# Comment contrôler le Redresseur-Régulateur

Première chose à faire : recharger la batterie. De préférence, pas avec un chargeur "auto" qui va délivrer un courant de charge trop important, mais avec un chargeur "moto".
Si chargeur "auto", intercaler une ampoule H4 dans la branche "+" du chargeur pour limiter l'intensité de charge.

**Règles de base** :
Ne JAMAIS faire tourner le moteur avec la batterie débranchée, ni la débrancher moteur tournant : danger grave pour le régulateur (c'est pas vraiment ce qu'on cherche à faire !)
Brancher un voltmètre (0-25V, ou 0-50V continu) aux bornes de la batterie.
Un petit multimètre à quelques dizaines de francs acheté en grande surface convient très bien, on n'est pas à 1 ou 2/10 de volt près.
Contrôle du régulateur :
NE PAS débrancher la batterie.
Couper tous les consommateurs électriques (éclairage, etc. ...).
Démarrer le moteur.
A 5000 t/m environ, on doit avoir entre 13,5 V et 16 V aux bornes de la batterie
(Ces mesures ne sont valables que HORS fonctionnement du ventilateur du radiateur)

1. S'il y a moins de 13.5V, le régulateur est défectueux, ou sa prise est mal branchée, ou des contacts sont oxydés. On peut rouler en rechargeant régulièrement la batterie.
   Une batterie bien rechargée permet de faire au moins 150 à 200 km en l'économisant (tous feux éteints, démarrer en poussant ...)
   Symptômes : batterie à plat, démarreur paresseux ou inopérant, compteur fantaisiste.
2. S'il y a plus de 16V, le régulateur est H.S. Surtension = risque de brûler le faisceau électrique, de déglinguer des organes électriques/électroniques, et de surchauffer la batterie qui peut se mettre à fuir ... => bonjour les dégâts !
   Symptômes : ampoules de tableau de bord claquées (le reste ne tarde pas à suivre ... )

Dans le premier cas, vérifier-nettoyer-serrer les connexions suivantes :

- bornes/cosses de la batterie
- connecteur du régulateur sur le faisceau principal
- masse du faisceau principal sur le cadre (à l'AR droit du cadre, à la hauteur de la culasse AR)
- connecteur de l'alternateur sur le faisceau principal (3 fils jaunes, au-dessus de l'embrayage)
- bornes des câbles du démarreur (batterie-relais, relais-démarreur, et batterie-masse)
- contacts du fusible principal 30A (sur le relais de démarreur, près de la batterie)
- contacts (alim. et masse) du moteur de ventilateur de radiateur.

N.B. Des connexions nettoyées peuvent faire regagner plus d'un volt ( !!! )
Dans le deuxième cas, on peut se dépanner pour ramener la moto :
- débrancher la prise multibroches reliant le régulateur au faisceau principal (sous le cache latéral droit sur les RC36, sous le gauche sur les RC46A et D)
- recharger la batterie, et rentrer sur la charge de la seule batterie (150 à 200 km d'autonomie, si la batterie est bien chargée).

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Pour info, les tensions à vide respectives en fonction de l'état de charge des batteries (différentes selon le type de batterie) :

| Etat de charge | Batterie scellée | Batterie conventionnelle (bouchons amovibles) |
|---|---|---|
| 100% | 13.0v | 12.6v |
| 75% | 12.8v | 12.4v |
| 50% | 12.5v | 12.1v |
| 25% | 12.2v | 11.9v |
| 0% | 12.0v ou moins | 11.8v ou moins |

# Wiring Mod for charging issues

Firstly, what follows is a description of WHAT I HAVE DONE it is not a description of WHAT YOU SHOULD DO
The difference is simple, if you choose to modify your wiring, you and **YOU ALONE** are responsible for that decision, the work done and the outcome.

**Why did I mod my wiring?**
Several reasons
1) The known issue of melting brown connectors at the reg/rec and the fire risk associated.
2) Poor charge rate of 13V
3) poor starting
4) it has nothing to do with accessories. The wiring is too small and goes a "funny" route which, in short, means there was not enough volts at my battery. It only had 13 instead of 14.when the bike was ticking over

**What I did**
Firstly I cut the 3 yellow wires at the brown plug and soldered the connections as per the photo.
Then I modified the rectifier output wiring.
The job was simple..... add another wire ..... full stop
The job was simpler when I got that clear in my mind, all I did was add a wire.
The cable I added goes from (is connected to) the red/black at the rectifier to the red/black under the 2 green fuses next to the starter solenoid.
There are pictures below
I also connected an extra earth, from the blue at the rectifier to the negative of the battery.
Again simple Full stop. I did not make it any more complex in my mind.
The cable I used was simply a bit of mains flex, like an old kettle lead, extension cable, or similar. That kind of cable is perfect. Its actual technical dimensions are irrelevant; I knew any bit of flex would do the job.
I used the brown to go between the red/blacks and the blue to go between the blue and battery negative.
It has the benefit of 2 bits of insulation; the outer gives it extra protection from engine heat and rubbing.

Now, that said, without the right crimps or soldering kit I knew it would be a pain to do. I chose to solder as I have the tools, but I know others have chosen to crimp as they have those tools. It mattered not to me as both will do the job perfectly.
Not everyone has a good soldering bolt and cables this big need a good bit of heat to be soldered.
I also joined the two blues together at the rectifier, though I know now this was not necessary but I am happy I did it
I also joined the two red/blacks together at the rectifier, also unnecessary but again I am happy I did it.

I went Here to download a brilliant fault finding chart which explains how to diagnose the problem and check the results.

That is what I did to **MY** bike
**I repeat, anyone doing any work to their bike does so entirely at their own risk.**

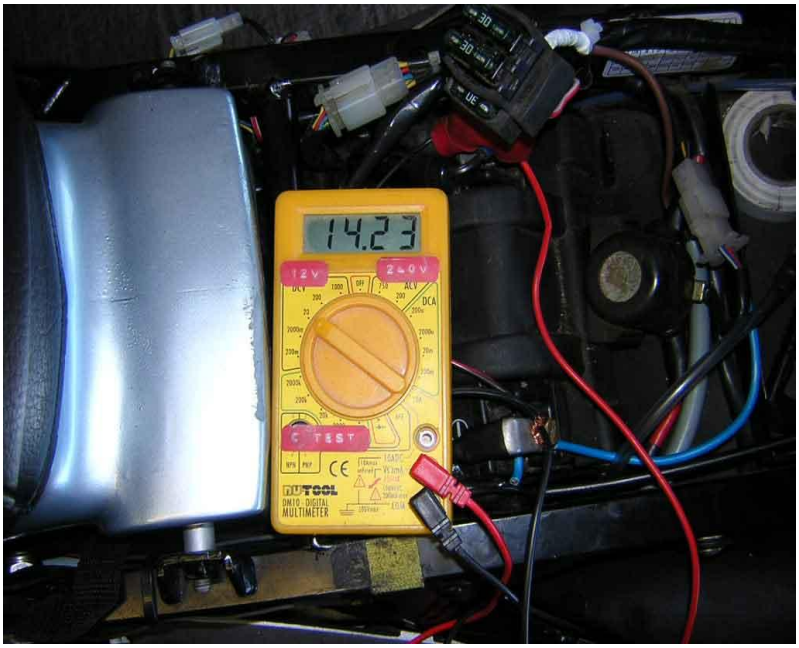
I have posted this description as the original thread is now too long for the pertinent info to be found easily. Could I ask that to keep this thread clear any discussions on the subject continue on that thread by clicking This link. This may help others in the Future.
http://www.apriliaforum.com/forums/...40&pagenumber=1

I hope that what I did is clear
Rab

The wiring at the Reg/Rec where I have joined through the 3 yellow wires and added a brown to the red/blacks and a blue to the blues

The picture of the brown added to the red/black under the two 30A fuses next to the starter solenoid..... which is on the battery

The resulting voltage at my battery.
Also the blue connected to the negative ..... which is now crimped




Performed the mod yesterday. Ran one 12AWG from the two red/blks in the connector to the red/blk at the 30A fuse block by the battery, and one 12AWG from the two blue in the connector directly to the battery negative.

VOLTAGE BEFORE THE MOD:
13.72 @ idle (1200 rpm)
13.06 @ 4000 rpm

VOLTAGE AFTER THE MOD:
14.53 @ idle (1200 rpm)
13.94 @ 4000 rpm.

BTW, my brown connector from stator to regulator had melted earlier, so I took the metal connections out of the brown plastic, plugged them together, and insulated with double shrink tubing.

Sorry to stick my nose in here, but no... I'm afraid that's *incorrect.*

**Quote:**

> The stator is a permanent magnet delivering full power all the time.

Again, incorrect. The *rotor* is a permanent magnet. The stator is three separate wires wound around a metal core. As the rotor rotates, it induces an AC voltage in the stator windings; the greater the rotational speed, the greater the voltage. The amount of AC voltage at any given rotor rpm is a function of the magnet strength and the number of turns in each stator winding.

