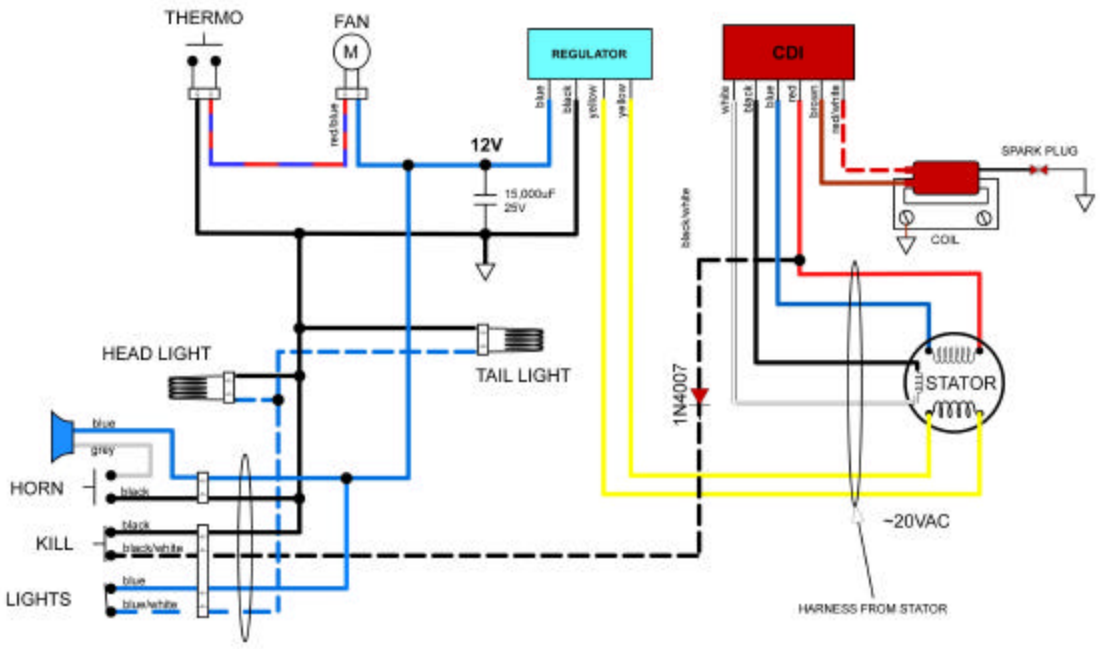
This is my report on the wiring anomaly on my bike. My original suspicions have been confirmed along with a “Huh?” type of wiring error.

PROBLEM:
On my new ’08 the horn didn’t work. The kill switch appeared to be intermittent and the lighting didn’t work. By random chance I noticed that even though the lights didn’t work when they were switched on they came on briefly if they were switched on and the kill switch was pressed.

