

Why Isn't There Enough Power To Start My Bike!?!

By Drjones18LC

This article is going to examine the importance of good connections. By the end of the article you will have a greater understanding, and a new appreciation of why it is you should keep *all* your battery/starter cable connections clean and tight...and a much better understanding of circuits in general.

Most of the LC/C90 community is aware that the electrical/charging system on our bikes have some weak points that need attention. Given our bikes history, whenever we hit the start button and there isn't enough oomph to turn it over properly we automatically assume either the charging system isn't up to snuff, the battery is on it's way out, or the decomp cables need to be adjusted. While each one is certainly a possibility, what most people don't consider is the amount of connections there are in these circuits, and that *any* resistance in these connections due to either corrosion, oxidation, the connection not mating properly, etc., can rob you of much more power than you are aware of.

First We Need A Little Electrical Theory

(don't be afraid...it isn't that hard)

When we talk about “Ground” on our bikes we are actually talking about the negative battery terminal. The negative battery terminal is the reference we use to measure all the different voltages on our bikes. (The major exception to this is measuring the AC stator voltage) That reference is zero volts.

If you're using your multimeter to measure DC voltage anywhere on your bike you will always have the negative meter probe at ground. Any voltage you measure is a comparison to that zero volts reference we call ground. If you measure the voltage at a light bulb socket for example, the negative probe will be touching the terminal connected to the ground wire, and the positive probe will be touching the terminal connected to the positive, or hot wire. If your meter reads 12 volts it means the pos/hot wire is 12 volts higher in potential than the zero volt ground reference.

“Ground” is also any point that is connected to the negative battery terminal. On our bikes, the cable connected to the negative battery terminal also connects to a starter bolt on the engine. (This is not random as we will see later on) Since the engine is connected to the negative battery terminal the engine *should* also be at zero volts. (more on this later) The engine is also bolted directly to the frame. Since that is also metal to metal contact the frame *should* also be at zero volts and considered ground.

A “Load” is any item that uses electricity to do its work. A load is always in between ground and the positive/hot side of the battery. A load is also a “resistance.” The resistance (measured in Ohms) in a circuit determines how much “current” (measured in Amps) flows in it, at a particular voltage. If you have any two quantities, a third can be found using some simple math known as Ohm's Law's. They are:

$$\text{Voltage} = \text{Ohms} \times \text{Amps}$$

$$\text{Watts} = \text{Voltage} \times \text{Amps}$$

$$\text{Amps} = \text{Voltage} / \text{Ohms}$$

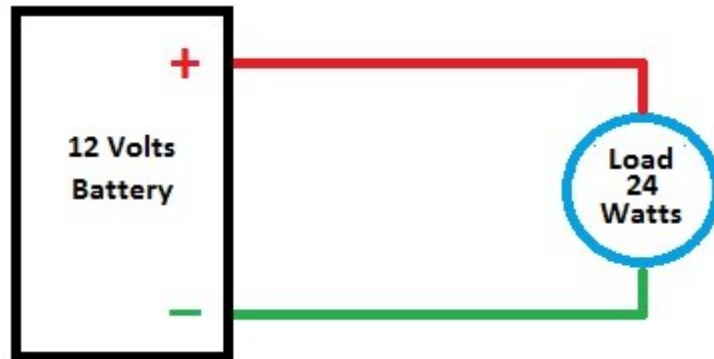
$$\text{Watts} / \text{Voltage} = \text{Amps}$$

$$\text{Ohms} = \text{Voltage} / \text{Amps}$$

$$\text{Watts} / \text{Amps} = \text{Voltage}$$

Wattage is a measure of Power used by a load. Light bulbs are the best example of a load rated by wattage, but they aren't the only example. Sometimes you have a load like an amplifier/radio. An amplifier/radio can be rated by wattage, but that is *supposed* to be a measure of how much power is available to produce the music. It is not a measure of the *total* power used by the unit because it doesn't include the power lost as heat in the amplifier as it does its work, or the things like powering lights, LCD screens, memory backup, etc.

