Primer on AC power

AC power supply in our homes is taken for granted since the power utility company controls the quality of the power supplies to our homes. The sine wave of the power supply is a true 60 Hz (cycle) and the acceptable voltage will range between 107 to 127 volts.

Products on the market are designed to run on these controlled power supplies. We now have more sensitive electronics on board now than we had in the past. Most appliances such as fridges and stoves have electronic controls. Flat screen TV's and associated electronic components are more power supply sensitive.

On a boat we may have more than one power supply. These may be shore power from your marina dock, an onboard generator or an inverter. It is important that the power from these sources is within an acceptable range when the circuit is loaded. If is in not then we will experience poor performance from our electrical and electronic devices as well as possible damage and a shortened life span.

We have several different loads on a boat that will affect the power supply when they are out of balance. Following are some examples:

Capacitive loads: These can be motors in refrigeration units, Air Conditioning water pumps and compressors and other motors.

Resistive Loads: These can be lights, stove element, clothes dryers and anything with a resistive element.

Inductive Loads: Anything with a transformer in it such as some stand alone battery chargers and inverter chargers.

Effects of Load

1. Sine Wave: AC power is 60 Hz (cycles) per second. In the perfect situation one Hz (cycle) will rise from a value of 0 volts to positive 120 volts, back down to 0 volts and down to Negative 120 volts and back to 0 volts. The

reason it is called “alternating current” AC. In a balanced load situation the current (amperage) will be matched to the voltage wave form.

Due to unbalanced loads the current can either lead or lag the voltage. This can creates problems on our power supply with detrimental effects on our loads.

2. Power Factor: this is an important aspect of an AC system. We have to consider *Real Power* the amount of power the system is capable of delivering and *Apparent Power* the amount of power actually used. Product of current and voltage. In the perfect world we would like to have a 100% Power Factor. In the real world the different loads such as capacitive, inductive and resistance we will have a lower power factor. So Power Factor = Real Power/Apparent Power. Therefore a load with a 70% PF showing an apparent load of 3500 watts would require a real power supply of 5000 watts.

POWER SUPPLIES:

We can look at some of the different power supplies and affects and possible corrective measures

A/ Shorepower

In a well designed marina shorepower should not be a problem. When you are traveling and staying in different marinas you should keep an eye on the voltage level on the incoming shorepower. A full marina and long runs of AC power may find that you will experience low voltage below 107 volts. You would be wise to cut back on some of your critical loads such as air conditioning.

Cruisers that have 120/240 volt shorepower requirements have to ensure they have an adequate power supply. Equipment such as 240 volt air conditioning requires a good supply voltage. Some marinas are equipped with a three phase

power supply which provides 120/208. This is not good for 240 volt devices. Air conditioner compressors will run hot and cause future failure.

The best solution on a boat with 120/240 volt requirements is to install and Iso Boost transformer. This is connected to the incoming shore power and will boost the voltage from a low voltage source to an acceptable 120/240 volts.

B/ Generators

Although generators are a rotary machine they do not product a perfect sine wave. Some are better than others. You will need an oscilloscope in order to view a sine wave. Modern marine generators are very much advanced with good quality control features such as AVR (automatic voltage regulation). There are still lots of older generators that don't have the control features of the ones produced today. On some generators the frequency will fluxuate between 57 Hz and 63Hz (cycles). The voltages will fluxuate as the load increases and decreases. This will have an effect on sensitive equipment. Some of the examples you may experience:

1. Battery charger: It works well when on shorepower. A 60 amp charger will output 60 amps on shorepower. When on the generator it may only output 40 amps
2. 2 .UPS Power Supply: It will work Ok on shorepower. When on the generator it sees it as dirty power due to frequency and voltage and will not switch over to the battery charge function.

Some boaters will utilize portable generators (which I am not in favour of) to charge up their batteries. Due to the factors involving AC supplies and loads it would be wise to contact the manufacture of the battery charger to see if the applications will work. Typically most chargers will require a generator output supply that is three times the battery chargers AC requirement. Therefore the *apparent power* of 7 amps may require a generator capable of *real power* supply of 21 amps.

In order to get the best results from a generator it should be kept well tuned up and the output setup for the correct frequency and voltage.

B/ Inverters

A popular source of power on many boats today is an inverter. Prices have dropped on them considerably in the past years. In the past many inverters where modified sine wave. A true sine wave inverter was much more expensive. Due to the prices dropping a true sine wave inverter is well worth the money. A true sine wave will provide power as clean if not cleaner that your power utility. Today's sensitive electronics and motors work well on them.

Modified sine wave inverters can cause problems on electronics. You may see lines on your TV screens as an indication. The other problems you will not see.

Conclusion

If you experience problems with your equipment, check out the power supply quality before you blame the equipment.