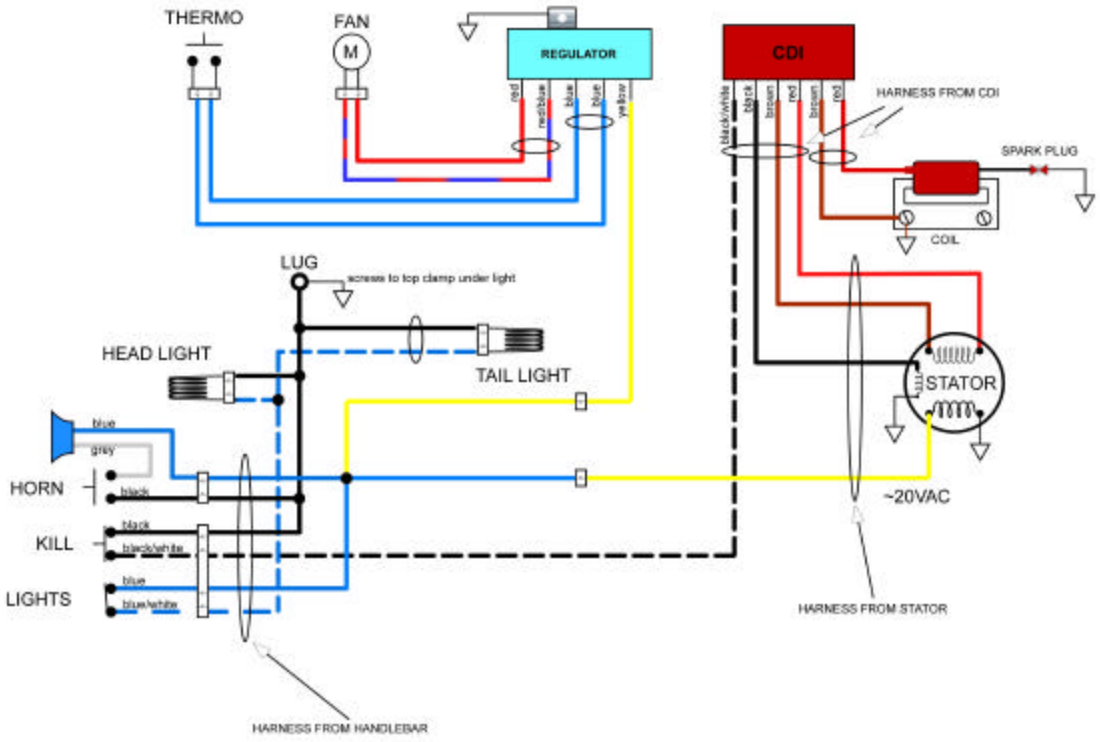
As these are supposed to be two separate systems this was indeed curious and I felt this was a good chance to investigate the possibility that a similar wiring issue could be responsible for the reports of failed stators and CDI units which appear to come mostly from England where use of the lighting system is much more prevalent then in the US. As you know the stator is essentially a coil of wire. Years ago I was working on resolver (a position sensor that is basically a differential transformer) to digital converters and one of the features we tried to sell to the customers was a flag bit that would tell you when the resolver had an open circuit. Customers were very blunt that it was more likely the semiconductor would fail then the resolver which when you get down to it is fundamentally a piece of wire. So there are two main failure modes for a coil. Mechanical damage and just plain running too much power through it. So my main suspicion for the failed electrics was rogue power from the low-voltage/high-current lighting coil getting into the high-voltage/low-current trigger coil.

The first thing I noticed on removal of the headlamp assembly was the use of a “ground lug” captured by a screw that passes through the top headlamp screw hole into the top triple clamp I was immediately suspicious of this connection for two reasons. The head of the screw rests on the headlamp assembly insulating it from the ground lug and the lug rests on the surface of the triple clamp which is anodized aluminum. Anodized aluminum is formed of an aluminum oxide which is an insulator. I verified this by measuring the resistance of the surface of the clamp at the lug site. This means that the ground lug is relying on the surface contact of the screw threads against the inside surface of the

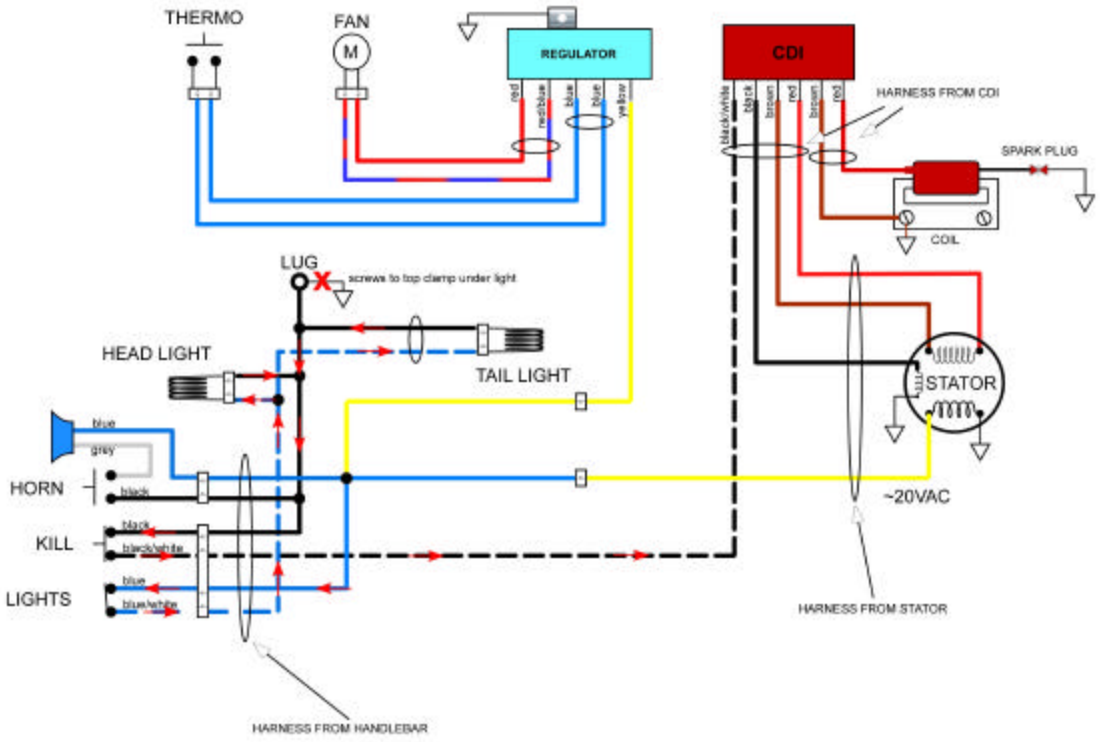
center hole of the lug. To investigate further I unplugged the handlebar control cluster, horn and switch, headlamp and tail lamp and metered out the respective connections.