Light bulbs are a good example to use to demonstrate what goes on in electrical circuits.



The diagram above is that of a simple series circuit. It is called a series circuit because there is only a single path for current to flow through to get from one side of the battery to the other. As you can see there is a 12 volt battery and a load of 24 watts. Using Ohm's Law of Watts / Volts = Amps we can figure out how much current flows in this circuit.

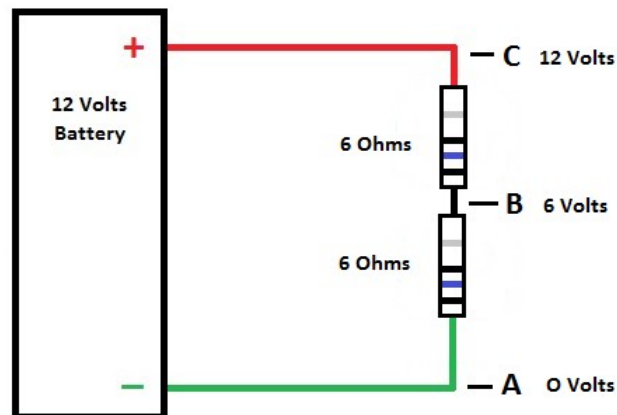
$$24 \text{ watts} / 12 \text{ Volts} = 2 \text{ Amps}$$

You can also figure out how much resistance the load presents in the circuit by using Ohm's Law of Voltage / Amps = Ohms.

$$12 \text{ Volts} / 2 \text{ Amps} = 6 \text{ Ohms}$$

An interesting thing to note here is if we took our ohmmeter and measured the resistance of the light bulb when it was cold it would have measured much less than 6 ohms. That's because when the filament heats up its resistance increases. This will also become important later when further discussing connections.

Let's look at another series circuit with two loads in series and break down what is happening.



This time the load in this circuit consists of two 6 ohm resistors in series. The rule for resistances in a series circuit is that they add together.

$$6 \text{ Ohms} + 6 \text{ Ohms} = 12 \text{ Ohms}$$

12 Ohms is the total resistance in the circuit. We can now use Ohm's Law of Voltage / Ohms = Amps to find out the total current flowing in the circuit.

$$12 \text{ Volts} / 12 \text{ Ohms} = 1 \text{ Amp}$$

Since there are two resistors in series there will be a voltage drop across each individual resistor. The sum of the individual voltage drops must equal the total applied voltage in the circuit. Since we know 1 amp of current flows through both resistors we can use Ohm's Law of Voltage = Ohms x Amps to find the voltage drop across one of the resistors.

$$6 \text{ Ohms} \times 1 \text{ Amp} = 6 \text{ Volts}$$

Since both resistors are the same we know that there are 6 volts dropped across the other resistor as well. If we add together the individual voltage drops in the circuit we see that they add up to the total circuit voltage of 12 volts.

$$6 \text{ Volts} \times 6 \text{ Volts} = 12 \text{ Volts}$$

In the above diagram, if you took your voltmeter and put the negative probe at point A which would be ground, and put the positive probe at point B between the two resistors the meter would read +6 volts. If you moved the positive probe to point C the meter would read +12 volts.

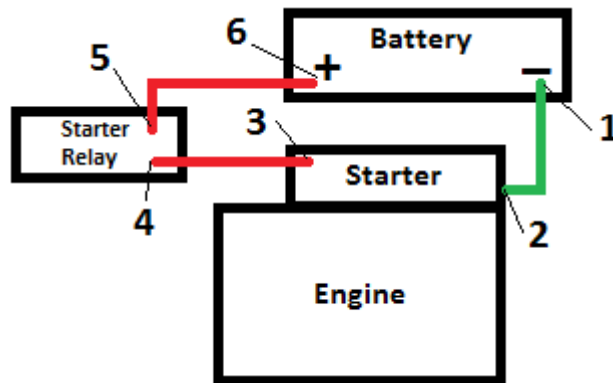
Earlier we talked about ground being the zero volt reference point that we measure all other voltages against. In the above circuit you could also put the negative probe at point B between the two resistors. That would make your reference point +6 volts instead of zero volts. If you put the positive probe at point C your meter would read +6 volts because that point is 6 volts more positive in comparison to point B. Conversely, if you put the positive probe at point A your meter would read -6 volts. This is because you are now measuring a point that is 6 volts more negative than your +6 volt voltage

reference.

