

A Basic Lesson in Electrical Capacity

Almost everyone has paid an electric bill on a house, apartment or some other form of living arrangements. That electric bill is based on the number of kilowatt hours of power which have been consumed over a given period of time usually the period is one month.

The kilowatt is a measure of electrical power and 1 kilowatt equals 1,000 watts. Watts are the basic unit of power. My most recent stick house electric bill was for 1540 KWH (kilowatt hours) of power consumed over a 30 day period. The electric company also breaks the bill down into how many KWH's of power were used each day of the billing period in this case 51.333 KWH per day. I broke that number down even further by dividing the 51.333 KWH per day by 24 (number of hour in one day). I now have the KW's or watts used per hour of one day. The result is 2.139 kilowatts or dividing by 1,000 (definition of kilo) gives me 2,139 watts used per hour during the past month in my stick house.

That means the AVERAGE power consumption over that 30 day period 24 hours each day was 2,139 watts per hour. As we all know none of us use the same amount of power each and every minute of every day, so we are going to see cases of 4,000 watts being consumed during the heat of the day but maybe only 1,200 watts consumed during the early morning hours, when we may be sleeping. This is just a way of keeping track of the power usage and for the electric company to charge each customer their fair share of the cost of producing the power sent to them.

My home is fairly new (built in 2006) it was built using the latest electrical codes, rules and regulations. We have an electric panel rated at 200 Amps which is also capable of supplying 240 volts of electricity.

We now have two new words, Volts and Amps (Amperes). Volts or Voltage is a unit of electrical PRESSURE. Where as Amps or Amperes is a unit of CURRENT or capacity. The three terms are used in a formula to define what or how electricity works. $P = I \times E$, where POWER uses the letter "P", CURRENT uses the letter "I" and VOLTAGE or VOLTS uses the letter "E". POWER is defined by a unit as watts per unit of time, in this case one hour.

We also express the unit in kilowatts per hour to take advantage of using smaller numbers, rather than using 2,100 WH (watts per hour) we use 2.1 KWH. CURRENT is defined by a unit as AMPERES or AMPS. To make the term AMPS easier to use in a formula we can use the term MILLIAMPS or how many (one thousandths) of an AMP of current are we using. When we are talking about house current it is easier to use the term AMPS, but when we get

into the RV electrical systems which uses a combination of AC (Alternating Current) and DC (Direct Current) we will be dealing with smaller numbers of AMPS at that point we will see the unit MILLIAMPS used more often.

VOLTAGE or VOLTS, the unit of measure for electro motive force (EMF) the electrical pressure or force used to push the AMPS through the wire.

In the United States we use electrical power made up of all three components of the above formula. We also use appliances which operate on either 120 volts or 240 volts. Most small appliances use 120 volts AC while the larger appliances use 240 volts AC. More on why the two different voltages are used at a later time.

Now, back to my stick house's electrical panel, the panel is rated at 200 amps and has both 240 and 120 volt wiring. The 240 volt wiring has two 120 volt components which are timed to be 180 degrees out of phase with each other. I do not want to go into the how or why 240 volts are what we have at this point, let us just agree that it is just the way it is.

The electrical panel has four wires with have the correct wire size to carry the rated capacity of the panel, in this case 200 AMPS. So each 120 volt wire can on its own carry 200 AMPS. We have two 120 volt wires, one neutral wire and a fourth which is a ground wire.

Back to the power formula, Power in watts is equal to 200 Amps multiplied by 120 volts. Which is 24,000 watts or in more simple units, 24 KW (Kilowatts). We have two 120 volt wires so we have the capacity of 48,000 watts or 48 KW per hour. So if I were to consume ALL of the available power supplied to my house, I would be using 48 KWH x 24 hours a day x 30 days in the average month, 34,560 KWH/month or 34.56 MWH/month (MWH) that is over 34 million watts per month. I would not even like to think how much money that would cost me. The above is the POTENTIAL POWER USAGE of an average stick house in the United States.

