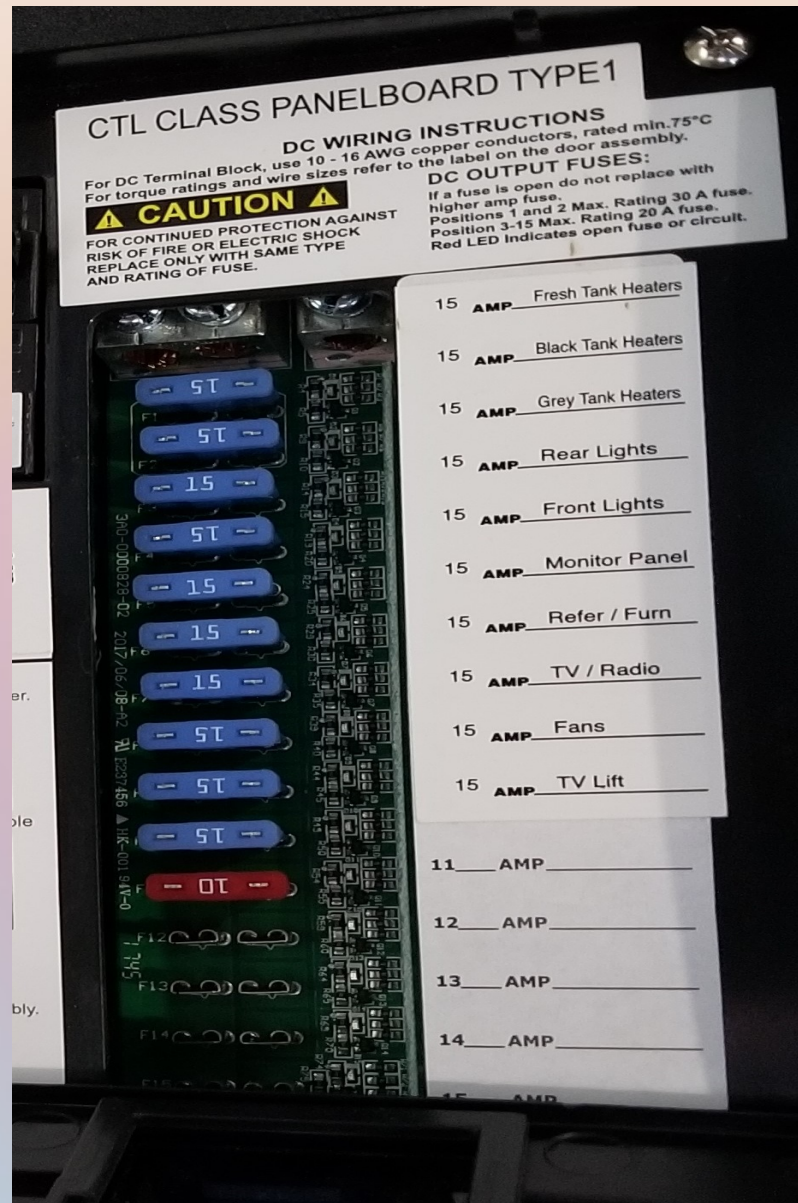


# RV Breaker Panel DC Fuses





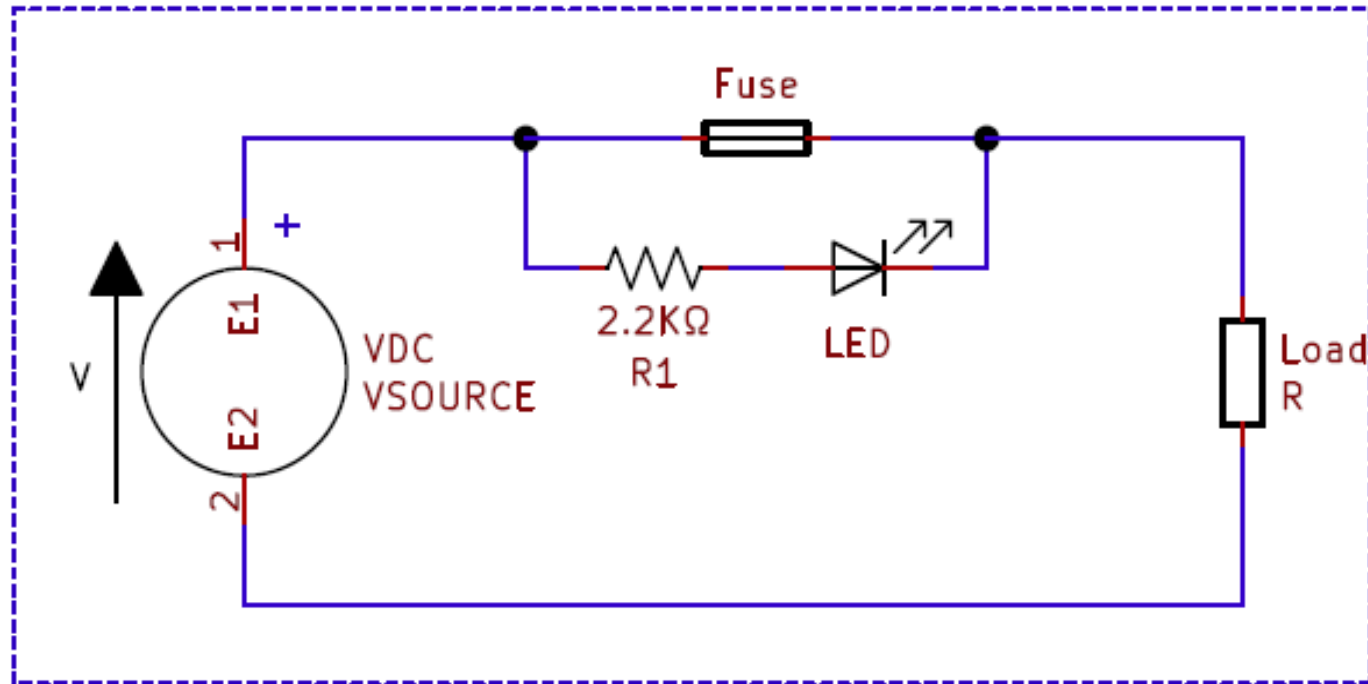
# RV Breaker Panel DC