

Trailer Systems

(Gas, Water, & Electric)

Presented
At The
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2012

Jim Cooper
June, 2012

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Rally

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System View Point

- Look at
 - Use, Source, Storage, Distribution, Use, Waste
- Consider
 - Safety
 - System Configuration
 - Math
 - System Components
 - Troubleshooting

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Use of the Material

- **Propane**
 - Burned to generate heat
- **Water**
 - Human consumption
 - Used as a solvent
 - Used as a mass
- **Electricity**
 - Electron flow converted to energy



Gas System Characteristics

	Propane	Water	Electric
Source	Dealer	Tap	AC Receptacle (120 VAC)
Storage	Tank (100psi)	Tank	Battery (12 VDC)
Distribution	Cu pipe (½ psi)	Cu or Pex pipe (50 psi)	Cu or Al Wire
Use	Heat	Drink, Wash, Flush	Heat, Light, Rotate
Waste	Heat & Exhaust	Gray & Black Water	Heat

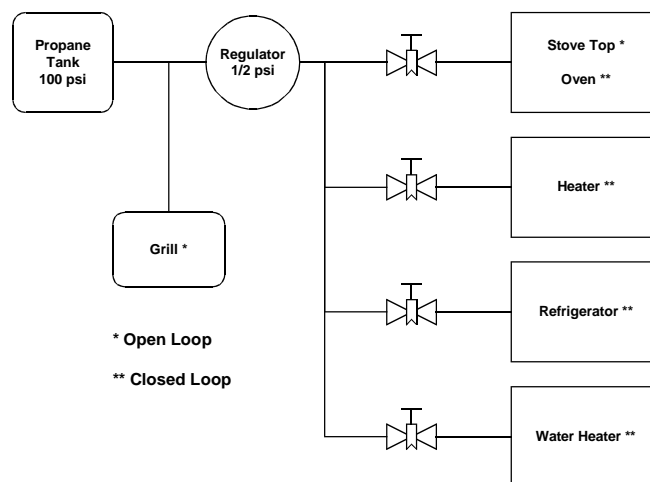


Propane Safety

- Avoid Fire/Explosion & Carbon Monoxide
 - Propane heavier than air – mount detector low
 - No combustibles (critter nests) around flame
 - Mount carbon monoxide detector low
 - Assure working exhaust & air flow



Propane System Diagram



Do The Math

Inside the tank

$PV = rT$ (Volume is constant. If Pressure drops, Temperature must drop, and visa-versa.)

In the flame

Flammable at 2.2% to 9.6% air ratio.

- 4% optimal
- <2.5% lean, flame lifts from burner
- >8% rich, yellow flame

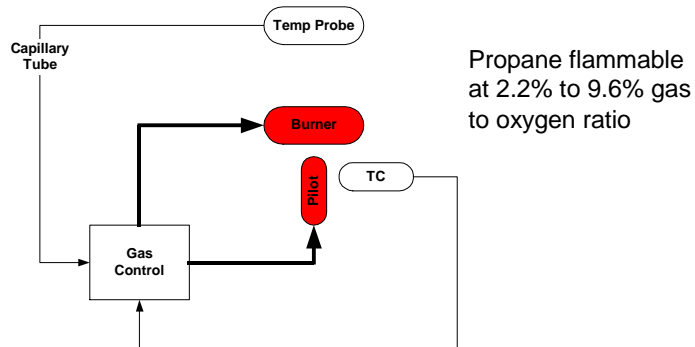


Propane Regulator

- Two stage automatic change over
 - 1st stage output is 10 psi
 - 2nd stage output is 11 water column inches
 - Change over will draw vapor from second tank when first is empty
 - Lever point to empty tank, Red Flag
 - Lever point to non-empty tank, Green Flag



Gas Controller Diagram



Propane Big Deals

- Disrupted Air Flow
 - Intake Air
 - Exhaust
 - Cooling (refrigerator)
- Failed Thermocouple or Capillary Tube
- Leaks

Propane Troubleshooting

- Pilot Flame
 - Adjustment
 - Thermocouple Position
- Thermostat
 - Connections
 - Working?
- Air Flow
- Leaks
 - Gas Detector
 - Bubbles
 - Manometer (low pressure meter)

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Gadgets, Gas



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Water System Characteristics

	Propane	Water	Electric
Source	Dealer	Tap	AC Receptacle (120 VAC)
Storage	Tank (100psi)	Tank	Battery (12 VDC)
Distribution	Cu pipe (½ psi)	Cu or Pex pipe (50 psi)	Cu or Al Wire
Use	Heat	Drink, Wash, Flush	Heat, Light, Rotate
Waste	Heat & Exhaust	Gray & Black Water	Heat