But now back to reality, none of us would consume that much power at our stick house but we DO NOT have that capacity on our RV's. We have at best two 120 volt wires with 50 Amps on each wire. We still have the four wires, two hot (120 volt) one neutral and a fourth with is the ground wire. So power wise, our RV is rated and built to allow the consumption of 120 volts multiplied by 50 amps equals 6,000 watts. We have two legs (wires) of 120 volts so in total we have the capacity to use 12,000 watts of power or 12 KW per hour in our Tiffin motor homes.

Unless we have the fortune to ONLY connect to newer or better built RV parks we will never have the campground SUPPLY our coach's FULL rated power capacity.

We also have our own portable power source, the Onan generator. In my case a 7.5 KW Onan diesel powered generator. Rated output is 31.75 amps on each 120 volt leg (wire) of our generator. This is a 120 volt **ONLY** generator but we have two 120 volt legs so, a total of 62.3 amps under full load. Again back to the power formula, 120 volts multiplied by 31.75 amps is equal to 3,810 watts, we have two 120 volt legs so a total of 7,620 watts from our on board generator.

Now if I am camping in an older or in some cases state or federal campground and they **ONLY** provide a 30 amp electrical service. The electrical pedestal is wired with three wires, one hot (120 volt) one neutral and the third is a ground wire. So back to the formula, power in watts is equal to 30 amps multiplied by 120 volts which equals, 3,600 watts or 3.6 KW per hour. We can further reduce the available power to 20 amps and using the same formula we now have 2,400 watts or 2.4 KW per hour. Or even 15 amps with 1,800 watts or 1.8 KW per hour.

Power available at the stick house:

200 Amp	48,000 watts per hour	48.0 KW per hour.
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Power available when connected to shore power:

50 Amp	12,000 watts per hour	12.0 KW per hour.
30 Amp	3,600 watts per hour	3.6 KW per hour.
20 Amp	2,400 watts per hour	2.4 KW per hour.
15 Amp	1,800 watts per hour	1.8 KW per hour.

Power available while running the on board generator:

31.75 Amps	3,810 watts per hour	3.8 KW per hour
31.75 Amps	3,810 watts per hour	3.8 KW per hour
62.3 Amps	7,620 watts per hour	7.6 KW per hour

As you can see when using the on board generator we have more than twice the available capacity that we have when connected to 30 amp shore power but less then 64 percent (about 2/3) of what is available when connected to 50 amp shore power.

So what appliances do we use to consume the power connected to our RV's? The following is a short list of appliances which consume our coach's electrical power. Each unit has the rated wattage of the power consumed by using the appliance for one hour. In some cases the appliance will not be used for one hour, in those cases you will need to divide the wattage by 1/2 if only using for 30 minutes or 1/4 if only used for 15 minutes.

Home Theater System	90 watts
AC powered Lamps, (100 watt bulb)	100 watts
Curling Iron	150 watts
LCD TV	155 watts
Computer and accessories	200 watts
Norcold 1210IM Refrigerator	500 watts
Inverter/battery charger	1,000 watts
Microwave	1,600 watts
1 AC/HP	1,560 - 2,000 watts
2 AC/HP's	3,120 - 4,000 watts
3 AC/HP's	4,650 - 6,000 watts
Clothes Dryer (120volt)	1,500 watts
Hair Dryer	1,500 watts

So in most cases if we are connected to reliable 50 amp shore power depending on how well TMH balanced the electrical load, we can get by with operating most of our creature comforts built into our RV's. We begin running into problems when we are required to use our generator or when connected to 30 amps of shore power or less. That is when we need to understand how to and also be able to budget the available power. In the event you do not understand how to budget or do not care to use this information, then stand by to reset circuit breakers on your inverter, electrical panel, generator and/or outdoor electrical pedestal.

I have presented this simple lesson hoping the information it contains will assist everyone's better understanding of the need to budget your coach's electrical power use.

We have not even considered the DC power consumed by our coach!