The Starter Circuit, and the Ground Connection(s)

(*Note: Those of you who have voltmeters on your bikes know that when starting your bike the starter loads down the battery voltage to around 10 volts. This is because the starter presents very little resistance to current so it is a tremendous load. In the following text we are going to use 12 volts in the examples because most folks think of a battery as being 12 volts. The math we'll talk about still applies. Our goal here is to keep everything as simple as possible.)

The diagram below represents the starter circuit. The starter button circuit has been omitted for clarity.



The starter circuit as shown is a simple series circuit. The current has only one path it can travel in. The starter is the load, and is in between the ground side and the hot side of the battery. The starter relay is a high current switch. When you hit the starter button you energize the relay and pull a set of contacts closed which completes the circuit between points 4 and 5 which allows current to flow.

As we talked about earlier, when we talk about ground we are talking about the negative battery terminal. From the diagram above we can see that the cable that runs between the negative battery terminal and the starter has two connection points. (point 1 and point 2) These two connections carry the most current on the ground side of the electrical system. In fact, on a stock bike *all* the current used by the bike flows through these two connections. The same is also true for connections 5 and 6.

Electricity will always take the path of least resistance. If there is less resistance then more current can flow for a given voltage.

The starter circuit needs a lot of current in order to start the bike. This is why the negative battery cable connects directly to a starter bolt and not somewhere else on the engine. The shortest most direct path will contain the least resistance.

Let's say all the connections in our starter circuit are clean and tight so that we have the least resistance there can be. Let's also say just for the sake of our discussion that the starter requires 100 amps of electricity at 12 volts to start the bike. Using Ohm's Law of Volts / Amps = Ohms we can find the resistance the starter represents in the circuit.

$$12 \text{ Volts} / 100 \text{ Amps} = .12 \text{ Ohms}$$

One twelfth ($1/12^{\text{th}}$) of an ohm. That isn't very much resistance at all is it? Now imagine what would happen if we introduced two extremely small resistances due to corrosion. Let's say that each of the connections at point 1 and point 2, due to corrosion, each added a mere .025 ohms (25 thousandths of an ohm) of resistance to the circuit. Just like in the diagram with the two series resistors we now have to add all the resistances together to find the total resistance in the circuit.

$$.12 \text{ Ohms} + .025 \text{ Ohms} + .025 \text{ Ohms} = .17 \text{ Ohms}$$

Let's use Ohm's Law of Volts / Ohms = Amps to see how much total current we would now have flowing in the circuit with the extremely tiny resistance the corrosion added.

$$12 \text{ Volts} / .17 \text{ Ohms} = 70.588 \text{ Amps}$$

Just from an added .05 ohms due to a little corrosion we lost about 30% of our current! That is how important our cable connections are in this circuit.

Since corrosion introduces resistance in a circuit, and a resistance will always create heat, any connection that contains corrosion that inhibits current can be thought of as a load.

Also, remember what we said about resistance rising when a connection gets hot? This means you lose even more of the power in the circuit as the connection heats up.

Now that we know how much current flows in the circuit we can find out how much voltage gets dropped across each of those three small resistances. We use Ohm's Law of Ohms x Amps = Volts.

$$.025 \text{ Ohms} \times 70.588 \text{ Amps} = 1.7647 \text{ Volts for each of the corroded cable connections.}$$

$$.12 \text{ Ohms} \times 70.588 \text{ Amps} = 8.47056 \text{ Volts for the starter.}$$

8.47056 volts at the starter is also about 30% of 12 volts. Would you expect to be able to start your bike with a battery that was only charged to 8.47056 volts? That's all the starter is seeing in the circuit due to that small added resistance. Think about that...we lost 30% of our voltage *and* 30% of our current at the starter due to a mere .05 ohms. How small a resistance is that? Chances are your DIY multimeter couldn't *accurately* measure it.