Fuses





# RV Breaker Panel DC Fuses

## Blown Fuse Indicator Circuit



theoryCIRCUIT.com

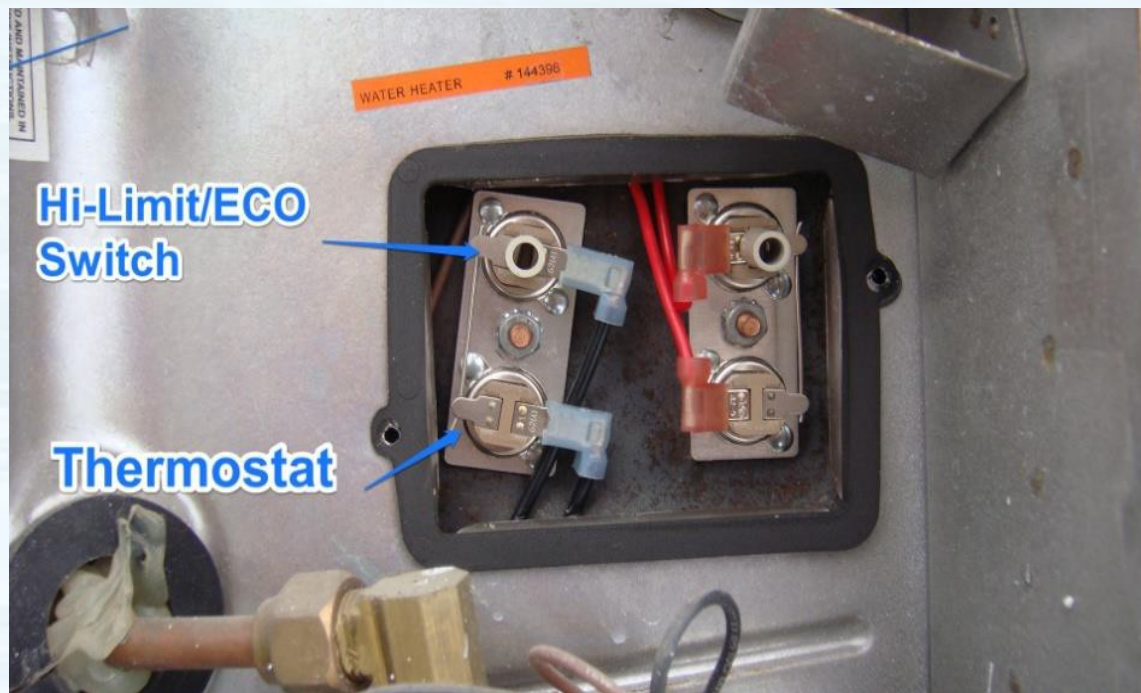
