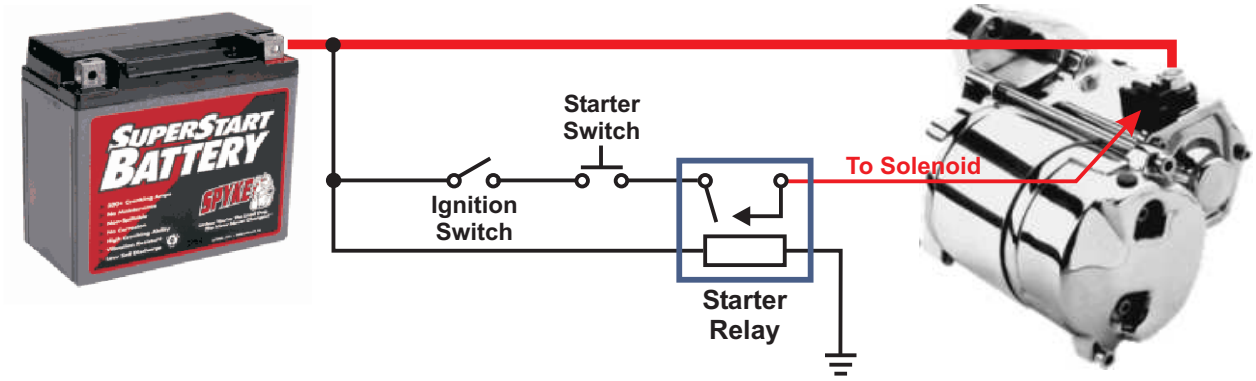

Battery:
The supply to drive the whole electrical system is the battery. It is most taxed during the starting of the engine with a typical load of 300+ amps. During this time it must supply adequate voltage and amperage to not only run the starter but the starter solenoid, relay, ignition, ignition coil and in many cases the head light and injectors, along with other support circuitry of modern engines. Everything wants its share, making it imperative that the battery be in peak condition!

Ignition Switch:
The ignition switch is the beginning of the start and run cycle. It will supply the needed support circuitry with power to allow the engine to run but does not directly supply the power through it to run the starter as it is incapable of carrying the loads necessary to run the starter. The ignition switch and support circuitry it supplies can be the cause of starter kick back which due to premature ignition firing and will be discussed later.

Starter Switch:
Pressing the starter switch initiates the start cycle by doing one thing, turning the starter relay on. That's it, nothing more.

Starter Relay:
When the starter relay is energized by the starter switch the relay points are closed applying voltage to the starter solenoid, turning it on. All the starter relay does is turn the solenoid on, since the switch is only capable of carrying a small amperage load it turns on the relay and the relay carries the load required to run the solenoid! Basically the switch and relay are a pre amp circuit for the solenoid.

Starter Solenoid:
The solenoid has a dual function, it acts a large high current relay and engages the starter drive gear. When the magnetic field on the solenoid is turned on by the starter relay the plunger on the solenoid engages a large contact (same as a relay) capable of carrying the amperage required to run the starter motor. When the contacts come together the starter motor turns on and the solenoid plunger pushes the drive gear into the starter ring gear allowing the starter to turn the engine over.

Starter Motor:
The starter rotates turning the drive gear now engaged with the ring gear turning the engine over. A huge amount of current is required due to the extreme load to roll over the engine, especial with the performance bikes of today. Currents in excess of 300 amps are not uncommon and probably normal.

Battery Cables:
Consider this, when the starter motor is engaged you are pulling more amperage than a large house uses in peak Air Conditioning season. With this in mind the battery cables should be of a size and quality to carry the load required during peak load conditions (starting the engine). Most people think that it is enough to have a good positive cable and miss 1/2 of the circuit. The path of electric is from the negative (-) terminal of the battery through the component being used and back to the Positive (+) terminal. If both cables are not of equal quality your supply is only as good as the weakest cable and its connection.

Putting it all together:

A good rule is to check your battery's voltage while the bike is sitting still, it should read about 12.5 volts. While holding the starter button down if battery voltage falls below 5.6 volts, your battery probably has a bad cell, and by the way jumping the battery with another one will be useless as the shorted cell will NOT let the new extra amperage pass through it. If you feel the need to try another battery, disconnect the old one first.

Do I have the correct starter for my application?
Does my battery produce enough Cold Cranking Amperage (CCA) to do the job?
Do I have enough space for the correct battery to do the job?