**Quote:**

> The rec is just a diode bridge bleeding the unused power to ground.

Once again, incorrect. The rectifier is indeed a diode bridge, but its function is to convert the 3-phase AC voltage pulses from the stator into DC. It's the *regulator* portion of the regulator/rectifier that bleeds excess current to ground.

**Quote:**

> When the battery is getting "tired", less power is stored. More power is bleeding to ground. This push the voltage down.

That statement is totally off-the-wall.

As with the Caponord, some of your Futura charging problems are caused by high resistance wiring connections. But most of the trouble is caused by the fact that the regulator/rectifier unit used by Aprilia adjusts DC output based on AC input to prevent battery overcharge. That's why you see voltage going down as rpm goes up. This regulator has no way to detect actual battery voltage and simply "errs on the side of safety," if you will. This results in the battery being undercharged at cruising rpm, and it shortens battery life through oxydation. The situation wouldn't affect the older "flooded" style batteries to the same extent, but sealed, AGM batteries need a charging voltage of around 14.2 volts.

A better method (more accurate voltage control) is to incorporate a circuit that actually senses battery voltage and adjusts output accordingly. Shindengen, the company that makes the regulator/rectifier, manufactures both types. The voltage-sensing type appears identical, but it has an additional wire that's attached to a switched source of battery voltage.

Taking an initial look at the rectifier connector issue, I thought I would snap a few pics. The oft' mentioned "BROWN" connector joins the stator (light gauge wires) to the rectifier INPUT (heavy gauge wires). The WHITE connector joins the rectifier OUTPUT (light gauge wires) to the harness (heavy gauge wires?). These are my "before" pictures. Testing seems to indicate that the rectifier contains only diodes, and has no regulator function. Can anyone show that it does have a regulator, or provide an internal schematic?

May fixed the charging problem. Looks like it’s too long or thin wires between the rectifier and the battery.
The rectifier has 2 red/black wires and 2 blue. The red/black is +, and the blue is -. Connected the 2 red/black to one of the connectors. Both is connected anyway inside the rectifier, and in the bike cables. Then put a new 6 mm² from the other connector directly to the fuse before the battery. Disconnected the existing red/black between rectifier and fuse. And like magic, charging voltage is now 14,2V at 4000 rpm with full light, fan running and and the heated grips on. Just finished the job, more testing tomorrow. Can see the difference on the headlights.
May not need to replace my battery...

Hansb - Good work!! I went through the Electrex fault finding chart on my bike this afternoon & the test shows a bad connection in the positive lead between the rectifier and the battery. Exactly what you found! I have been talking with Ritzo at Electrex USA & will be sending him my info as well as your findings to see what he has to say. Electrex also recommends running a ground from the rectifier directly to the battery. Could you do me a favour & check the harness from the stator to see if it stays cooler now or still gets too hot to hold after idling for a minute or two.

John B.

Quote:

> Lastly, you said to put the 2 red/blk into one terminal..... then later you said disconnect it at the battery

There are 2 red/blk wires from the rectifier. 1 supplies the front fuse box, and the other supplies the battery. Disconnected the one at the battery because because it's replaced with a new 6qmm.

Quote:

> Could you do me a favour & check the harness from the stator to see if it stays cooler now or still gets too hot to hold after idling for a minute or two.

It was idling for about 15-20 minutes last night, and the rectifier was not hot. no problem holding a hand hard on the ribs as long as you wanted.

Quote:

> What was your reading before the mod, hansb?

My readings before was around 13V, sometimes under when the bike was hot after 2 hours riding.

Quote:

> and what made you go down this route?

2 new batteries in 2 years, and a third on its way. Make my local bike pusher happy... And the fact that 13V charging voltage on the battery is far too low.

It may look like the stator and rectifier is quality parts, but the wiring on the bike is not. other wires from the rectifier goes to the front fuse box, then 1 new returns to the battery. Long way in a thin cable for 40 Amps.
BTW, it also pass through a connector under the seat. Bye passed it now.

About why voltage drops on higher rpm. Showed a friend of mine an internal drawing of a bike rectifier. He is working a lot with electronic parts on cars and boats. He says when the rectifier no longer has a "receiver" for the current, it starts connecting the + earth. Typical sign for tiny wires.

_____
Hansb

Hi John,
I am in progress with the mod right now, like you I am curious as to why Hans disconnected the red/blk at the fuses next to the battery and left it connected at the rectifier. I haven't done it that way.
I have joined the two R/B's at the rec with another heavy brown (4mm) wire making a joint of 3
I have connected the brown to the R/B under the fuses next to the battery
I have joined the two blues with a third blue (4mm) making a joint of 3 the other end of which I am connecting to the battery negative.
I have soldered the 3 yellows to remove the connector.

I haven't had a chance to check if the yellows get warm yet, I will make it my first test

Think you have misunderstood Hans, john. He did not disconnect the existing r/b's at the rectifier..... he moved them onto one terminal, they are both still there. I **THINK** he disconnected the r/b at the fuses to replace it with his new cable, but I cannot see why!

Anyway, I'm done ..... job's a goodun
Not pretty, but it works, solves the issue, unquestionably, and should negate the need for starting/battery/solenoid issues to ever arise again.

The yellows do still get warm, even on tickover, but I would reckon not as hot as they used to get. Hard to tell. I did not have the 0.2v drop on the live, my readings were
0.14v drop from the red/blk at the rectifier to the +ve of the battery
0.08v difference from blue at the rectifier to the -ve of the battery
Total 0.22v therefore I did both
The voltage at my battery, bike running, was 13.1
When revved it fell to 12.9v

It now shows 14.22v at tickover
13.96v at appx 4k rpm
a couple of pics to follow.....
Attached Images

At the fuses, next to the starter solenoid

Like this it can be done:

1. First remove left side upper and lower fairing. Remove the seat.
2. Remove the battery from the bike. Gives you better space to the work, and no risk dropping tools on it to make any short circuits.

3. Disconnect the white connector from the rec.

4. At the white rec connector part connected to the bike, there are two red/blk wires and two blue. Remove insulation from the two red/blk from about 20 mm over the connector and for about 20 mm. DO NOT CUT THEM!!!

5. Now you need a new 4 or 6 mm² wire. Remove insulation on this new wire end. Twist the end around both the unisolated part of the two red/blk. Solder the connection of the three wires and isolate it well. Look at boss bobs pic.

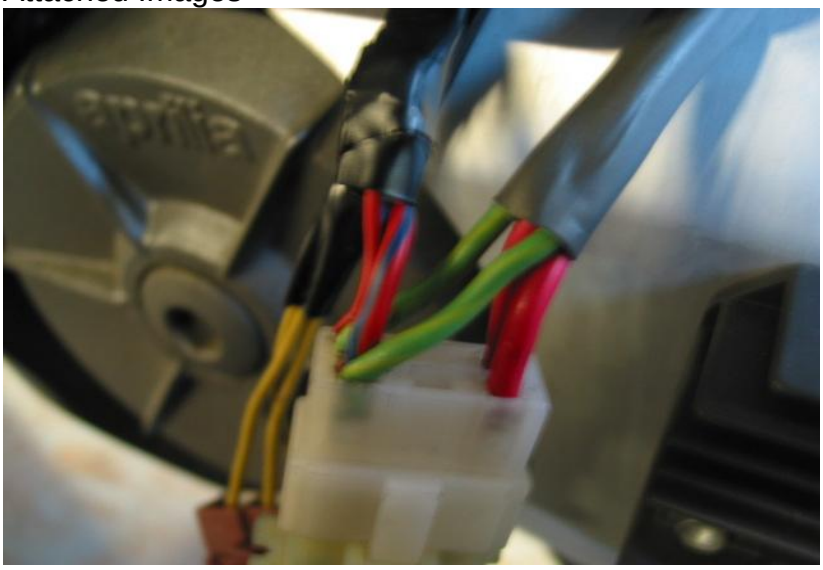
6. Now lift the fuse socket under the seat and turn it upside down. There are four wires on it. The two red goes to the battery. The white/red goes to the front of the bike. The fourth is a red/blk. To this red/blk wire you connect the other end of your new 4 or 6 mm² wire the same way you did at the rec connector. Don't cut it, just remove the insulation and twist the new wire around. Solder the connection and isolate well. Again look at bossbobs pic.

7. That's it. Find a way to put the new wire inside the frame. I stripped it to the thick black ground wire from the battery. Then under the back of the fuel tank. Make sure it's kept away from sharp edges an hot engine parts.
Still have not done anything with the blue wires on the rec. Not sure if I will do it.