Remember, all the individual voltage drops must equal the total applied voltage of 12 volts. If we add them together we get:

$$1.7647 \text{ Volts} + 1.7647 \text{ Volts} + 8.47056 \text{ Volts} = 11.99996 \text{ Volts}$$

(the tiny remainder we lost due to rounding off some numbers)

Think 30% of voltage and current is a lot to lose? Well it isn't about just current, or just voltage. It's about **Power**. At 12 volts and 100 amps the power the starter used is calculated using Ohm's Law of Volts x Amps = Watts.

$$12 \text{ Volts} \times 100 \text{ Amps} = 1200 \text{ Watts}$$

With the corrosion added to the circuit we need to use the numbers the starter was actually seeing to calculate the power that was available to it.

$$8.47056 \text{ Volts} \times 70.588 \text{ Amps} = 597.91988928 \text{ Watts}$$

That's right folks. The starter only had slightly less than half the power available to it than it needed to start the bike. All this power was lost due to a mere 50 thousandths of an ohm added resistance.

Think that was too much extra resistance we added for two connections? Think about this...the starter circuit is a series circuit so all the current flows through every part of the circuit. There are 6 different connections labeled in the starter circuit diagram. You could spread that .05 ohms out over all 6 connections. Since the starter relay has two internal connections there are actually 8 connections altogether. If you divided that .05 ohms by 8 it comes to .00625 ohms. Your connections could easily present that tiny bit of resistance in a circuit without you ever being able to detect it in any way.

If you really want to get technical about it there are even more connections in the circuit. Every cable you use to make a connection between two points that has crimped/soldered connectors on each end means there are actually 4 connection points. The terminals to the wire itself, and the terminals to the equipment you're connecting them to. We will discuss this more later.

This is why clean and tight connections...especially in the starter circuit are absolutely critical.

Maybe the next time you're having trouble starting your bike and someone suggests cleaning and tightening the cables you won't roll your eyes and say, "Nah...that couldn't be it. They look clean enough to me." ;^)

We Need a Good Ground, Right?

Of course we do...but ground is only part the story. Almost every circuit on the bike is a series circuit. We've learned that in a series circuit all the current flows through every part of the circuit. That means that no one connection is any more or less important than any other. Take the starter circuit example where we introduced the tiny resistance at points 1 and 2. You could have added that resistance to any two other connections anywhere in the circuit and got the same result.

Every Connection Is Important.

Since we're talking about ground let's refer back to the starter circuit diagram. Earlier we said that since the negative battery cable is attached to the engine that means the engine *should* also be at zero volts. Well if there is any resistance at points 1 and 2 in the starter circuit diagram that would mean the engine block wouldn't be at zero volts *while you were trying to start the bike*. According to the math we did each ground connection dropped 1.7647 volts across it. That would mean as you were trying to start the bike the starter would have been 3.5294 volts higher at its ground connection than the negative battery terminal. That's why the starter only saw 8.47056 volts out of 12 volts.

The engine is bolted to the frame so technically the frame *should* also be at zero volts. How clean and tight is the connection of the engine to the frame? It might be tight, but it certainly can't be very clean. Add that resistance to any cable connection resistances and you lose even more voltage and current if you are using the frame as a ground. A good example of this is installing a voltmeter that is connected in the headlight bucket. A lot of folks use a bolt in the headlight bucket as ground. Anyone who has done this knows you don't get a very accurate reading. This is partly because of the resistance in all the connections in the ground path back to the negative battery terminal. Of course there can also

be resistance in the connections on the hot side as well. Every minute little resistance adds up. Some folks like to add a frame ground directly from the negative battery terminal. It can cut out a few connections in the path making the frame a slightly better ground connection than it would normally be. Nothing wrong with that. Just remember that any resistance on the hot side of a circuit is just as bad. You could add 20 extra grounds, but if there is resistance on the hot side of the circuit those extra grounds won't help that. Every connection is important.