# Suburban Water Heater





# Suburban Water Heater

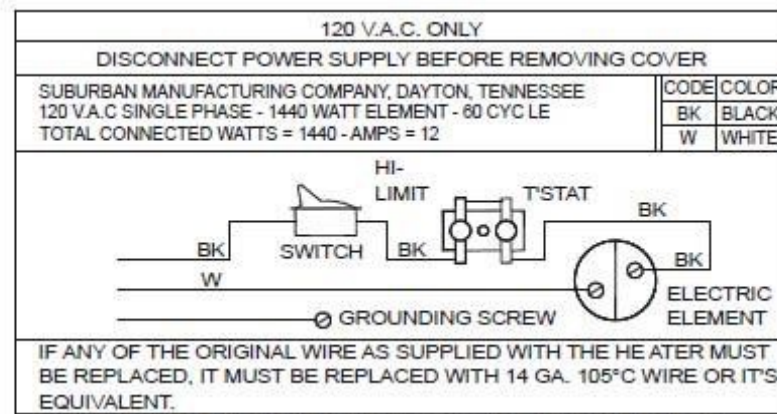
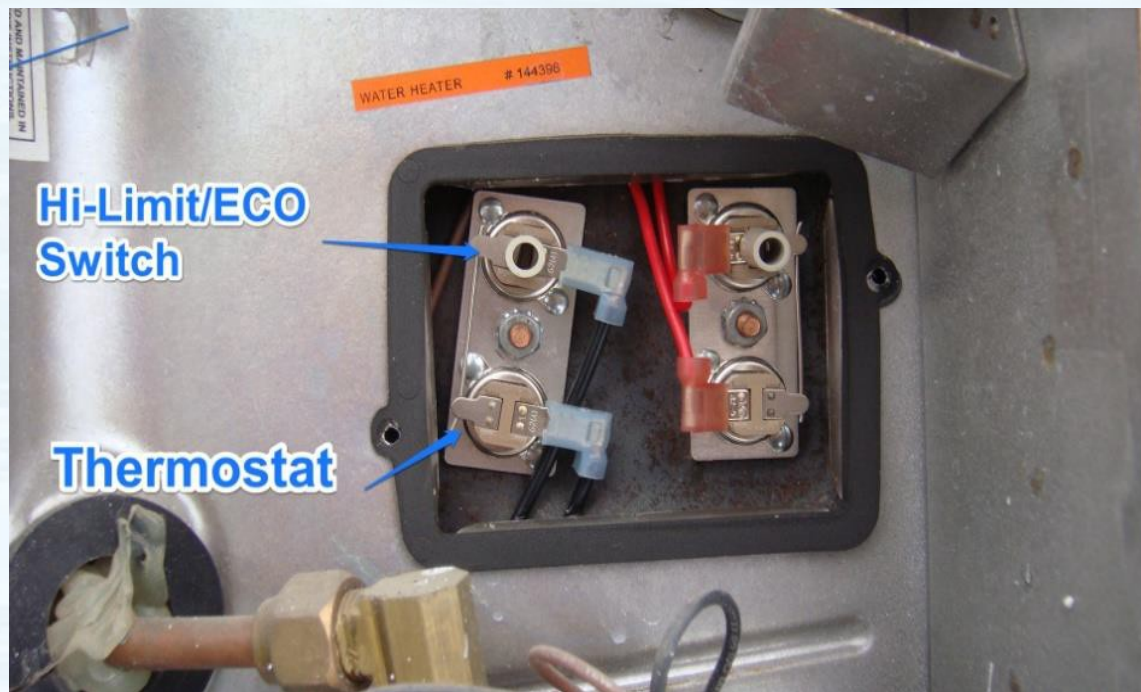
120 Volt AC