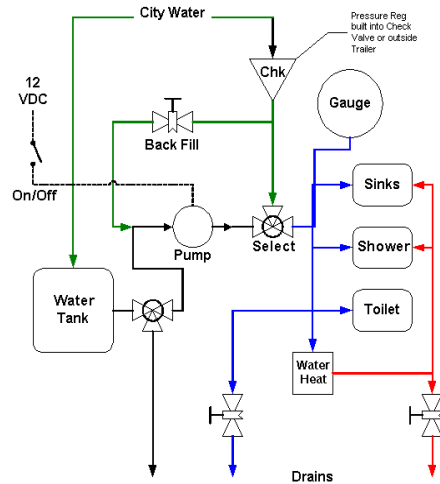


Water Safety

- The issue is contamination
- Leaks are a danger to your RV
 - Floor rot
 - Mold



Water System Diagram



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Do The Math

Water weighs 8.3 pounds / gallon

- 0.036 # / cu in
- 62.4 # / cu ft

Water volume:

- 1 Gal = 0.1337 cu ft
- 1 Gal = 231 cu in
- 1 cu ft = 7.48 Gal

$$20 \times 48 \times 6 = 5760$$

$$/ 231 = 25 \text{ gal}$$

$$25 \times 8.3 = 207 \#$$

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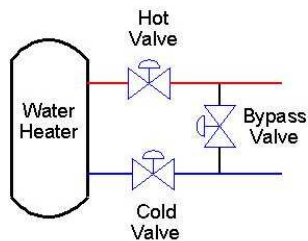
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Water Heater Bypass

“I get in the shower,
and the water is
hot for less than a
minute.”



The bypass valve is
open.

Water System

- Big Deals
 - Winterizing (anti-freeze or blow out)
 - Input Check Valve & Pressure Regulator
 - Hose Clamp Connections – not reliable
- Troubleshooting
 - Pressure Gage
 - If system holds pressure, no leaks.

Gadgets, Pressure Gage



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Electrical System Characteristics

	Propane	Water	Electric
Source	Dealer	Tap	AC Receptacle (120 VAC)
Storage	Tank (100psi)	Tank	Battery (12 VDC)
Distribution	Cu pipe (½ psi)	Cu or Pex pipe (50 psi)	Cu or Al Wire
Use	Heat	Drink, Wash, Flush	Heat, Light, Rotate
Waste	Heat & Exhaust	Gray & Black Water	Heat

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Electrical Safety

Shock

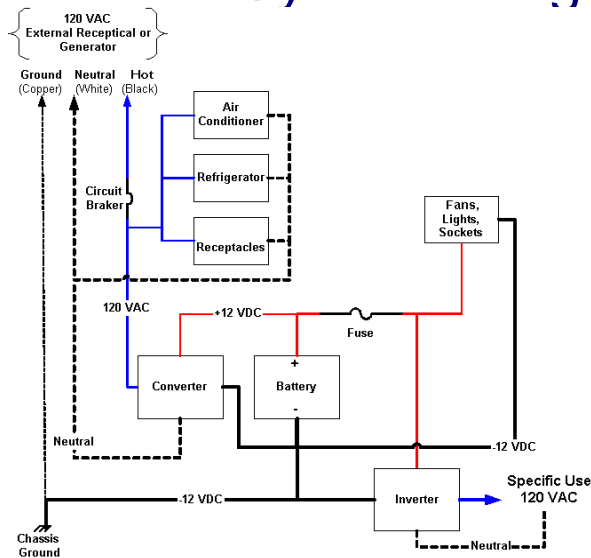
12 volts DC not dangerous

120 volts AC is dangerous

- Hot (black) and Neutral (white) must not be reversed.
- Neutral and Common (copper or green) are not connected in the trailer.

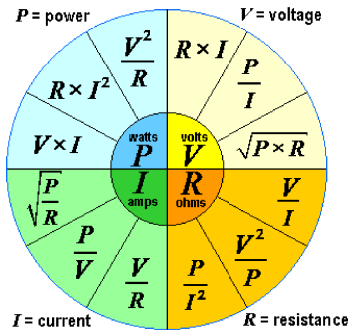


Electrical System Diagram



Do The Math

Double-click to add graphics



Lights, heaters, and motors present Resistance to the Current flowing through them, which is forced by the Voltage across them. As a result, they consume Power.

The Big Picture

Your RV runs on 12 volts DC supplied by the battery. 120 Volts AC is there to charge the battery, power big appliances, and provide receptacle power.

Batteries are charged by 120 VAC Converters and Solar Panels.

Sometimes Inverters change 12 VDC into 120 VAC to provide receptacle power when not externally available.