”Why can't I just take my ohmmeter and measure across the connections to see if they have any resistance?”

It won't work. In the starter circuit you were dealing with high current. Your meter uses a very small voltage and current to make measurements. The same connection that presents resistance to high current wouldn't present the same resistance to low current. Think of it like this...

The positive battery cable runs between the positive battery terminal and the starter relay. If you put the negative probe of your voltmeter on the negative battery terminal, and the positive probe on the positive battery terminal, it would read 12 volts. If you moved the positive probe to the cable connection at the starter relay you would get the same 12 volt reading. The cable doesn't present any appreciable resistance to the tiny current from the meter. Now cut every strand in the battery cable except one and retake the measurements in the same two spots. It would again give you exactly the same 12 volt readings because that one tiny strand is plenty big enough to carry the current the meter needs to make the measurement. But what would happen if you now tried to start the bike? That one tiny strand would present so much resistance to the current in the circuit it would just immediately heat up and melt. The starter wouldn't even begin to think about turning.

Anal Much?

Is this being too anal? Well...for most circuits...*maybe*. A lot of circuits are pretty forgiving about fluctuations in voltage. Certainly *not* for any high current circuit though. We've already seen how the tiniest bit of resistance robbed a tremendous amount of power from the starter circuit. What about the charging system?

The Charging System

The charging system works by taking electrons from the positive side of the battery/loads and moving them to the negative side of the battery/loads. It does this via the stator and the R/R. All the electrical current used by the bike while running continuously passes through this circuit. If the starter circuit is the highest amperage circuit on the bike, the charging system is next in line.

In order for the battery to receive a good charge, the charging voltage needs to be 1, to no more than 2 volts higher than the at rest battery voltage. If your charging voltage is currently 14 volts that isn't bad, but if you could gain a few tenths of a volt that is actually a big plus. A higher charging voltage means more electrons can be deposited into the negative side of the battery. That means more muscle when you're trying to start the bike. Most other circuits on your bike will happily operate on a slightly lower voltage. The starter circuit needs every possible volt and amp it can get to start the bike.

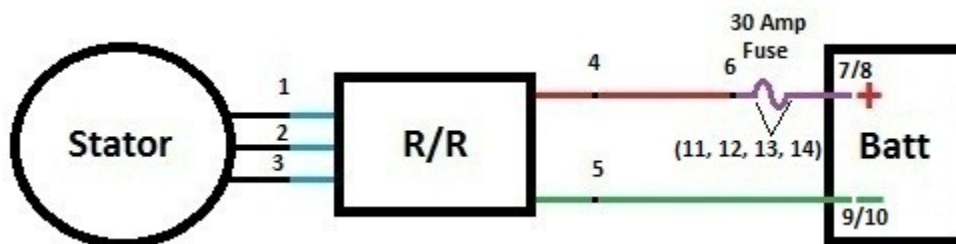
Anyone who has seen a melted stator-R/R plug has seen the result of bad connections in a high current circuit. As the plug connections get contaminated building up resistance they generate heat because there is now a voltage drop across the connections, and eventually that heat melts the plug. (the

contaminated connections in the plug become a load) This is why one of the recommended mods is cutting out the plug and soldering the connections.

It's also recommended that the negative wire from the R/R gets grounded to an engine bolt, but doing this puts up to 6 connections (and the entire engine block) between the R/R and the negative battery terminal on the ground side.

The red wire bypass mod at the starter relay doesn't really add any extra connections on the positive side of the R/R to the battery, but you can reduce the number of connections between the R/R and the battery increasing the effectiveness of the charging system.