***Note that the sensor on the left carries 120V AC and the sensor on the right carries 12V DC.***

# Suburban Water Heater

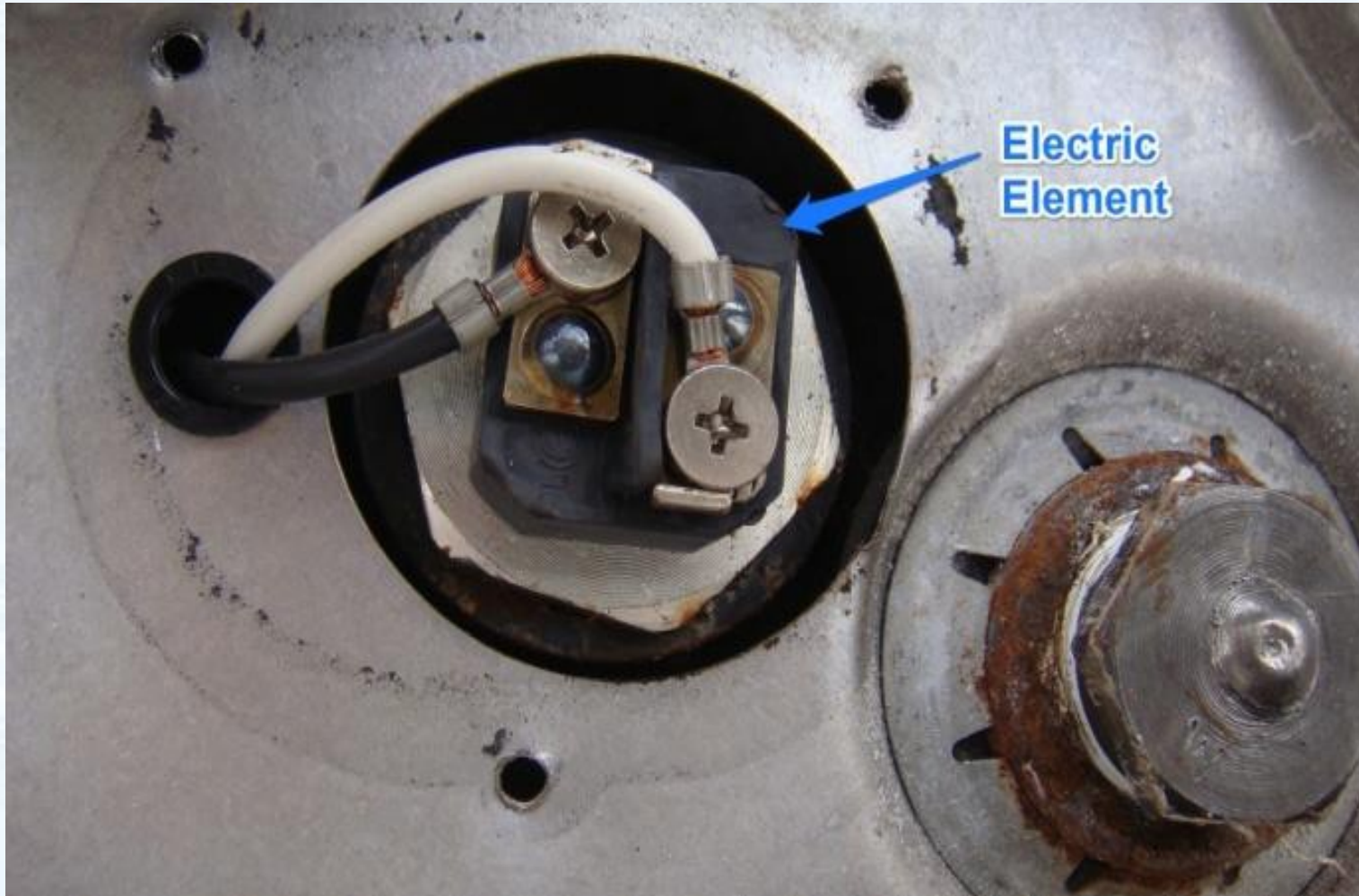
## 120 Volt AC





# Suburban Water Heater

120 Volt AC