Battery rating vs. starter size
275 CCA = 1.0 starter (stock)
300 CCA = 1.4 starter
385 CCA = 1.8 starter
500 CCA = 2.4 starter

A starter only converts electro-chemical energy into mechanical (kinetic) energy. It can NOT create it, so unless you have sufficient energy in your battery, anything in excess in a starter size(KVA) will actually do harm. The bigger KVA the starter the less effect as it will pull the battery voltage lower running basically at "half throttle" and causing heating of the starter.

Hopefully this has shown the importance of a good battery.

The ignition switch must in good working order to supply the down line circuitry and it is not uncommon to be a source of starter problems but will usually show faulty in other ways before causing a starter related problem.

A starter switch is not normally a problem as it has low current flowing through it and has a life of 500,000 cycles, but never over look it.

The starter relay is were you begin to see things fail because it is the first high current step up. Stock Harley relays (that little black cube under your seat) are only good for 30 amps. The most performance starter solenoids including the Spyke starter solenoid draws more than 30 amps to engage the contacts and drive gear more positively . All thou the relay is rated at 30 amps continuous with a surge current of much more it's only a matter of time before it will fail. When testing the relay here's the tricky part, a blown relay will still show full voltage (or light the test light) at the starter! What we're looking for to do the job is PRESSURE (amperage) which will only pass through at the rate of about 2 amps to the solenoid. So to test this make a jumper wire out of piece of twelve gauge and go directly from the battery's positive terminal to the SMALL clip terminal on the starter it self. Make sure the bike is out of gear because it will probably turn over. If it does then replace the relay, replacing it with a higher amperage relay would be wise but requires some wiring.

On any starter the solenoid circuit runs through the drive armature so that if the starter stalls the solenoid plunger will "kick out" thus not frying the windings on the commutator.

Premature Ignition Firing

Now you've got the starter circuit down and everything is perfect and you hit the starter button. As the starter rolls up to the first compression cycle you hear a loud noise as the starter kicks back like it wants to leap off of the engine. Either you have the ignition timing to far advanced or remember all the support circuitry the battery has to supply mentioned earlier. A common problem causing this is the supply to the ignition system. This can be caused by a weak battery or poor supply lines (wiring) to the ignition. The power for the ignition system is supplied by the battery and the wiring goes as follows: Battery > Starter + > Circuit Breaker > Ignition Switch > Kill Switch > Ignition Coil > Ignition Module. How many connections are there, and when was the last time you checked them. What happens is at some point along the supply line to the ignition there is a high resistance connection causing a voltage drop.

If you have a drop of 3 volts to the ignition and the starter pulls the battery voltage down to 10 volts at start up the ignition see 7 volts. If the ignition has a dropout voltage of 8 volts or the point it will no longer will operate it turns off. The key is how do you fire a coil to generate a spark to the spark plug? Turn the charged coil off collapsing the magnetic field around the secondary of the coil. Peak load on the battery occurs as it approaches the first compression cycle and is near TDC. If the voltage falls below the dropout voltage of the ignition at that point the ignition turns off in turn shutting the coil off and a spark is generated. If the time the spark is generated happens to be 45° BTDC the fuel in the cylinder is ignited. Since the engine has minimal RPM's the combustion of the fuel wants to drive the engine in the opposite direction the starter is turning it and the engine wins. The ignition may only be off for a millisecond, but that's all that is required to fire a coil. If this occurs, clean all connections to the ignition circuit and check the voltage to the ignition while the circuit is loaded.

Test procedure: With ignition off and the bike out of gear, get a jumper wire with alligator clips and jumper the trigger side of the coil to ground (done not jumper the + side of the coil, the side feed from the kill or ignition switch as this would be a direct short to the battery and you will have smoke). Turn the ignition on and with a volt meter on DC volts, measure the voltage at the battery, Negative (black) lead of meter on the battery negative and the Positive (Red) lead of the meter on the positive of the battery. Note the voltage i.e. 12.5 volts. Then move the Positive (Red) lead of the meter to the positive (+) side of the coil, the post feed by the kill switch. Note the voltage reading of the meter. If the difference between the battery voltage and the voltage at the coil is more than 1.5 Volts you should clean and check all connections between the battery and the ignition coil. The dropout voltage of the Spyke Super Comp Ignition 5.5 volts or less and is very low in comparison to many ignitions on the market.

Important Note: Do not leave the jumper wire from the battery to the coil in place more the 4 minute if using a 3 Ohm coil. This jumper wire turns the coil on to load the circuit for the test. The coil will get hot and damage the coil if left on.