Thanks John B, I guess i see that logic, but i believe the physics will be more like the juice following the path of least resistance. Resistance (small wires, connectors not up to the task) being the problem. It's that old water flowing thru a bigger pipe analogy. Doubling up the wires w/larger wire and fewer connects going to the same place should cut the current to the wimpy lines by way more than half allowing those wires to stay cooler and as a result have even lower

losses.
Is the FUTURA the only Aprilia stuck with this problem, and if so, why?
One other thing, seems like current thought is to eliminate the brown connector completely before the inevitable meltdown. Why not do the same with the white connector as well. Or if not removing it, wouldn't it be better to splice in on the regulator side to take that connection out of the pic.
Can't imagine all this creative wiring not voiding the warranty. My 02s stock battery is still OK w/12.8V (ignition off) after a 4 mile commute in rush hour traffic. Probably not gonna change mine till the warranty goes pumpkin.
I've also installed a small LED voltmeter that shows from 8-16 volts in 1/2 volt increments. It is a little distracting watching the Vs drop @3k to 11.5(this is across the lights circuit, so about .7V less than at the battery)
One minor downside of gaining almost 1V @4K is that bulb life will suffer a bit. Think I'd rather carry spare bulbs than the electrician's kit though.
The only thing better than good info is free good info. Thanks to all yunz guys who've taken the time to pound on this and share.

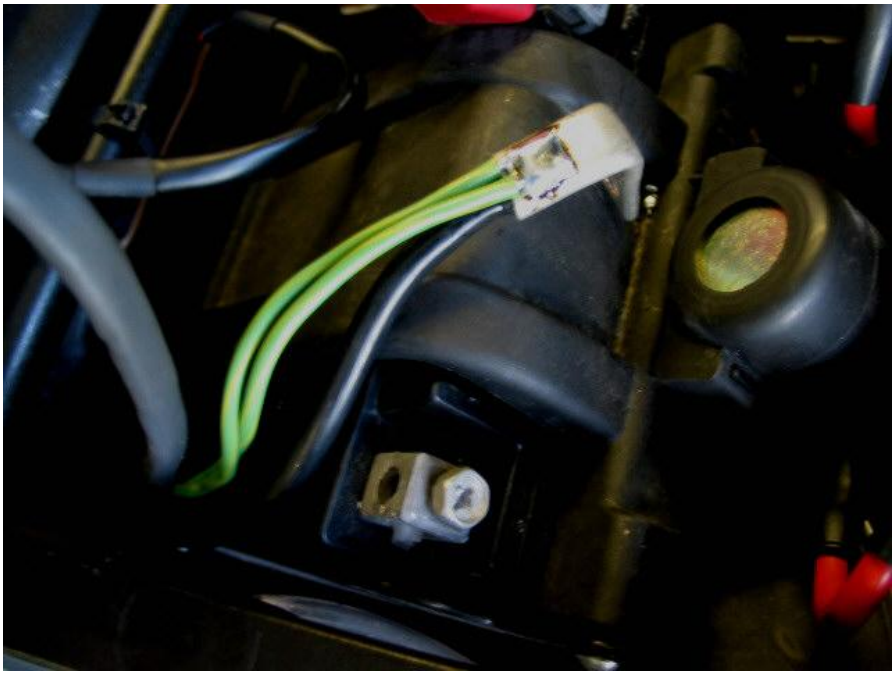
Here's a pic of my modified connector. I cut off the factory feeds after removing the spade terminals from the connector. Then I opened up & cleaned the spades and soldered on my new feeds & reinstalled. To add the new ground wires I removed the spades from the connector & soldered my new wires on top of the existing grounds & squeezed them both back in. All 4 wires went into heat shrink tubing & I ran the new harness up under the frame & along the battery ground cable to the battery area.
Attached Images



This is how I attached the grounds to the battery ground clamp. Both wires were soldered on after cutting away the factory heat shrink cover. I slipped a new heat shrink cover over all three wires afterwards. The harness with the 2 remaining feed wires was routed around the battery & then the wires were soldered to the red/blk spade after removing it from the main fuse box.

Voltage before the mod was averaging 12.9-13.1v @ idle & 12.5-12.7v @ 4K. After mod voltage is 14.3V @ idle 7 13.97V @ 4K with high beam on. 1 tenth lower with low beam on.

John B.



Lots on here now....
**I agree with this emphatically**

> But I believe the physics will be more like the juice following the path of least resistance. Resistance (small wires, connectors not up to the task) being the problem. It's that old water flowing thru a bigger pipe analogy. Doubling up the wires w/larger wire and fewer connects going to the same place should cut the current to the wimpy lines by way more than half allowing those wires to stay cooler and as a result have even lower losses.

Hence I would argue there is greater benefit leaving all existing wires in place and adding another and is the very reason I joined the 3 wires together at the reg/rec. Your guarantee that the draw was split 50/50 on the regulator outputs. To each there own. (Drawing to follow)

> I've also installed a small LED voltmeter that shows from 8-16 volts in 1/2 volt increments. It is a little distracting watching the Vs drop @3k to 11.5(this is across the lights circuit,

This is great info.... It also says that **ALL** your electrics are only getting 11.5V i.e. coils, ECU, injectors, , sensors, fans ..... the lot

> I don't think eliminating the brown connector is necessary anymore

Again, I would agree..... but it is done, and one less "weak link" to catch me out on a trip, especially if one has lots of accessories.

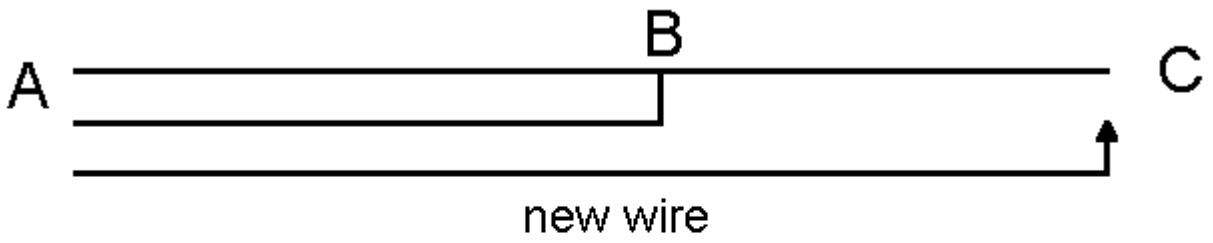
> Take a good look at my connector pic & you will see I replaced both red/blk feed wires in the white connector with slightly larger red wires which run directly to the main fuse box as I described

This bit I don't follow yet. I see the 2 new reds at the reg.rec plug, and note the 2 red/blk are missing. But where did you put the other end of the 2 reds? the same place as Hans and I ? Namely the fuse holder next to the starter solenoid?
If so, I cannot understand that as you must have left the red/blk connected at the fuse block and are therefore now supplying the entire bike back down that single cable instead of 3 cables like Hans and I ..... see drawing

Yours is neater, by far, and I think that is important before others start following the mod

So to the drawing, what I have done is add a wire from A to C thus creating a circle, a feed from both ends, otherwise known as a "ring" circuit in the UK.
The flow was from A to B to C and at C we had too little voltage.
John's flow, if I understand his mod correctly, is now A to C to B with no return path to the reg/rec as they are cut off.
Hans and I have a flow from A to B and A to C and B to C , a circle or ring circuit.
The benefit is that the flow will go to where it is needed by the route of least resistance, if the battery needs the power it will use A to C
If it is the lights et al drawing power it will use A to B untill it is easier to use A to C to B

The outcome is that Johns mod has B supplied by one cable from the rear fuse block under the seat (again, if I understand correctly) and this is one of the small original ones while hans and I have 3 cables supplying B
The drawing where the new wire now makes a full circle by joining A to C




**Where**
**A = reg/rec**
**B = Front fuse box**
**C = Fuses at battery**

Bossbob - You need to take a good look at the factory wiring diagram. You don't have two separate wires from the rectifier supplying the front fuse box as in your drawing. The two red/blk feed wires become one & tie into the one red/blk coming from the main fuse box which then goes to the frt box so you really aren't giving the front box any more juice with your set up. The feed wire to the frt box is limited by it's size as far as how much it can carry.

. Why do you think a circle back to the rectifier is beneficial? Once the bike is started the rectifier puts out juice & doesn't require anything coming back.

As for 1 large wire spliced onto the two at the rectifier connector giving a better 50/50 split then my 2 separate wires you've lost me there! I can't imagine a better 50/50 split then 2 separate wires.

If you really want to improve the flow of juice to the front fuse box you would replace the red/blk from the main fuse box forward with a heavier gauge wire doing away with the connectors & wires T'ing off of it like the no longer necessary stock feed wires from the rectifier.

As to what I did with the cut off wires it's all there in my last few posts. Before I did any of this I ran my ideas by Ritzo @ Electrex who I consider to be one of the most knowledgeable people on the planet when it comes to motorcycle electrical systems. He felt there was no need to leave the factory feeds in the system & that 2 wires for the feed & ground were better then one large one so that's the way I went.

John B.