***The heating element normally has a resistance of 14.5-17 Ohms.***

# Suburban Water Heater

## 12 Volt DC

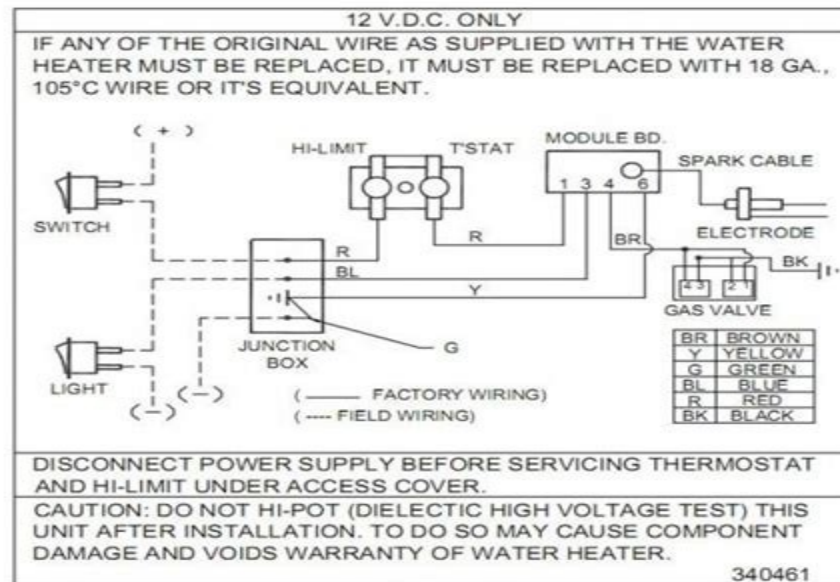
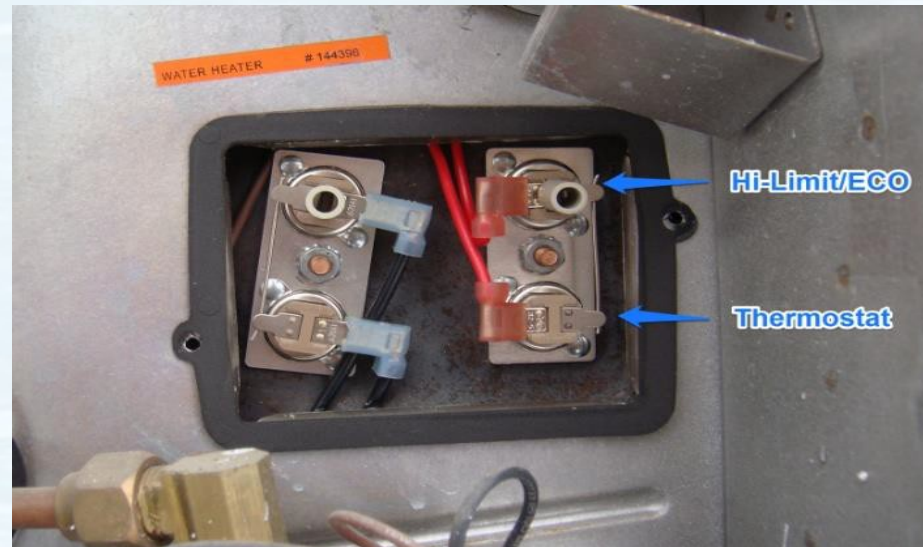
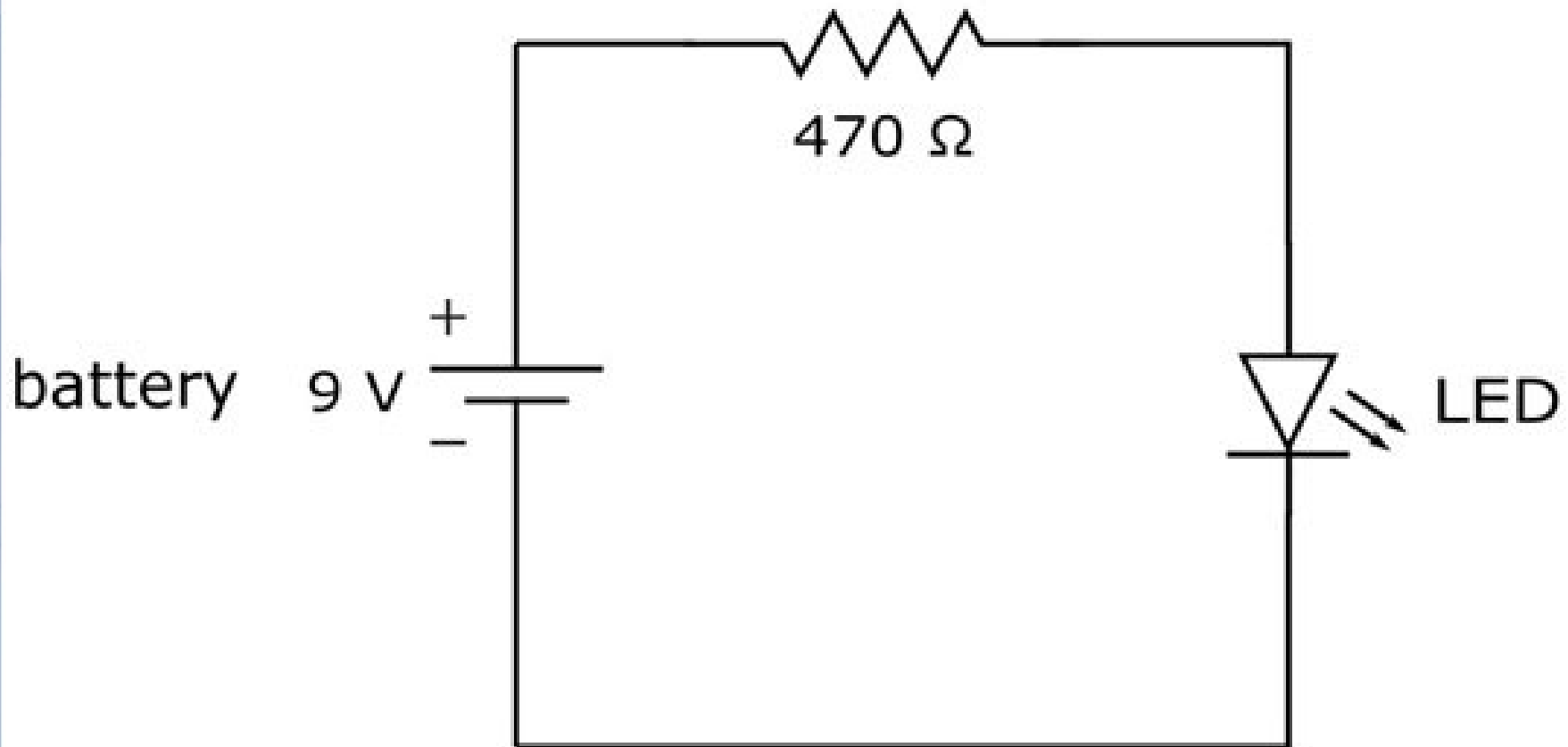


