Re: Newbie − Current, Voltage, Resistance, Power and Transformer theory

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- *Date*: Mon, 16 Oct 2006 16:49:07 −0400

Sorry, the first word is "Imagine" and not "Image".

I always screw that word up the same way and my work processor never helps.

Dorian

"Dorian McIntire" <dorianmc@xxxxxxxxxxxxx> wrote in message
news:6bSYg.17093$O65.16967@xxxxxxxxxxxxxxxxxxxxxxxx

> "hdjim69" <hdjim69@xxxxxxxxxxx> wrote in message
> news:1161016103.078589.288050@xxxxxxxxxxxxxxxxxxxxxxxxxxxxxx
>
>> I'm self−teaching myself electronics and the only place to ask questions is in this forum so please excuse me if this has been asked a million time already but after reading several books, I still have questions on these topics. No real values, just theory in this question.
>>
>> I'm just starting the section on AC and the book is explaining why we (homes and industry) use AC instead of DC and the use of transformers. Now, the books says the reason we use AC is to minimize power loss. That homes and industry need a lot of current and if we were using DC we'd need to push a huge amount of current through the transmission lines and the higher the current the more we'd lose in heat loss. OK fine. But now let's see what happens in AC. Rather then pushing a huge amount of current we have a very high voltage say 200,000 to 600,000 volts and a low amount of amps (current). But how can we have this HUGE amount of "pressure" (the typical explanation of what voltage is) and hardly any current ? I've been reading that voltage and current are proportional − the more voltage the more current. Ahh... but this isn't the case really since current is a variable value. It depends on the amount of resistance. So getting back to the transmission lines, if we have HIGH voltage and LOW current then resistance MUST be high. E = I * R that is, if I is low R must be high to get a high value of E. And resistance is what cause heat which causes power loss. So how can we have low current + low resistance =

high voltage ?

In summary, if we have very high voltage and low current we must have very high resistance which would eliminate just about all the current so loss would be almost 100%.

TIA

J

Image you wanted to transmit 1Kw (kilowatt) of power from point A to point B. This 1Kw of power could represent 1V (volt) at 1000A (amps) or it could represent 1000V at 1A or an infinite number of other possibilities. The product of volts and amps in all cases is 1000 watts. If your transmission line has 1 ohm of resistance there are two scenarios:

A − You push 1000A of current of through the transmission line and experience a power loss of 1000A * 1000A * 1Ohm (I squared * R) = 1,000,000W (watts) or 1000Kw of power dissipated as heat in the transmission line. You will measure a 1000V voltage drop across the transmission line and will require 1001V to get your 1V at 1Kw to the load on the other end. You lose 1,000,000 watts of power in the process of transmitting 1000 watts.

B − You push 1 A of current through the transmission line and experience a power loss of 1A * 1A * 1Ohm = 1 Watt of power dissipated as heat in the transmission line. You will experience a 1V voltage across the power line and so will need 1001 volts to get your 1000V at 1Kw to the load on the other end. You lose 1W of power in the process of transmitting 1000 watts.

You will need a transformer on the other side of the transmission line to convert your transmitted power to the voltage required by your load. Transformers make converting power from high current − low voltage to high voltage − low current and back again trivial in AC systems and with very little power loss in the transformer itself.

The down side of high−voltage transmission is the possibility of insulation failure, arc−over and, of course, accidental electrocution of personnel.

The same power transmission problems exist in other systems such as hydraulic and mechanical systems. If you were transmitting a large amount of hydraulic power over a long distance you might convert it to high pressure−low flow using an appropriate hydraulic converter. When transmitting a large amount of mechanical power a long distance you might use the gear−train (mechanical equivalent of a transformer) to transmit the power in the form of a high torque − low rpm. The power robber in all these systems is friction due to movement of some medium whether its fluid, rotating parts or moving charges.

Hope this helps.

Dorian

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