According to the wiring diagram the two red/blk from the rec becomes one and connected to the fuse under the seat, and fuse A , B and E at the front. Fuse E is not connected according to the

wiring diagram. But it is for shure, discovered it when installing the heated grip. As far as I can see the two wires goes in to one at the front of the bike somewhere. The rest of the fuses at the front is supplied via ignition. The ignition is supplied via the white/red wire from under the seat.
But right now this have turned into a discussion that just a few of the guys here fully follow.
The problem is: THE WIRE BETWEEN THE REC AND THE BATTERY IS TOO THIN.
My advise to fix it quick and safe: Do it bossbobs way. Connect a parallel cable from the two red/blk wires on the rec connector to the red/blk wire to the fuse under the seat. Made a description here yesterday evening. A 4 mm² is probably more than enough.

_____

If a second wire is wired in parallel to the existing wire you just create a parallel circuit of resistors, which the wires and their contact just are. Overall resistance is (R1*R2)/(R1+R2) so always lower than just one wire. The actual resistance lowering effect of the parallel circuit in this situation might in reality be (very) small if the difference in resistance between the wires is big (and the results this far have proven that that is the case).

The headlights (main beam) ARE the biggest consumers:
2 times 60 Watts = 120 Watts @ 12 Volts = 10 Amps (in reality a bit less since it's about 14 Volts). The main fuse is rated 30 Amps; my guess is that without auxiliary devices it's about 15 Amps max which the regulator has to supply, under normal situations.

_____
Rob - '01 Rosso Flame

Bef, all 3 ways fix the problem quite well. John and I are just a little disagreed what the optimate way is. But the quickest, easiest and most understandable way is:
Put a parallel 4 or 6 mm² from your rec (the two red/blk wires)to the inlet side of the fuse under the seat(a single red/blk). That’s all I have done, works perfect.
As said before; the problem is long and thin wiring between the rec and the battery.

> Put a parallel 4 or 6 mm² from your rec (the two red/blk wires)to the inlet side of the fuse under the seat(a single red/blk

Totally Agreed
And then .....
Put another parallel cable from the blue at the reg/rec to the battery negative.
And I emphasize, I never cut any cables. All originals are in use.

I think we are completely oversize on cable, my suggestion to jon (podpeeze) was to use an old bit of mains flex, like a kettle cable or bit of extension lead or similar, this would give two layers of insulation to protect them from heat or shorting on metal. That is the kind of cable I used

I am happy to write up "what I have done"
But not "what you should do"
I trust you can see the difference.

Here is a copy of the mail I sent to Jon,

it has nothing to do with accessories, it is the same on all the bikes. The wiring is too small and goes a "funny" route which, in short, means there are not enough volts at the battery. It only has 13 instead of 14.when the bike is ticking over.
The job is simple..... add another wire ..... full stop
The job is simpler if you can get that clear in your mind, all you are doing is adding a wire.
The cable to add goes from (is connected to) the red/black at the rectifier to the red/black under

the 2 green fuses next to the starter solenoid.
There are pictures on the thread.
I also connected an extra earth, from the blue at the rectifier to the negative of the battery, again simple. Full stop. Do not make it any more complex in your mind.

Now, that said, without the right crimps or soldering kit it would be a pain to do. Not everyone has a good soldering bolt and cables this big need a good bit of heat to be soldered.
the cable I would suggest using is simply a bit of mains flex, say an old kettle lead, extension cable, or similar. That kind of cable would be perfect.
Use the brown to go between the red/blacks and the blue to go between the blue and battery. It has the benefit of 2 bits of insulation; the outer will give it extra protection.

See..... it's not easy to explain in detail, it's OK for Hans and I , we understand the logic.

Does that help oh Befmeister one

Been some interesting reading here..... now my take. First off let me state that I've been wiring bikes for over 20 years and have learned my wiring lessons the hard way.

I agree that the wiring and the connectors on the rec to fuse and rec to ground are weak. Tony apparently put all his engineers on designing the motor, chassis, and bodywork on this bike, leaving the electrical design to the apprentice and only gave him one day to do it.

IMHO, there are some items that need to be considered in addition to the "run 2 more wires" school of thought.

First off, the bike is wired in typical European fashion, meaning that the wire size is always marginal..... just barely enough to meet spec, but unable to handle the real world in a reliable way. Anyone involved in industrial control knows what I mean if you compare IEC to NEMA rated components. IEC components are rated for a lifetime of "number of cycles" while the NEMA rated stuff is built like a tank and expected to last nearly forever. Not being critical of IEC, just stating fact.

The red/black wire that provides ground to the headlamps and dashboard are a great example. They have used what appears to be about 22 AWG size wire coming off the rec to run the hots for the headlamps and the dash. They take this one thin wire and split it essentially into 3 of the same size wire! Elsewhere in this thread someone pointed to a "how to" thread for connecting the bar switch so that the low beam (dip) remains on with the high beams. Hell, the wire size can barely support 2 - 55 watt high bulbs as it is, let alone the additional 55 watt low beam. Seriously undersized for the way it is being used.

I've just completed a complete rewire of the high beam circuit running a high quality 16 AWG wire to the high beam relay and all the wiring past it (to the stock white connector then to the headlamp connectors). Same goes for the ground circuit for these lamps. I know that I'll be getting full wattage from my high beams now.

BMW is notorious for giving you reduced brightness due to poor wire size and it is common to run an additional relay and wiring circuit to achieve full brightness. I believe the Futura is no different, but I am running 2 - 70 watt bulbs in the high beam so proper wire upgrading was needed anyhow IMHO.

I've also installed an aftermarket Hella HID kit and ran it on it's own circuit, using the stock low beam wiring only to trigger the HID relay. I'll do the mod to have the low HID on with the high beams (or just throw on a toggle switch since our lows are always on over here) but will not have to worry about inadequate current to run all this. I'm a big fan of HIDs on bikes and the only thing yet to be seen is how the stock Futura headlamp reflector behaves with the HID bulb. I'm

expecting it to work fine since the stock reflector has such an excellent, though underpowered, light pattern.

Going over what connectors I could find, I noticed numerous points of exposed copper at the terminal connections which will seriously degrade performance and current carrying capability over time. Disassembling the connectors to make the appropriate changes (new terminals or shrink tube over the wire/terminal joints) is a PITA, but a worthwhile investment in time. Better to fix the probs now while I'm in a nice lighted, temperature controlled garage than out on a freeway in the rain with traffic flying by.

**Now some other related comments about some things on this thread.**

Soldering.
I strongly suggest that unless you are proficient in using a good quality soldering iron, you stick to crimp terminals and shrink tube.
Most folks tend to get too much solder on joints that are not hot enough to get good flow. Too much flow you wind up having the solder wick down the wire under the insulation, making the wire brittle. A brittle wire joint on a vibrating bike is not a good thing especially if it breaks and the break is hidden under the insulation.

High and Low beam on at the same time, or higher wattage bulbs.
You need to upgrade the entire wiring circuit for the headlamps to get full lighting potential. The stock wiring simply cannot handle the increased load.

Wire sizes.
At one point in this thread I noticed someone used 12 gauge wire for the positive, but only 14 gauge for the ground (or something similar). You have wasted a good chunk of 12 gauge wire doing this. The same amount of current is carried on both the positive wire as is carried on the negative wire and it's the old "weak link in the chain" syndrome if you don't use common sense here.

Rectifier grounding.
I notice that the rec case is really not grounded itself. The metal plate it bolts to is rubber mounted. Granted, the bolts do provide some grounding, but it would be a good idea to run an additional ground wire from the mounting bolt that contacts the rec case to a good ground, preferably the neg on the battery. Maybe overkill, but that little trick kept my bulbs on an HD living more than 3 weeks.

Rectifier heating.
While some heating is expected due to the function of the rec itself, having it mounted in an area that doesn't receive much cool air and to a metal plate that is going to pick up transmission and engine heat makes it worse. I plan on spacing mine out using 2 spacers between the rec case and the mounting plate to provide an additional air path behind the rec case. This may help, or it may not depending upon what gets hotter, the rec or the plate. If the former, then I will be defeating the plate's use as a heat sink, but I'm betting that it will be an improvement.

Rec wiring.
Someone please explain the benefit of running the extra positive rec to fuse wire to the fuse block rather than to the battery. Unless there's something I'm missing, wiring it to the battery should be fine.

Brown rec connector.
Mine like others, has accumulated oil. Disassemble the terminals from the brown connector, clean out the oil with brake cleaner, sand the terminals all nice and shiny with emery cloth, reassemble and seal the wire entries with silicone to prevent the oil from getting in there. Oil will tend to wick up these wires and further degrade them.

That's enough for now.
Off to bed. Got to get up for work in 4 hours.

The red/black wire that provides ground to the headlamps and dashboard are a great example."

Red/blk wire is bringing power to the headlight not ground.