Running both the positive and negative wires directly from the R/R to the battery will ensure you have the most direct path between the R/R and the battery. Below is a representation of the circuit you want to end up with.



The numbers represent the number of connections in the circuit. The most direct path from the stator to the battery still has 10 connections that have to be made in this case. (there are actually 14 connections because the fuse socket itself has four connections that must also be considered) Don't underestimate how vital good connections are in the fuse socket in this circuit. Not just the terminals that make contact with the fuse, but the connection of those terminals to the wires. In fact, if all the other connections are soldered (as they should definitely be in this circuit...with the exception of the physical connections to the battery) the connections of the fuse socket in the pigtail will be the weak link in this circuit and most vulnerable to corrosion. Again, all the electricity used by the bike has to pass through these connections.

I hope that seeing it in this way drives home the need to eliminate every unnecessary connection you possibly can.

What Makes Good Connections?

Two things immediately come to mind. Strength and surface area.

If the connection isn't strong enough to hold firmly together two things happen. First, obviously it can come apart. Second, the looser the connection the easier it is for corrosion and other contaminants to come between the connection introducing resistance.

Surface area is very important. The more surface area a connection has the less resistance it has to current passing through it. A good example of increased surface area to carry more current is using larger gauge wire in a circuit. This is why the starter circuit needs the heavy battery cables. It needs the increased surface area to carry that huge amount of current with the least amount of resistance possible. As we've learned, more resistance means more heat, which in turn means more resistance,

etc. All of which rob the intended load of voltage, current, and power...not to mention possibly melting the plastic jacket off of the wire creating a short and potential fire hazard.

When we use a ring terminal to crimp on the end of a wire what most folks end up doing is looking for a terminal that matches the screw we want to connect the wire to. If that terminal doesn't necessarily match the wire people usually just spread the terminals a bit and sort of make it fit. Fitting on the post is important, but just as important is the terminal needs to be rated for the current it will carry. The gauge numbers aren't there to tell you what size wire the terminal fits on. They are there to let you know the terminal is sized to carry the current that the same gauge wire will carry. If you use a smaller gauge terminal you could possibly be introducing resistance to the circuit inadvertently.

How a connection mates is very important. If the two surfaces don't mate flatly and cleanly it reduces the path for current and can create resistance and heat. Battery cables are a good example. The terminals on battery cables often get bent so that only the middle makes the connection. Make sure they mate as well as they possibly can.

When you clean cable ends the best way is to use contact cleaner and a brass brush. A lot of people go straight for the sandpaper, but you have to be careful not to use too coarse a grit. The small gouges you put in the terminals do two things. First, they reduce the surface area that actually makes contact. Second, those gouges wick in moisture and grime. Once that happens you start to get very tiny arcing that occurs and that produces carbon, and carbon creates resistance. The moisture also contributes to corrosion and the two start to work their way under the good parts of the connection.

Make Good Connections

There are a few ways to make connections. Most people use crimp-on terminal connectors. These can be sufficient for most circuits, but they do have some drawbacks. One of the biggest drawbacks is that they tend to corrode from the inside. Take a ring terminal for example. It's very easy to keep the "ring" clean. A little contact cleaner and a brass brush and you're in business. The problem with these though is where the wire itself meets the terminal. When you crimp one of these on and use the right amount of pressure they can be plenty strong enough. The biggest problem with them though is that stranded wire acts like a wick. Moisture will wick into the wire and that's when the corrosion starts. The corrosion eventually works it's way between the wire and the terminal, and once that happens you'll get some resistance. Most folks aren't even aware that this could ever be a problem. Ask an auto mechanic how many times they've seen this happen with battery cables. The terminals look fine. The stranded wire inside them can be a mess.

Soldering

If you are splicing two wires together, or putting a terminal on the end of a wire, the best method by far is to solder them. I've read posts in forums that say solder introduces too much resistance and should be avoided. If you hear anyone say this you can know two things for certain. First, they have absolutely no clue what they're talking about. Second, they obviously can't solder worth a damn.