Figure 7



## LEDs

resistor



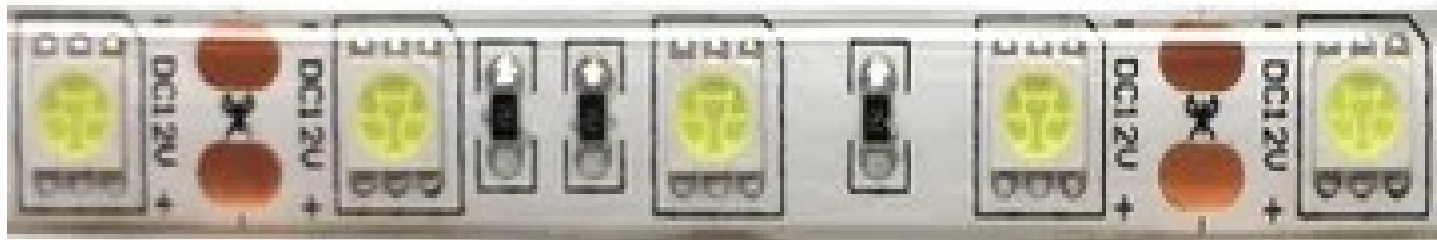
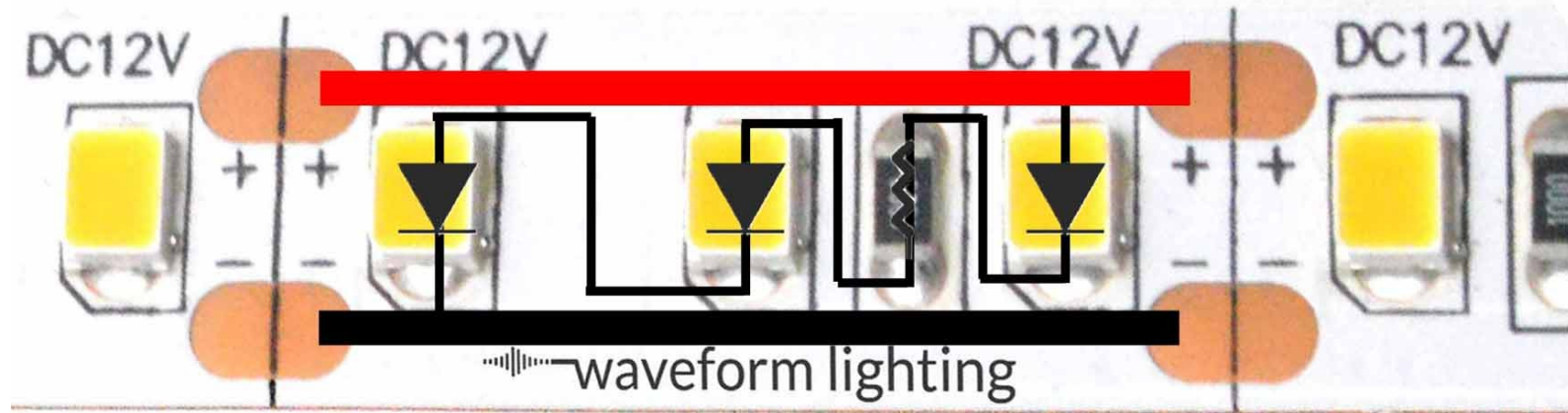
Electrons flow from negative to positive. In a direct current (DC) circuit, current flows in one direction only, and one pole is always negative and the other pole is always positive.