"At one point in this thread I noticed someone used 12 gauge wire for the positive, but only 14 gauge for the ground (or something similar). You have wasted a good chunk of 12 gauge wire doing this. "

If you read my entire post you would know that I ADDED two 14 gauge wires to the already existing 2 factory ground wires & ran them to the battery ground clamp. I think 4 ground wires is more then sufficient.

"Rectifier grounding.
I notice that the rec case is really not grounded itself. The metal plate it bolts to is rubber mounted. Granted, the bolts do provide some grounding, but it would be a good idea to run an additional ground wire from the mounting bolt that contacts the rec case to a good ground, preferably the neg on the battery."

This is a complete waste of time as the rectifier case does not serve as a ground on this model. Check continuity between the rectifier green wires & the case & see for yourself.

"Rectifier heating.
While some heating is expected due to the function of the rec itself, having it mounted in an area that doesn't receive much cool air and to a metal plate that is going to pick up transmission and engine heat makes it worse. "

Take a good look at the cut out in the lower fairing piece. This channels air directly up & into the rectifier area when the bike is moving. I'm betting the aluminum plate is meant to serve as a heat sink & also to shield the rectifier from engine heat. When the bike is moving the air flowing through the fairing cut out will flow across both the plate & the rectifier.

"Rec wiring.
Someone please explain the benefit of running the extra positive rec to fuse wire to the fuse block rather than to the battery. Unless there's something I'm missing, wiring it to the battery should be fine."

I asked the same question when I spoke to Electrex & they insisted that with the output of the charging system (500W) it needed to be fused. You of course could run it directly to the battery & as long as you never had a major component failure it would work fine.
John B.

I really enjoyed reading your comments. And I do agree with you. The bike is marginal wired. The critical part is charging supply to the battery. This has caused damages to batteries, recs, connectors and probably stators. The rest is not critical, but can be so much better.
Two years ago I rewired the last fuse in the front fusebox. It was connected to the rec-side, changed it to the ignition side. Did not think it over, just did it. This fuse supplies my alarm,

heated grips and a socket to charge my mobile phone. Well, the 30 watts to the heated grips now makes the voltage drop more than one Volt. This is the part supplied from the other fuse under the seat.

Tested my headlights as well, drops about 0,5-0,6 Volt. All numbers refering to battery.
So I am gonna rewire all main feeding wires including the headlights.

Rec heating.
Put some heat sink under it, but am not sure what gives heat to what. Plate to the rec, or rec to the plate? Right now the plate feels warmer than the rec.

Rec wiring.
The fuse is probably there to protect the battery. If there is a short circuit inside or in the outlet of the rec, or the wiring directly connected to the rec. If it happens, the power from there will be zero. The only power supply in this situation will be the battery. No fuse, damaged battery in a minute or melted wires...

Brown rec connector.

The tiny o-ring on the filler plug makes it leak. The oil isolates the cords in the scrimp. did it on my bike. Replaced the o-ring with a thicker one. Cleaned and soldered the crimps. Seems to help.

_____

Quote:

> *Originally posted by RPB*
> One thing I would like to add, or better, remark is that I'm a little bit disappointed about the type of connectors Aprilia have been using. I have not yet seen any connector on this bike which is weather resistant sealed.

Well, I found ONE..... the connector for the temp sensor in the mirror is a high quality Duetsch (sp?) connector. Good to know that in a downpour at least the temp sensor will work, eh?

Stick - Republik of Kalifornia
"Temperamentally and constitutionally incapable of leaving well enAs battery manufacturers list the battery as 10 Ah I wonder if it is part of the reason for premature battery failure."

I think the main cause of the premature battery failures has been the minimal charge the batteries have received from the rectifiers. I would have to think we'll see much longer battery life after doing the rec mod. I already bought the YTZ14S battery so it's going in anyways. The stock battery will move to my Moto Morini 3.5 Sport.

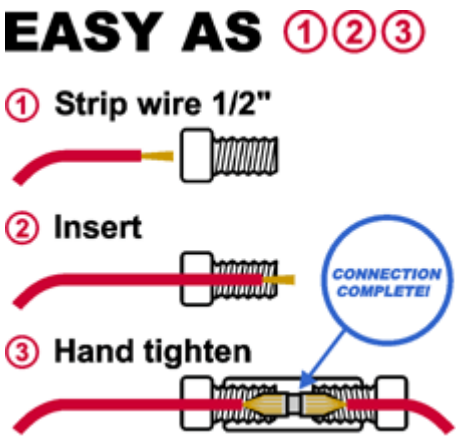
_____
John B.

> Since I've already replaced a melted brown connector, I'm certainly interested in getting to the real cure.

As I said previously, I want to use a connector of some sort to replace the brown plug so that in the future I can take it back apart for troubleshooting without the hurdle of soldering. That'd be a nice feature to retain for on-the-road repairs.

As someone else mentioned, Posi-lock butt connectors make a good choice since the the yellow

(the manual calls them green) wires can be connected in any order and reconnected in any order as well. The Posi-locks I bought at WalMart are for 18 to 24 AWG wires.... no crimp, no solder.

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So I've done the wiring mod and my bikes still under warranty, but the service manager said it would be ok for me to carry out the work...I told what my job was....always works fpr me.

One red/black wire on the regulator multi-plug linked into with a thicker wire, fed up to the main fuse (30amp) black/red wire.

Second red/black wire at the regulator linked into with thicker wire, routed up to the battery area and connected to an inline 30 amp fuse (additional parts) and then this was connected directly to the battery positive terminal. This second wire was added just because I wanted to even though I obtained good (14volts) with the single wire to the main fuse box.

Now with the ability to interrupt the power supply from the modified wiring I can show the Aprilia guys (at my dealers at least) what they need to see.

This additional wire gave me a reading of 14.18 volts at idle with headlight on dipped beam, and it remained virtually constant with increasing the revs.

Maybe instead of seeing who has the most powerful engine, we ought to see who can generate the most electrical energy.

May the Gods of hot metal go with you and your Futura be bright
Hard to believe we need yet another charging thread. All these questions have been answered many times over in previous threads.

1/ My bike has been fine with the stock battery but if you upgrade the YTZ14 is preferable.

2/ Everyone has a different solution. I found that soldering the crimps was all mine needed to keep it cool. I'm not a fan of hard wiring the rectifier as it makes swapping out the rectifier on a trip difficult at best.

3/ Start with a voltmeter & find out what your problem is before you buy anything. Load test your battery & see if its bad. Check your charging rate & then read all the threads pertaining to the charging issue & decide what works best for you.

---

Yes the charging mods improve battery life by keeping it charged fully. And yes the brown connector can melt down completely leaving you stranded as it has happened to a few here. Mine was fine for quite awhile then I checked it one day and the wires were discoloured and the

connector was starting to melt. So I cut it out, soldered the wires and have had no problems since, easy fix.

Just a thought.....the generator on the Futura has a greater output than on all the other models, right?
.....and they don't seem to have nearly as much in the way of problems as we do.
Could it be that the wiring, connectors, rectifier, battery as supplied have not been upgraded up to suit?
...and following on that train of thought would it be possible to fit a generator from a Mille and see what happens?
I know that the location of the rectifier on the Futura is fairly hostile heat and airflow wise but my wiring heats up before the bike is even warm.....
OK, tell me I'm talking crap but it would be nice to bottom this problem once and for all, so far we seem to have had several 'solutions' that in the end have turned out to be not quite so.....I'll go and lie down now.....
I believe both the Futura & Capo have the same output & both use a heavier duty version of the brown connector with larger brass terminals. All the models suffer from an undercharging problem & I really don't see the stator as the source of the problems. From what I'm seeing lately soldering all the crimped connections cools down the wires even with the higher output rectifier. The brown connector is fairly straight forward but the white connector can be a PITA. I ground down a small flat bladed screwdriver so it will fit into the slot above the terminals & reach in to the rear. You need to depress the tab on top of the terminal while pulling the wire out from the rear. In some cases the wire comes out & leaves the terminal behind & you will need a pair of small needlenose pliers to extract it. If you screw up the white connector/spades on the rectifier side I have spares available.

Correct. The stator is a permanent magnet delivering full power all the time. The rec is just a diode bridge bleeding the unused power to ground.
When the battery is getting "tired", less power is stored.
More power is bleeding to ground. This push the voltage down.

Quote:

Sorry to stick my nose in here, but no... I'm afraid that's *incorrect.*

**Quote:**

> The stator is a permanent magnet delivering full power all the time.

Again, incorrect. The *rotor* is a permanent magnet. The stator is three separate wires wound around a metal core. As the rotor rotates, it induces an AC voltage in the stator windings; the greater the rotational speed, the greater the voltage. The amount of AC voltage at any given rotor rpm is a function of the magnet strength and the number of turns in each stator winding.

> The rec is just a diode bridge bleeding the unused power to ground.

Once again, incorrect. The rectifier is indeed a diode bridge, but its function is to convert the 3-phase AC voltage pulses from the stator into DC. It's the *regulator* portion of the regulator/rectifier that bleeds excess current to ground.

