Fit a Japanese Regulator Rectifier unit to a 12v AC/DC Royal Enfield Bullet

The standard, seperate regulator and rectifier units on the later model Royal Enfield Bullet are not noted for their reliability. Aftermarket replacements are available but can be expensive.

This instructable will show you how to fit one of the widely available, more reliable and less expensive integrated regulator rectifier units off a modern Japanese motorcycle in place of the standard unit.

Step 1: Can I do this to my bike?

This guide only covers Indian made 350cc and 500cc Royal Enfield Bullets fitted with the 12 volt AC/DC charging system. Given it's long production run, there are a large number of variants of these models. It is not suitable for all of them.

A few checks will tell you if this modification is suitable for your bike. You need to be able to answer YES to the following questions:

Do you have a 12 Volt battery? *This modification is NOT suitable for 6 Volt systems.*

Does the engine need to be running to turn the main headlight on? *If you can turn the main headlight on when the engine is off, you have a different charging system and should proceed no further.*

Are there four wires leading from the alternator? *Follow the bundle of wires emerging from the top of the primary chaincase (see red arrow on picture). It should contain a total of four wires. Any more or less and you should stop here.*

Step 2: Select a regulator rectifier unit.

Almost every model of Japanese motorcycle has its own regulator rectifier unit. They are slightly different shapes, have slightly different wire colours with different connectors on the end of them. Internally, the electronics are almost all the same, made by the shendingen company. They certainly all do the same thing.

So, if it's a one-piece regulator rectifier unit off a bike made by one of the "big four" Japanese manufacturers (Kawasaki, Honda, Suzuki and Yamaha) with a 12v charging system, it ought to do the job. There are occasional oddities which use field coil alternators but these usually have a seperate regulator and rectifier. Any road bike over 250cc and made after 1985 will have a 12v charging system.

There are two actual types according to how they regulate the voltage. Some of the more modern ones use a mosfet voltage regulator and others use a zennor diode. The mosfet ones are desirable for a number of reasons which boil down to increased reliability. Other people have produced lists detailing models fitted with these, I wont repeat them because I can't verify them but an internet search should point you in the right direction. Either type will function perfectly well for our purposes though.

Some come with flying wires attached and others have terminals mounted on the casing. Again either will work but it is easier to modify one with flying wires attached and to identify which wire to connect where (see next step).

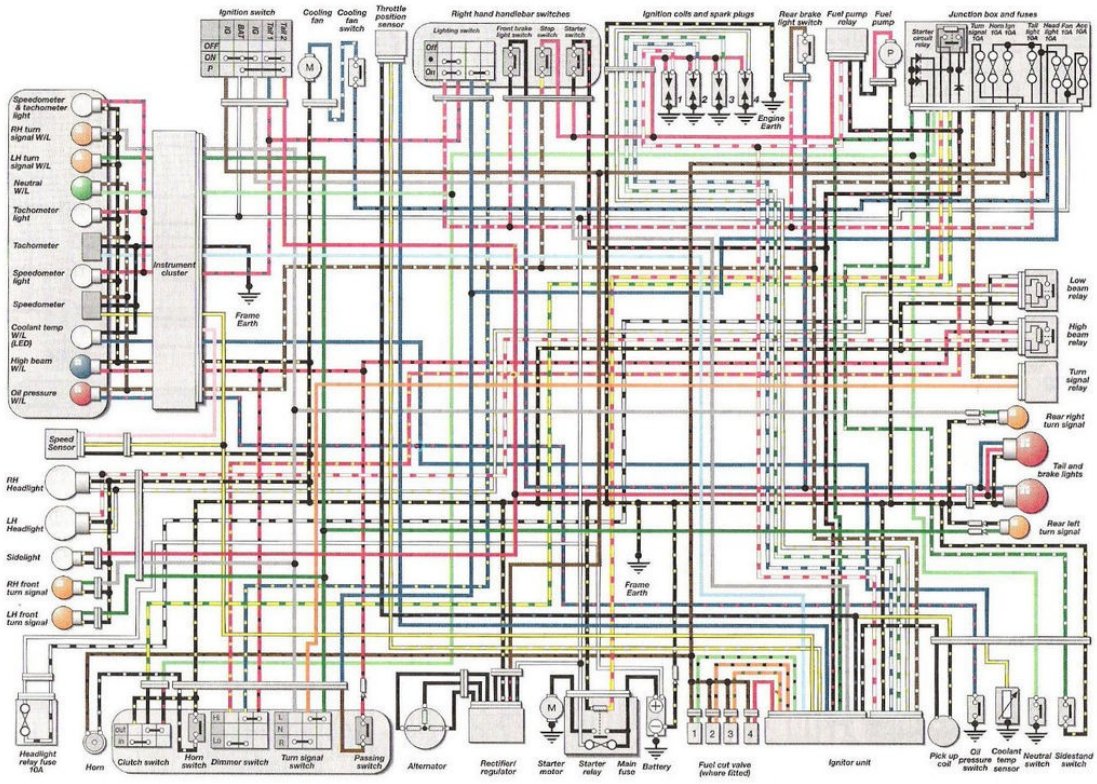
Some are fitted with cooling vanes, others are not. Some of the manufacturers had difficulties with the units overheating, especially in the mid 1990's so I'd recommend you choose one with cooling vanes.