# LED RV Light





# LEDs



# GFCI

- What Is It

The ground-fault circuit interrupter, or GFCI, is a fast-acting circuit breaker designed to shut off electric power in the event of a ground-fault within as little as 1/40 of a second.

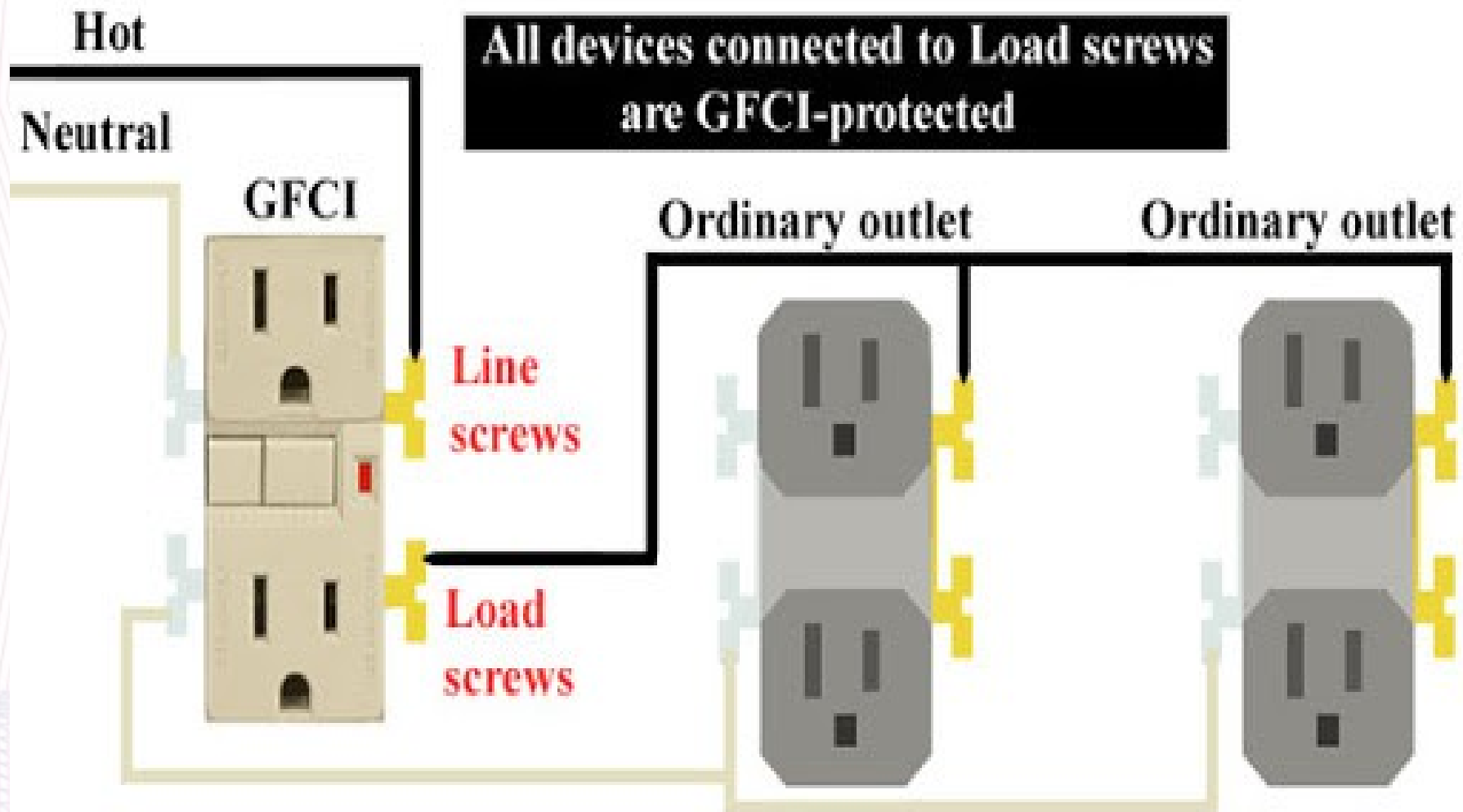
- What Does It Do

A GFCI is specifically designed to protect people against electric shock from an electrical system, and it monitors the imbalance of current between the ungrounded (hot) and grounded (neutral) conductor of a given circuit. Don't let the name confuse you — these devices will operate on a circuit that does not have an equipment-grounding conductor.