**Quote:**

> When the battery is getting "tired", less power is stored. More power is bleeding to ground. This push the voltage down.

That statement is totally off-the-wall.

As with the Caponord, some of your Futura charging problems are caused by high resistance wiring connections. But most of the trouble is caused by the fact that the regulator/rectifier unit

used by Aprilia adjusts DC output based on AC input to prevent battery overcharge. That's why you see voltage going down as rpm goes up. This regulator has no way to detect actual battery voltage and simply "errs on the side of safety," if you will. This results in the battery being undercharged at cruising rpm, and it shortens battery life through sulfation. The situation wouldn't affect the older "flooded" style batteries to the same extent, but sealed, AGM batteries need a charging voltage of around 14.2 volts.

A better method (more accurate voltage control) is to incorporate a circuit that actually senses battery voltage and adjusts output accordingly. Shindengen, the company that makes the regulator/rectifier, manufactures both types. The voltage-sensing type appears identical, but it has an additional wire that's attached to a switched source of battery voltage.

Okay, I'm gone. Sorry for the interruption.

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Quote:

> *Originally posted by new forest man*
> I was just about to do my wiring mod today and I thought that I would ring my local dealer .as I have 10months left on my Aprilia warranty ,I asked if it would invalidate my warranty ,if I went ahead. the reply was " OH YES SIR! " So I lost my nerve and will wait for another **10 months.** the dealer said that they had never heard of this mod and there wasn't a problem with the charging system. Well in that case ,we the riders of futura's must be wrong and Aprilia must be right .....NOT!

When I asked my dealer about it he had never heard of it and thought it was the stupidest thing he'd ever heard of. Of course this was only the opinion of one person at my dealer and he said he would research it, but I never heard back. For this reason I did a test mod where I only added some wire by skinning back the insulation and twisting on the new wire in a way that I could easily have kept it looking untouched without great scrutiny. The results were so dramatic and my brown connector was getting so hot before I decided to go for it regardless of the warranty. I'm taking the chance that if something breaks it won't be electrical. My bike only had about 3500 miles on it and no problems yet when I did it, but after so many others with failures I did not want to chance it.

Not telling you what to do, just more to think about.

Hey John B.

I just finished installing the new regulator that I bought from you. I had already done the wiring mod listed before. My readings at the battery were 14.5 v at idle and 13.8 v at 4000 rpm. After installing the new regulator I bought from John I am now getting 15 v at idle and at 4000 rpm. I sure hope this fixed it for good. Thanks for the good quality product John! It should also be noted that the stock reg was already heating up badly and melting the insulation at the connector again. A fire hazard waiting to happen.

Bob - What were your figures before you did the wiring mod? 15v is getting mighty close to too much of a good thing. My guess is that the rectifier would have put you in the mid 14s without the mod which is where I like to see it. Many times the w/m is not required with the new rectifier & it would be interesting to see what your figures are if you disconnect the w/m feed from the fuse box red/blk & take a reading.

Quote:

> Originally Posted by **dcarrRS250**
> *How do I go about getting a replacement rectifier? And is there anything else I need to do? Sorry I just purchased a 02 Futura (haven't even picked it up yet) and am doing research before going on a long trip. Glad I found this info. Thanks everyone. Dan*

Dan - I sent you a PM with the info.
One of the problems with the stock rectifier is the voltage drop off idle. Adding the extra wires will improve the voltage but won't solve the problems inherent in the rectifier itself. Those of us that have upgraded to the new rectifier have found the wiring mod unnecessary & see voltage readings of 14.2-14.5v at 4k.

First of all the stock rectifier is made in Japan by Shendengen who makes rectifiers for Honda & others. In this case I'd say its a rectifier with too much voltage drop off idle but its not that simple. If you do a version of the wiring mod you can get the stock rectifier up to an acceptable but not ideal level. The interesting thing is that the wiring mod has little or no effect on the rectifier I sell but makes a huge improvement in the stock unit. Why does the stock unit require the wiring mod to put out decent voltage when an aftermarket replacement will work fine with the stock wiring? The stock unit is not used by anyone else at this point & you really have to wonder what made Aprilia chose it.

---

Mmm, sounds like the internal resistance on the output side of the stock rectifier is fairly high. That, in combination with too thin wires in the stock wiring setup may cause the observed voltage drop. That could explain the huge effect of the wiring mod (effectively lowering the resistance to the battery). I would guess that John's unit has a (much) lower internal resistance so that the wiring mod has a much lesser effect.

Be sure & check to see if the white connector gets hot after letting the bike idle for a few minutes. A couple guys have had problems similar to the melting brown connector which would indicate a high resistance in the stock harness & might require doing the wiring mod to cool things down. I'd appreciate hearing any feedback one way or the other either here or by email/pm.
Your right, it is a pain in the a$$. That is why I did what I did to the connectors. It has taken the heat factor away. I also seem to be seeing more issues as the weather has taken a turn for the HOT part of the year. Not to much about this topic during the winter months.
If your were wondering about what I did before I changed the term strip, I could see both connectors thru the opening in the left side panel. Maybe they were placed there during manufacturing, I couldn't say for sure. Maybe you can arange them as to be able to see them thru the panel.
I think you also asked about how the connectors stay tight. I used blue loctite and have had great results with this. No problem with water either but you would need to have a lot of water to do any harm here.
The heat with both stock connectors were a issue on my bike also and that is why I did what I did too both connectors even after the new rec. Sence I have redone the connectors, The yellow wires have kept fairly cool and no more dead starts. One last thing is, I did the wiring mod, because John had not had the new style rec available yet. I hope this all makes sence.

P.S. As far as warranty goes, which I still have a warranty, my dealer has no problem what so ever with what has been done here.

*Last edited by ride200mi : 07-07-2005 at 01:57 PM.*

In my case the plate was like this before I changed anything.... Maybe there is a newer version... Mine is a 03....

The red jumper is part of the wiring mod. Now if I can get this right.... On the mod you are to run a wire from one of the red wires off the white connector to the 30 amp fuse, So instead of doubling up on the term strip (which would be the added red wire from the white connector) I ran a jumper to another post on the strip. I than ran a red wire from the jumper to the 30 amp fuse. Does this make sense..?? And did the same for the black wire going straight to the ground on the batt. You just can't see the black jumper wire in the pic. If this is confusing e-mail me or give me a call. It has been working really well and no hotter wires. I didn't solder the yellow wires but instead I have found a barrel type connector that has no resistance. You have to fan out the wire and inside the connector looks like a cone. What this does is make contact to all the filament wires inside the yellow wire. This way I can disconnect the wires if necessary. The area of contact is much greater than the normal blade type connectors found at most auto stores. I think I found the barrel ones at a electric parts store. And now all the wires stay pretty cool.

Cool enough that I can touch them at any time. Before the mod I couldn't touch the yellow wires at all. and the white connector was pretty hot too. Just for kicks here's another pic of the method I used to remove the white connector. I have since removed the brown connector in the same manner and all remains well, with the wiring mod in place & stock rectifier. The nice part is everything can be unplugged.

e touch.

As I've mentioned before I'm not in favour of removing the brown or white connectors unless they have failed. The white connector is used on most bikes on the road today with no problems so its design is not causing the heat problems. My advice is to remove the wires, solder all the crimp connections & put the connectors back together after making sure the male/female spades fit tightly. Once you remove the source of the heat the spades won't be loosening up from the heating/cooling cycles. If you compare the wire size on the Futura it's no smaller then what you find on a Honda or BMW so I don't see this as the source of our problems. If soldering the crimps doesn't cool down the wires/connectors then look at doing some version of the wiring mod to eliminate the multiple connections between the white plug/ battery & improve your grounds.

It is easier to remember the things you've experienced rather than the things you've learned

.My suggestion for the connector/charging issue:

Disassemble the brown stator connector.
Clean and de-oxidize as required. This may be difficult as oil PUMPS THRU the wires from the engine. (No you did not spill it!) This is part of the failure mechanism! ZX-12's have this problem too. Disassembly of the actual crimp may be necessary to clean it.
Solder BOTH ends of each conductor.
Re-tension the contacts of the connectors by squeezing them a bit with pliers.
Reassemble.
Do the same for the white output connector.
Apply heat sink compound on the mount plate, beneath the reg-rec unit.
Remove the ground cable from the battery and engine (hidden behind the aft coils).
Solder both ends.
Resecure firmly to the battery and cylinder.
Disassemble and solder the triple fuse connection crimps also.
With these improvements, I doubt you will ever have a problem.