This illustration shows the ignition/lighting system as it is shown in the manual. Note the 1N4007 diode in the kill switch circuit to block lighting current from back feeding into the ignition circuit through the common ground. One of the first things I learned when I started building bikes is that you do not connect the ground for the kill switch through the steering head bearings because a fully cranking engine is capable of putting out enough current to keep a sparkplug firing even through the relatively low resistance of a set of steering head bearings. This is why a separate wire tied to a hard ground point (I prefer to tie it to the ignition coil ground when possible) is necessary.



This illustration shows the actual factory wiring of my ’08 270. Upon disassembling my wiring I made several critical discoveries. The first and most disturbing was that all grounding for the wiring to the handlebar cluster is achieved through a single ground lug mounted behind the headlight assembly top bolt. There are five black wires coming from a common splice at the bottom of the handlebar wiring harness that can be considered the reference ground. One of these is an ~18 gauge wire that goes back up the harness to the ground lug. The other four ~22 gauge wires are headlight, tail light, horn and kill switch ground. The other wiring oddities I discovered were the lighting system is now driven directly from the lighting coil and there is now four wires coming from the stator assembly as opposed to the previous versions where six wires came from the stator giving access to both sides of each coil (lighting, ignition, trigger). This means that there is either some common grounding through one of the wires or Beta is using the engine case as a ground connection.



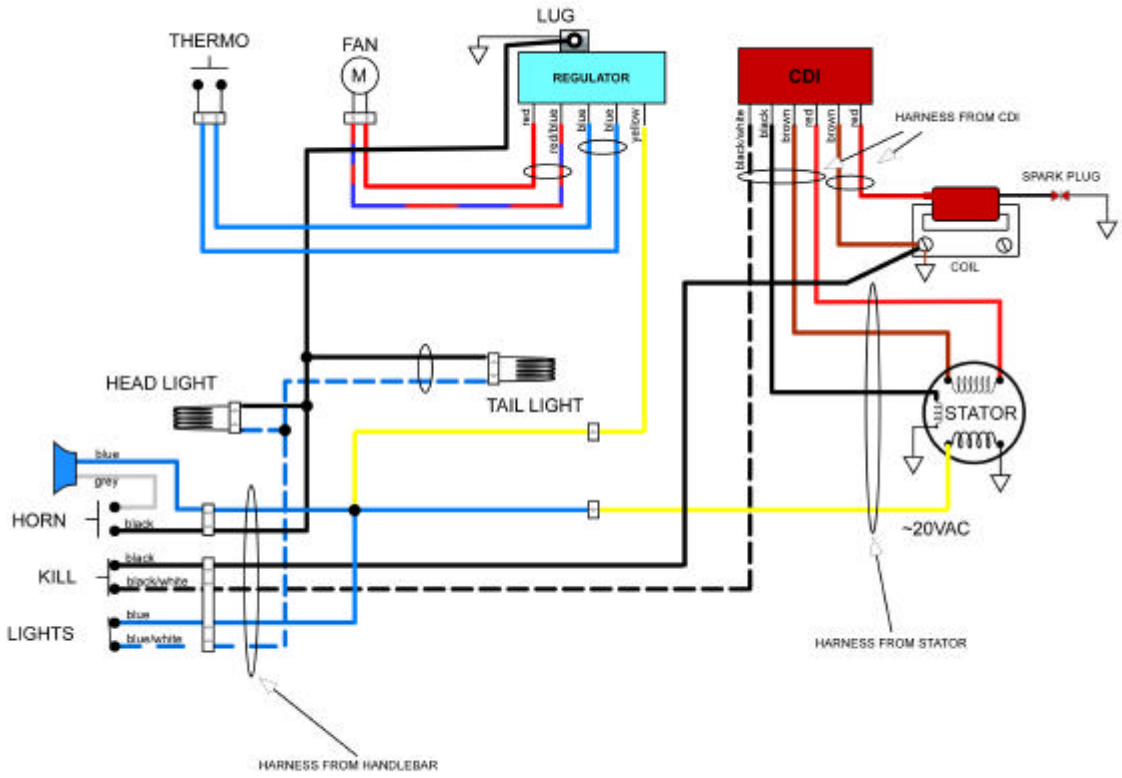
This illustration shows what I believe is a critical flaw responsible for the majority of failed ignition systems in the past and points to a modification that should be made by any owner who's kill switch ground is wired through the ground lug under the headlamp. As observed on my bike there is a possibility the ground lug under the headlight assembly will suffer a high resistance connection to ground. On a bike with the wiring feeding the ~8-20VAC lighting current to the control cluster and the kill switch tied to the ground lug there is a clear path for the lighting current through the light switch and the headlamp/tail lamp bulbs back through the kill switch into the CDI/stator coil.