Soldering has benefits. First, a *properly soldered joint* is extremely strong and will not pull apart. Second, a *properly soldered joint* means water and other contaminants are kept out of the connection so corrosion has an extremely low chance of ever taking hold. Third, a *properly soldered joint* fills in the voids between stranded wire so it actually increases the surface area of the connection meaning more current can pass with *less* resistance.

Notice I keep saying “*properly soldered joint*”. It takes some practice to learn to solder properly. It is true that an *improperly* soldered joint will introduce resistance in a connection. An improperly made connection by *any* means will introduce resistance in a circuit. You should definitely learn to solder if you are going to do any kind of electrical work on your bike. Any circuit, *especially* high current circuits, will benefit from properly soldered joints. There is plenty of information on the internet about learning to solder properly, but if you know someone who is good at it get them to teach you how. Watching someone do it right will save you much time and trouble. There is no substitute for experience, especially when learning how to solder properly.

Dielectric Grease

Dielectric grease deserves some discussion because it is so grossly misunderstood and misused. The reason it's so misunderstood is that it's marketed so poorly. (at times I wonder if it's even purposeful?) There are also countless YouTube videos wrongly demonstrating how to use it. I've even seen it sold in little squeeze tubes at auto parts stores marked “Conductive Grease”!

Dielectric grease is NON-CONDUCTIVE!!!! It is an INSULATOR, like the plastic jacket on wire. It's purpose is to *not* conduct electricity, and to lubricate and keep moisture out of a connector/connection.

It's important to understand the difference between an insulator and a conductor. An insulator, like glass, plastic, etc., doesn't allow current to flow. A *resistor* is still a *conductor*. It's purpose is to allow a *certain amount* of current to flow.

If you put dielectric grease on the mating surfaces of a connection you are reducing the clean mating surface area of that connection. Smearing your battery terminals with dielectric grease *before* you put them together is like putting a piece of plastic wrap between the terminals. Yes, there will be tiny points that will make some contact, (mostly the screw that holds the connection together) but overall you are reducing its surface area greatly. It's the reduced surface area that restricts the path for current and cause heat.

You may have even seen videos showing someone using an ohmmeter to show how much resistance there is in a connection. Then, they clean the connection with contact cleaner, brush, etc. Then they smear dielectric grease all over it like they were buttering a bagel, put the connection back together and voila! The ohmmeter shows the connection is all back to normal...except it isn't. An ohmmeter measures the resistance of *conductors, not insulators!* Using an ohmmeter to measure an insulator is like using a tape measure to weigh your fat Aunt Sophie. You can measure her all you want in any way you can think of, but when you're done you'll have absolutely no idea how much she weighs. (I suppose you could put the tape measure around her and try to lift?) As long as that connection has even a pinpoint worth of path for current to flow through it will register on the meter that all is good. Do not be fooled. Earlier we discussed how the current the meter needs to make a measurement is much smaller than a circuit may need to do its work. For some low current circuits you might get away with it. For most circuits it is very bad practice to use it on the conducting surfaces of a connection.

“But it squeezes out from between the connections when I put them together, *right?*”

Not really. It is like any other grease. It's made to stay where you put it. Think how much pressure there is between bearings and races. That tiny bit of film between the surfaces keeps them from tearing

each other to shreds. Sure, dielectric grease isn't as tough as wheel bearing grease, but the connections don't have as much pressure on them either. Think it's easy to wipe away? Smear it in a connection and try to clean it out. Try just smearing it on any metal surface, then try using another piece of metal to scrap it all away. It's really miserable stuff. It takes mineral spirits to really clean it...and even then it takes some effort to get every bit of it.

So what *do* we use it for?