Batteries

- **Capacity**
 - Amp Hours (100 AH)
 - Low Temp reduces AH
- **Charge**
 - Full 12.6 – 12.8 VDC
 - 50% 12.2 VDC
 - 0% 10.5 VDC
- **Charging**
 - "Bulk" (varying volt) , Max Current
 - "Absorption" (14.2 – 15.5 VDC), Limited current
 - "Float" (12.8 – 13.2 VDC), Trickle current
- **Load draws current (amps) over time**
 - amps * hours = AH
- **Load in Watts**
 - Watts = Volts * Amps
 - 100W light on 120VAC draws 0.8 amps, but running on 12VDC it draws 8 amps.
 - 25w is 25w/12vdc = 2a
 - 100w is 100w/12vdc = 8.3a

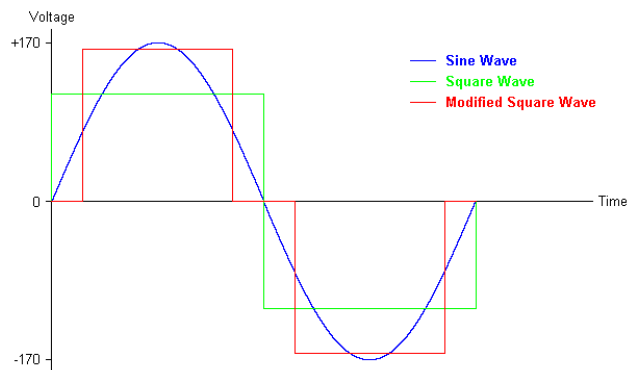


Inverter Characteristics

- **Square Wave**
 - Cheap
 - High standby current, low surge Current
 - Not good for electronics
- **Modified Square Wave**
 - Inexpensive
 - Peak voltage varies with battery voltage. Noise and harmonics.
 - Poor electronics performance
- **Sign Wave**
 - Expensive
 - Perfect output
 - Perfect electronics performance



Inverter (12VDC → 120VAC) Wave Forms



Electrical Big Deals

- Source Wiring
 - Reversed Hot & Neutral
 - No Ground
- Poor Connections
 - Loose Wires
 - Aluminum Wire Oxidation
- Drain on Battery
 - Amps = Watts / Volts
 - Battery stores Amp Hours of current

Electrical Troubleshooting

- 120 VAC
 - 120 VAC Monitor
 - Wiring Tester
 - Volt-Ohm Meter
 - 120 VAC Detector
- +12 VDC
 - 12 VDC Monitor
 - Volt-Ohm Meter
 - 12 VDC Detector

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Gadgets, 120 VAC Monitor



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Gadgets, 12 VDC Monitor



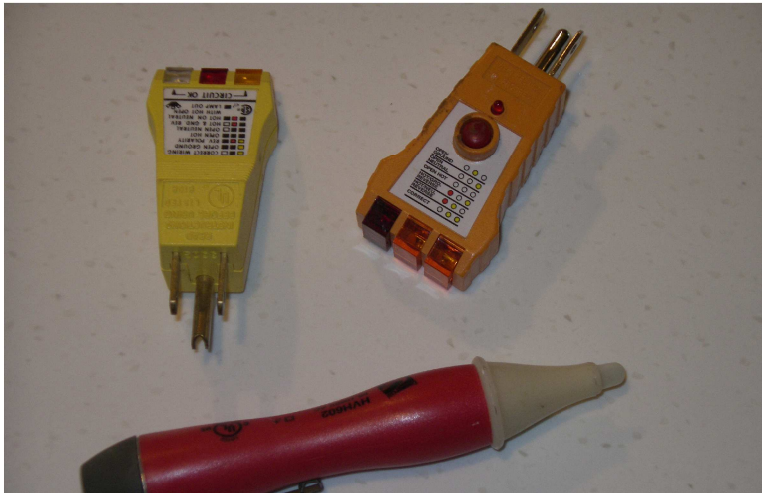
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Gadgets, 120 VAC



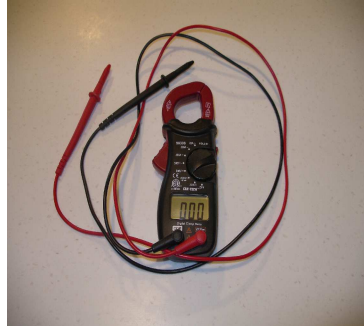
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Gadgets, Multimeter



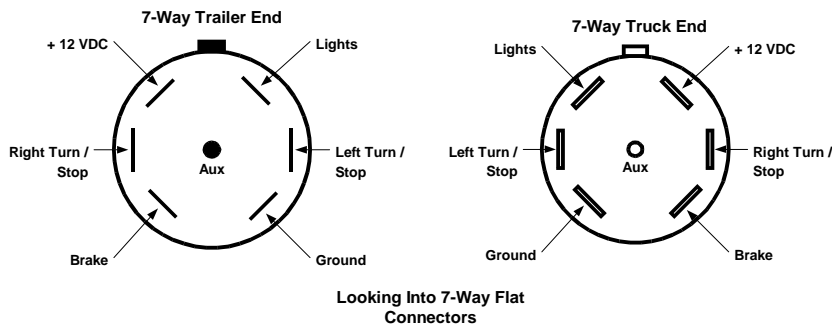
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Brake & Light Wiring



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7-Way Connector

- Big Deals
 - Poor Contacts
 - Poor Ground
 - Open Fuses
- Troubleshooting
 - Voltmeter or 12 VDC detector
 - Fused Short

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Gadgets, 7- Wire



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