Beta appears to have been aware of this problem on the later bikes that have a 1N4007 diode in the kill switch circuit to block this current from returning through the ignition coil. For the later bikes which ran the lighting system off the 12V regulator this effectively protects the ignition system from being damaged by the lighting current although it doesn't address the fundamental problem. For the newest bikes that run the lighting off the AC output of the lighting coil directly the effectiveness of the diode is dubious and has been left out of the circuit anyway.

This explains why a bike could run for quite a few months (years) without a problem and suddenly die. If the kill switch is never used while the lights are on there is no possibility of the lighting current finding its way into the CDI unit. Also if there is a good connection through the ground lug then the lighting and ignition systems remain isolated

as any differential current between the two systems is shunted to ground. If after a few months or years the ground lug loses contact or the engine is running wide open after a fall then the current from the lighting system could be sufficient to damage either the CDI box or even the thin wire on the trigger coil of the stator.

SOLUTION:
Unfortunately I only have my two bikes to work with and one of those was already modified by Ron Commo prior to delivery so I can't give detailed instructions for each year and configuration of machine but the changes are slight and are so basic in nature they are valid for everything from an '08 Rev3 to a '72 Bultaco so here goes. If you need to have lights on your machine it's critical to isolate the lighting circuit from the ignition circuit.



This illustration shows the correct way to connect the grounds for lighting and ignition kill circuit. The first and simplest solution is to run a separate ground wire for your kill switch back down through the wiring harness to a point on the chassis. My preferred point is the ground reference at the ignition coil. On the '08 this can be done by taking off the tank cover and finding the end of the harness tubing. Remove the electrical tape. You'll see a bunch of black wires connected together. You may have to pull the bundle out of the harness tubing as on mine it was stuffed up into the tubing. By pulling wires and observing the wires at the top of the harness it's easy to figure out which goes to the kill switch. This is the wire that needs to be removed from the big splice and connected to

the top screw of the ignition coil. If you use a good quality crimp connector it's going to be much better then relying on the connection through the steering head bearings to kill a runaway engine. If you're feeling particularly gung ho about doing this the right way the next step is to pull the exhaust header and radiator out and find the frame tab the regulator is mounted to. Remove the 10mm nut and take a little sandpaper and clean off the tab and mounting plate of the regulator. Now find the ground lug behind the headlight and cut it off and fish the ~18 gauge wire back down through the harness, cut to length and put a new circular lug on appropriate to the bolt that mounts the regulator to the frame. Remount the regulator putting the new ground lug under the 10mm nut. Put radiator and pipe back on and go have fun.

One thing I should point out is my drawing of the stator grounding is a supposition. There are three possible grounding configurations that will work but it makes no difference as far as the ignition failures are concerned.