Use it to lubricate plastic connectors. This will help keep moisture out and make it easier to put the connectors together and take a part. You can also use it on the back sides of connectors where the wires go through to seal out water and grime. Just be careful not to work it into where the terminals are inside the connector. You can use it to coat a battery terminal to seal out moisture *after* you've made the connection. The most popular use for it is making a seal between spark plug insulators and the rubber boots. This prevents the light show that can happen when the wires get wet. Many an automobile hasn't started from the spark jumping from the wire terminal straight to the engine block along the outside of a spark plug. Dielectric grease on the inside of the boot, and silicone spray on the outside of the wires can prevent this from happening.

“Well I've been using it “wrong” all these years and everything is fine. I'm not changing it now.”

That is certainly your prerogative. The purpose of my little diatribe was to give you the straight dope on what it is, and what it's used for. At least now you have the correct information. What you do, or do not do with it, is your decision. I whole-heartedly defend your right to be wrong. ;^)

“Is There A Product That *Can* Enhance A Connection?”

Yes there is. It's called Stabilant 22. It is an incredible compound that does actually enhance electrical connections, and is only conductive in the immediate area of the contact itself. I have seen demonstrations where they immerse entire computer motherboards in Stabilant 22 and it doesn't short anything out. Absolutely amazing stuff. Do a search for it on the web and check it out. All that amazingness comes with a hefty price though. You'll probably never use it, but it is pretty interesting reading.

Anal Revisited

Being anal about something is absolutely in the eye of the beholder. The most anal guy I ever knew about making electrical connections was a friend of a friend. This guy made connections that were a work of art. All of his rolls of wire had electrical tape on the bare ends to keep out any moisture. Whenever he would make a connection he would strip the jacket, then spray contact cleaner over the bare wire and blow it dry. Then he would use crimp terminals without the little plastic collars, and solder, not crimp, them to the wire. He would make sure the solder sealed the stranded end of the wire, and also filled in the little split where the terminal came together, and if there was a bit too much there he would file it smooth. Then he would slide up a little piece of marine grade shrink tube to seal between the plastic wire jacket and the terminal to keep moisture out of the stranded wire. Then clean the terminals with contact cleaner and a wire brush. Then he would apply Stabilant 22 to the mating surfaces before he'd make the final connection. There was simply no way any of his connections were ever going to fail. He absolutely took being obsessive to a whole other level. He also never had to worry about any connection he ever made.

Was he being too anal? That's a personal call...but if he offered to work on your bike you'd jump at the chance wouldn't you? Spend a little extra time and do it right. It really does pay off in the end.

Carry A Few Items With You

Most folks like to have a few items with them to deal with certain emergencies on the road. I know guys that carry every conceivable item with them at all times. It gets to be a bit much.

As far as electrical troubles go, you can get away with just carrying a few items. A few feet of 12ga. and 10ga. wire will get you out of almost any jam temporarily and get you home. A roll of electrical tape is essential. A small wire stripper/crimper and a few terminals is always good. All this will fit in a small zip-lock bag.

There is one other item I urge you to carry with you. Some assorted size wire nuts.

Wire nuts are great at making temporary/permanent connections quickly and easily. They protect against shorting out, especially in high current circuits, and they resist heat well. Strip and twist some wire, tighten the wire nut, wrap it up with electrical tape, and you have a clean, tight, waterproof connection that will hold you over indefinitely until you have a chance to permanently repair it in a way that makes you happy.

Anywhere I need to make a splice that won't be seen I always twist the wires together like you would if you were doing house wiring, then solder the wires together, cap it off with a wire nut, then wrap it all up in friction tape. You never have to worry about that connection shorting out against anything. I've seen too many connections that had a small tiny sharp point that eventually works its way through tape, shrink tube, etc., and shorts out. This is eliminated using a wire nut. It may not be pretty but if you use this method you can forget about that connection ever being a problem.

The best use for them on the road is making the connections for charging system problems. Connector melts? Just cut them out and wire nut the wires together. Need to replace a stator, or a signal generator on the road? Wire nut and tape the connections until you get a chance to solder them. Wire nuts can save your hogs bacon!

I hope this article gave you some useful information. Keep those connections clean and tight so you can spend your time riding!

Ride On!