## RST1000 Futura / ETV1000 CapoNord

### Re-setting the "SERVICE" Light

1. Remove the seat.
2. On the right hand side (as you face the bars) near the battery you will find two connectors. One each, male and female. The female connector has two grey wires and the male has a blue/green wire. Connecting these two together puts the onboard computer into diagnostic mode. Connect these together, noting their original position for later.
3. Turn on the ignition (don't start the engine).
4. On the right hand instrument panel, "EFI" will now display above the MODE button.
5. Press and hold the MODE button.
6. While still pressing the MODE button, press and hold the SET button.
7. Keep both buttons pressed until the "Service" indicator disappears (seems like a long time, 10+ seconds).
8. Turn off the ignition.
9. Disconnect the diagnostic connectors and place them in their original position.
10. Turn ignition back on to verify "SERVICE" indicator is out and panel displays normally.
11. Replace seat and ride safely.

# Battery Tutorial

You have most likely heard the term K.I.S.S. (Keep It Simple, Stupid). I am going to attempt to explain how lead acid batteries work and what they need without burying you with a bunch of needless technical data. Actually I have found that battery manufacturer's data will vary somewhat so I must generalize in some cases.

The commercial use of the lead acid battery is over 100 years old. The same chemical principal is being used to create energy that our Great, Great, Grandparents may have used.

If you can grasp the basics you will have fewer battery problems and will gain greater battery performance, reliability, and longevity. I suggest you read the entire tutorial, however I have indexed all the information for a quick read and easy reference.

A battery is like a piggy bank. If you keep taking out and putting nothing back you soon will have nothing.

Present day chassis battery power requirements are huge. Look at todayÕs vehicle and all the electrical devices that must be supplied. Electronics require a source of reliable power. Poor battery condition can cause expensive electronic component failure. Did you know that the average auto has 11 pounds of wire in the electrical system? Look at RVs and boats with all the electrical gadgets that require power. I can remember when a trailer or motor home had a single 12-volt house battery. Today it is standard to have 2 or more house batteries powering inverters up to 4000 watts.

Average battery life has become shorter as energy requirements have increased. Life span depends on usage; 6 months to 48 months, yet only 30% of all batteries actually reach the 48-month mark.

## A Few Basics

The Lead Acid battery is made up of plates, lead, and lead oxide (various other elements are used to change density, hardness, porosity, etc.) with a 35% sulfuric acid and 65% water solution. This solution is called electrolyte which causes a chemical reaction that produce electrons. When you test a battery with a hydrometer you are measuring the amount of sulfuric acid in the electrolyte. If your reading is low, that means the chemistry that makes electrons is lacking. So where did the sulfur go? It is resting to the battery plates and when you recharge the battery the sulfur returns to the electrolyte.



**1.** We must think *safety* when we are working around and with batteries. Remove all jewelry.

After all you don't want to melt your watchband while you are wearing the watch. The hydrogen gas that batteries make when charging is very explosive. I have had 2 batteries blow up and drench me in sulfuric acid. That is no fun. This is a good time to use those safety goggles that are hanging on the wall. Sulfuric Acid eats up clothing and you may want to select Polyester clothing to wear, as it is naturally acid resistant. I just wear junk clothes, after all Polyester is so out of style. When doing electrical work on vehicles it is best to disconnect the ground cable. Just remember you are messing with corrosive acid, explosive gases and 100's amps of electrical current.

**2.** Basically there are **two types of batteries**; starting (cranking), and deep cycle (marine/golf cart). The **starting battery (SLI starting lights ignition)** is designed to deliver quick bursts of energy (such as starting engines) and have a greater plate count. The plates will also be thinner and have somewhat different material composition. The **deep cycle battery** has less instant energy but greater long-term energy delivery. Deep cycle batteries have thicker plates and can survive a number of discharge cycles. Starting batteries should not be used for deep cycle applications. The so-called **Dual Purpose Battery** is only a compromise between the 2 types of batteries.

**3. Wet Cell** (flooded), **Gel Cell, and Absorbed Glass Mat (AGM)** are various versions of the lead acid battery. The **wet cell** comes in 2 styles; serviceable, and maintenance free. Both are filled with electrolyte and I prefer one that I can add water to and check the specific gravity of the electrolyte with a hydrometer. The **Gel Cell** and the **AGM** batteries are specialty batteries that typically cost twice as much as a premium wet cell. However they store very well and do not tend to sulfate or degrade as easily or as easily as wet cell. There is little chance of a hydrogen gas explosion or corrosion when using these batteries; these are the safest lead acid batteries you can use. Gel Cell and some AGM batteries may require a special charging rate. I personally feel that careful consideration should be given to the AGM battery technology for applications such as Marine, RV, Solar, Audio, Power Sports and Stand-By Power just to name a few. If you don't use or operate your equipment daily; this can lead premature battery failure; or depend on top-notch battery performance then spend the extra money. Gel Cell batteries still are being sold but the AGM batteries are replacing them in most applications.

There is a little confusion about AGM batteries because different manufactures call them different names; some of the popular ones are sealed regulated valve, dry cell, non-spillable, and sealed lead acid batteries. In most cases AGM batteries will give greater life span and greater cycle life than a wet cell battery.
SPECIAL NOTE about Gel Batteries: It is very common for individuals to use the term GEL CELL when referring to sealed, maintenance free batteries, much like one would use Kleenex when referring to facial tissue or "Xerox machine" when referring to a copy machine. Be very careful when specifying a battery charger, many times we are told by customer they are requiring a charger for a Gel Cell battery and in fact the battery is not a Gel Cell.

**AGM:** The Absorbed Glass Matt construction allows the electrolyte to be suspended in close proximity with the plateÕs active material. In theory, this enhances both the discharge and recharge efficiency. Actually, the AGM batteries are a variant of Sealed VRLA batteries. Popular usage high performance engine starting, power sports, deep cycle, solar and storage battery. The AGM batteries we sell are typically good deep cycle batteries and they deliver best life performance if recharged before the battery drops below the 50 percent discharge rate. If these AGM batteries are discharged to a rate of 100 percent the cycle life will be 300 plus cycles and this is true of most AGM batteries rated as deep cycle batteries.

**GEL:** The gel cell is similar to the AGM style because the electrolyte is suspended, but different because technically the AGM battery is still considered to be a wet cell. The electrolyte in a GEL cell has a silica additive that causes it to set up or stiffen. The recharge

voltages on this type of cell are lower than the other styles of lead acid battery. This is probably the most sensitive cell in terms of adverse reactions to over-voltage charging. Gel Batteries are best used in VERY DEEP cycle application and may last a bit longer in hot weather applications. If the incorrect battery charger is used on a Gel Cell battery poor performance and premature failure is certain.

**4. CCA, CA, AH and RC** what are these all about? Well these are the standards that most battery companies use to rate the output and capacity of a battery.

Cold cranking amps **(CCA)** is a measurement of the number of amps a battery can deliver at 0 ° F for 30 seconds and not drop below 7.2 volts. So a high CCA battery rating is good especially in cold weather.

**CA** is cranking amps measured at 32 degrees F. This rating is also called marine cranking amps **(MCA)**. Hot cranking **amps (HCA)** is seldom used any longer but is measured at 80 ° F.

Reserve Capacity **(RC)** is a very important rating. This is the number of minutes a fully charged battery at 80 ° F will discharge 25 amps until the battery drops below 10.5 volts.

An amp hour (AH) is a rating usually found on deep cycle batteries. If a battery is rated at 100 amp hours it should deliver 5 amps for 20 hours, 20 amps for 5 hours, etc.

**5.** *Battery Maintenance* is an important issue. The battery should be cleaned using a baking soda and water mix; a couple of table spoons to a pint of water. Cable connection needs to be clean and tightened. Many battery problems are caused by dirty and loose connections. A serviceable battery needs to have the fluid level checked. Use only mineral free water. Distilled water is best. Don't overfill battery cells especially in warmer weather. The natural fluid expansion in hot weather will push excess electrolytes from the battery. To **prevent corrosion** of cables on top post batteries use a small bead of silicon sealer at the base of the post and place a felt battery washer over it.

Coat the washer with high temperature grease or petroleum jelly (Vaseline), then place cable on the post and tighten. Coat the exposed cable end with the grease. Most folks don't know that just the gases from the battery condensing on metal parts cause most corrosion.

**6.** *Battery Testing* can be done in more than one way. The most popular is measurement of specific gravity and battery voltage. To measure specific gravity buy a temperature compensating hydrometer and measure voltage, use a digital D.C. Voltmeter. A good digital load tester may be a good purchase if you need to test batteries sealed batteries.

You must first have the battery fully charged. The surface charge must be removed before testing. If the battery has been sitting at least several hours (I prefer at least 12 hours) you may begin testing. To remove surface charge the battery must experience a load of 20 amps for 3 plus minutes. Turning on the headlights (high beam) will do the trick. After turning off the lights you are ready to test the battery.

| State of Charge | Specific Gravity | Voltage | |
|---|---|---|---|
| | | 12V | 6V |
| 100% | 1.265 | 12.7 | 6.3 |
| *75% | 1.225 | 12.4 | 6.2 |

| | | | |
|---|---|---|---|
| 50% | 1.190 | 12.2 | 6.1 |
| 25% | 1.155 | 12.0 | 6.0 |
| Discharged | 1.120 | 11.9 | 6.0 |

*Sulfation of Batteries starts when specific gravity falls below 1.225 or voltage measures less than 12.4 (12v Battery) or 6.2 (6 volt battery). Sulfation hardens the battery plates reducing and eventually destroying the ability of the battery to generate Volts and Amps.