- Where Will You Find One

Commonly they are located (or should be) at bathrooms, kitchen countertops, laundry areas, unfinished basements, crawl spaces, garages and at exterior outlets.

# GFCI Connections



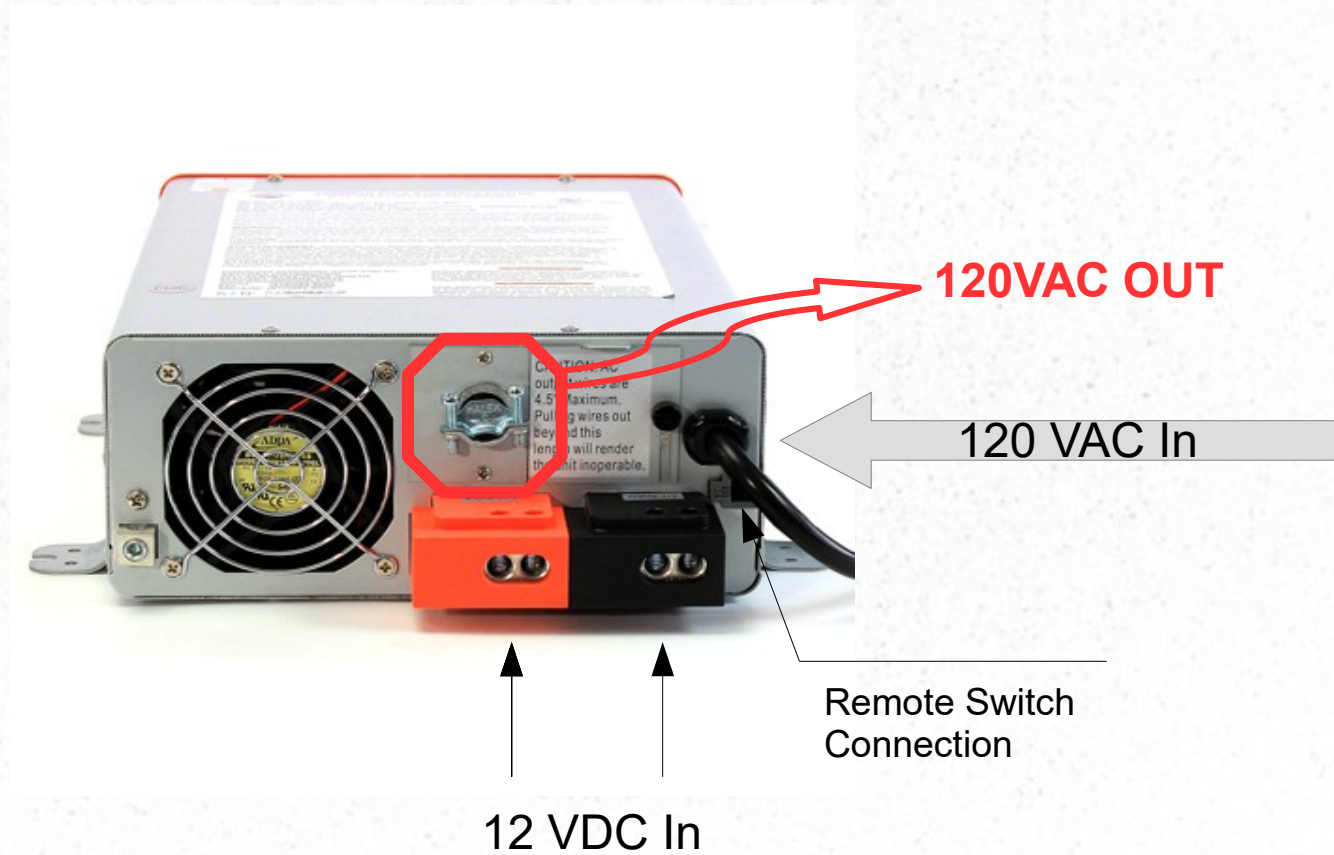
© Gene Haynes



# *Residential Refrigerator System*



# *Residential Refrigerator System*



# *Questions*