Load testing is yet another way of testing a battery. Load test removes amps from a battery much like starting an engine would. A load tester can be purchased at most auto parts stores. Some battery companies label their battery with the amp load for testing. This number is usually 1/2 of the CCA rating. For instance, a 500CCA battery would load test at 250 amps for 15 seconds. A load test can only be performed if the battery is near or at full charge.

The results of your testing should be as follows:

Hydrometer readings should not vary more than .05 differences between cells.

Digital Voltmeters should read as the voltage is shown in this document. The sealed AGM and Gel-Cell battery voltage (full charged) will be slightly higher in the 12.8 to 12.9 ranges. If you have voltage readings in the 10.5 volts range on a charged battery, that indicates a shorted cell.

If you have a maintenance free wet cell, the only ways to test are voltmeter and load test. Most of the maintenance free batteries have a built in hydrometer that tells you the condition of 1 cell of 6. You may get a good reading from 1 cell but have a problem with other cells in the battery.

When in doubt about battery testing, call the battery manufacturer. Many batteries sold today have a toll free number to call for help.

**7.** *Selecting* **a Battery** - When **buying a new battery** I suggest you purchase a battery with the greatest reserve capacity or amp hour rating possible. Of course the physical size, cable hook up, and terminal type must be a consideration. You may want to consider a Gel Cell or an Absorbed Glass Mat (AGM) rather than a Wet Cell if the application is in a harsher environment or the battery is not going to receive regular maintenance and charging.

Be sure to purchase the correct type of battery for the job it must do. Remember an engine starting battery and deep cycle batteries are different. **Freshness** of a new battery is very important. The longer a battery sits and is not re-charged the more damaging sulfation build up there may be on the plates. Most batteries have a date of manufacture code on them. The month is indicated by a letter 'A' being January and a number '4' being 2004. C4 would tell us the battery was manufactured in March 2004. Remember the fresher the better. The letter "i" is not used because it can be confused with #1.

**Battery warranties** are figured in the favor of battery manufactures. Let's say you buy a 60-month warranty battery and it lives 41 months. The warranty is pro-rated so when taking the months used against the full retail price of the battery you end up paying about the same money as if you purchased the battery at the sale price. This makes the manufacturer happy. What makes me happy is to exceed the warranty. Let me assure you it can be done.

**8. Battery life and performance** - Average battery life has become shorter as energy requirements have increased. Two phrases I hear most often are **"my battery won't take a charge, and my battery won't hold a charge".** Only 30% of batteries sold today reach the 48-month mark. In fact 80% of all battery failure is related to sulfation build-up. This build up occurs when the sulfur molecules in the electrolyte (battery acid) become so deeply discharged that they begin to coat the battery's lead plates. Before long the plates become so coated that the battery dies. The causes of sulfation are numerous. Let me list some for you.

- Batteries sit too long between charges. As little as 24 hours in hot weather and several days in cooler weather.
- Battery is stored without some type of energy input.
- "Deep cycling" an engine starting battery. Remember these batteries can't stand deep discharge.
- Undercharging of a battery, to charge a battery (letÕs say) to 90% of capacity will allow sulfation of the battery using the 10% of battery chemistry not reactivated by the incomplete charging cycle.
- Heat of 100 plus F., increases internal discharge. As temperatures increase so does internal discharge. A new fully charged battery left sitting 24 hours a day at 110 degrees F for 30 days would most likely not start an engine.
- Low electrolyte level - battery plates exposed to air will immediately sulfate.
- Incorrect charging levels and settings. Most cheap battery chargers can do more harm than good. See the section on battery charging.
- Cold weather is also hard on the battery. The chemistry does not make the same amount of energy as a warm battery. A deeply discharged battery can freeze solid in sub zero weather.
- Parasitic drain is a load put on a battery with the key off. More info on parasitic drain will follow in this document.

***There are ways to greatly increase battery life and performance. All the products we sell are targeted to improve performance and battery life.***

An example: Let's say you have "toys"; **an ATV, classic car, antique car, boat, Harley, etc.** You most likely don't use these toys 365 days a year as you do your car. Many of these toys are seasonal so they are stored. What happens to the batteries? Most batteries that supply energy to power our toys only last 2 seasons. You must keep these batteries from sulfating or buy new ones. We sell products to prevent and reverse sulfation. The PulseTech products are patented electronic devices that reverse and prevent of sulfation. Also Battery Equaliser a chemical battery additive has proven itself very effective in improving battery life and performance. Other devices such as Solar Trickle Chargers are a great option for battery maintenance.

**Parasitic drain** is a load put on a battery with the key off. Most vehicles have clocks, engine management computers, alarm systems, etc. In the case of a boat you may have an automatic bilge pump, radio, GPS, etc. These devices may all be operating without the engine running. You may have parasitic loads caused by a short in the electrical system. If you are always having dead battery problems most likely the parasitic drain is excessive. The constant low or dead battery caused by excessive parasitic energy drain will dramatically shorten battery life. If this is a problem you are having, check out the Priority Start and Marine Priority Start **to prevent dead batteries before they happen**. This special computer switch will turn off your engine start battery before all the starting energy is drained. This technology will prevent you from deep cycling your starting battery.

**9.** *Battery Charging* - Remember you must put back the energy you use immediately. If you

don't the battery sulfates and that affects performance and longevity. The alternator is a battery charger. It works well if the battery is not deeply discharged. The alternator tends to overcharge batteries that are very low and the overcharge can damage batteries. In fact an engine starting battery on average has only about 10 deep cycles available when recharged by an alternator. Batteries like to be charged in a certain way, especially when they have been deeply discharged. This type of charging is called 3 step regulated charging. Please note that only special SMART CHARGERS using computer technology can perform 3 step charging techniques. You don't find these types of chargers in parts stores and Wal-Marts. The first step is **bulk charging** where up to 80% of the battery energy capacity is replaced by the charger at the maximum voltage and current amp rating of the charger. When the battery voltage reaches 14.4 volts this begins the **absorption charge** step. This is where the voltage is held at a constant 14.4 volts and the current (amps) declines until the battery is 98% charged. Next comes the **Float Step**. This is a regulated voltage of not more than 13.4 volts and usually less than 1 amp of current. This in time will bring the battery to 100% charged or close to it. The float charge will not boil or heat batteries but will maintain the batteries at 100% readiness and prevent cycling during long term inactivity. Some gel cell and AGM batteries may require special settings or chargers.

### **10.** *Battery Do's*

- Think Safety First.
- Do read entire tutorial
- Do regular inspection and maintenance especially in hot weather.
- Do recharge batteries immediately after discharge.
- Do buy the highest RC reserve capacity or AH amp hour battery that will fit your configuration.

### **11.** *Battery Don'ts*

- Don't forget safety first.
- Don't add new electrolyte (acid).
- Don't use unregulated high output battery chargers to charge batteries.
- Don't place your equipment and toys into storage without some type of device to keep the battery charged.
- Don't disconnect battery cables while the engine is running (your battery acts as a filter).
- Don't put off recharging batteries.
- Don't add tap water as it may contain minerals that will contaminate the electrolyte.
- Don't discharge a battery any deeper than you possibly have to.
- Don't let a battery get hot to the touch and boil violently when charging.
- Don't mix size and types of batteries.

There are many points and details I have not written about but I wanted to keep this as short and simple as possible. Further information can be found at the links below. If you are aware of sites with good battery maintenance information please let me know.

## Phare et code simultanés :

Disassemble left hand switch gear. (two cross-heads screws from underneath)

Separate two halves. Note! pay particular attention to position of drip guard ring on right hand side. This is important for re-assembly.

Looking at the switch on upper shell, you should see three wires soldered to a plate. White, Black and Yellow/Black(May be Green on RSV).

The White cable is power to the Highbeam, the black cable is power to low beam, the Yellow/Black(May be Green on RSV) is power from the dimmer switch.

To keep the low beam on when switching to high beam, unsolder the black lead from its current position, and solder it to the Yellow/Black lead(May be Green on RSV).

Logic: yellow/black lead(May be Green on RSV) now provides power to low beam (via black lead) regardless of switch position (can still be controlled with dimmer). High beam rocker switch allows/blocks power to high beam via white lead as before.

Re-assembly. non-trivial. Two points to watch for!
1) Drip guard ring has a large block which goes to the front of the upper shell. It does not block the hole at the bottom of the lower shell as you might imagine it would. (That took me a while to work out!)
2) Pull clutch lever frequently to check for clearance and ease positioning.