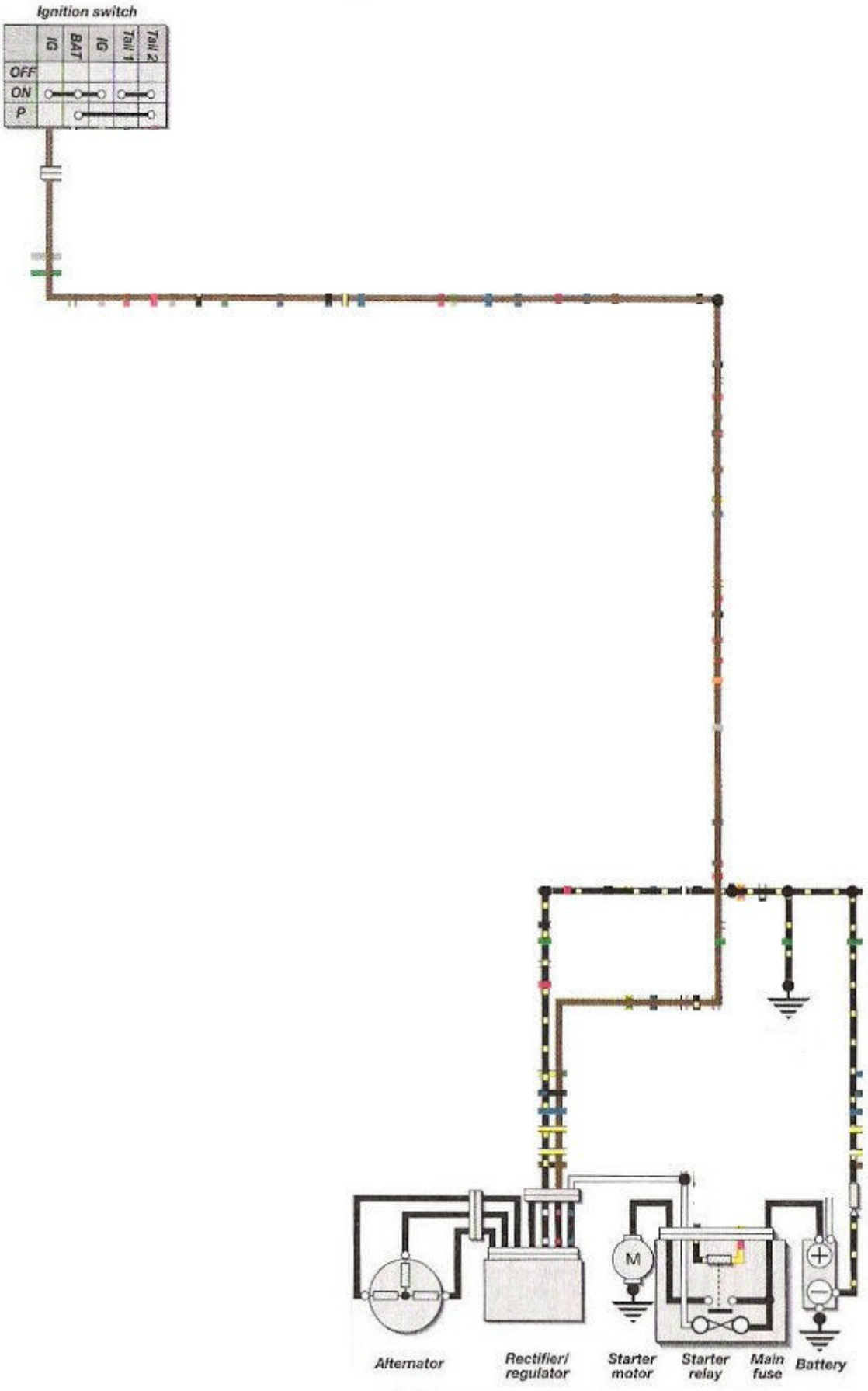
Also bear in mind that you will need to work out which wire goes where so you'll need access to a wiring diagram for the bike the unit comes off (I'll explain how in the next section). If in doubt, choose a Honda because they have a standardised set of wire colours across the range.

Regulator rectifiers are readily available from breakers yards and from online auction sites.

I'm using a regulator rectifier off a Kawasaki ZX6R which cost me £5 (around US$8) from an autojumble. This is not a mosfet type but it does have cooling vanes and flying wires attached.

Step 3: Identify the wiring layout




Ignition switch
IG
BAT
IG
Tail 1
Tail 2
OFF
ON
P
M
Alternator
Rectifier/ regulator
Starter motor
Starter relay
Main fuse
Battery

As I mentioned in the last step, the different manufacturers tend to vary their wire colours so you'll need access to a wiring diagram for the make and model your regulator rectifier is off. *If you are uncomfortable with reading a wiring diagram, scroll to the bottom and I'll tell you the wire colours for a Honda one.*

They all have at least five wires:

1) Three wires originating from the alternator charging phases. Usually (but not always) the same colour and do not need to be in any particular order. I'll referr to these as the "**charging phases**" .

2) The live output wire which carries the power to the battery. This is usually attached to either the battery itself, the main fuse holder or to the starter solenoid. I'll referr to this as the "**Live**".

3) An earth wire. Can be confusing because it often connects into a whole jumble of other wires but eventually goes to either a frame earth or the battery negative. I'll referr to this as the "**Earth**".

4) Most (but not all) have another wire connected into the loom which senses the voltage in the working part of the electrics. This connects to a live wire which is after the ignition switch. So it's only live when the ignition is on. I'll referr to this as the "**Switched Live**".

You may notice some appear to have two live or earth wires. I suspect this is a deliberate attempt to confuse the amateur motorcycle mechanic. Treat them as one wire, they feed into exactly the same place inside the unit.

A wiring diagram can be pretty daunting but we're only interested in a very small part of it. On my example of a ZX6R which I've attached. You'll see in the second picture, I've deleted all the bits I'm not interested in and it all looks a lot more manageable.

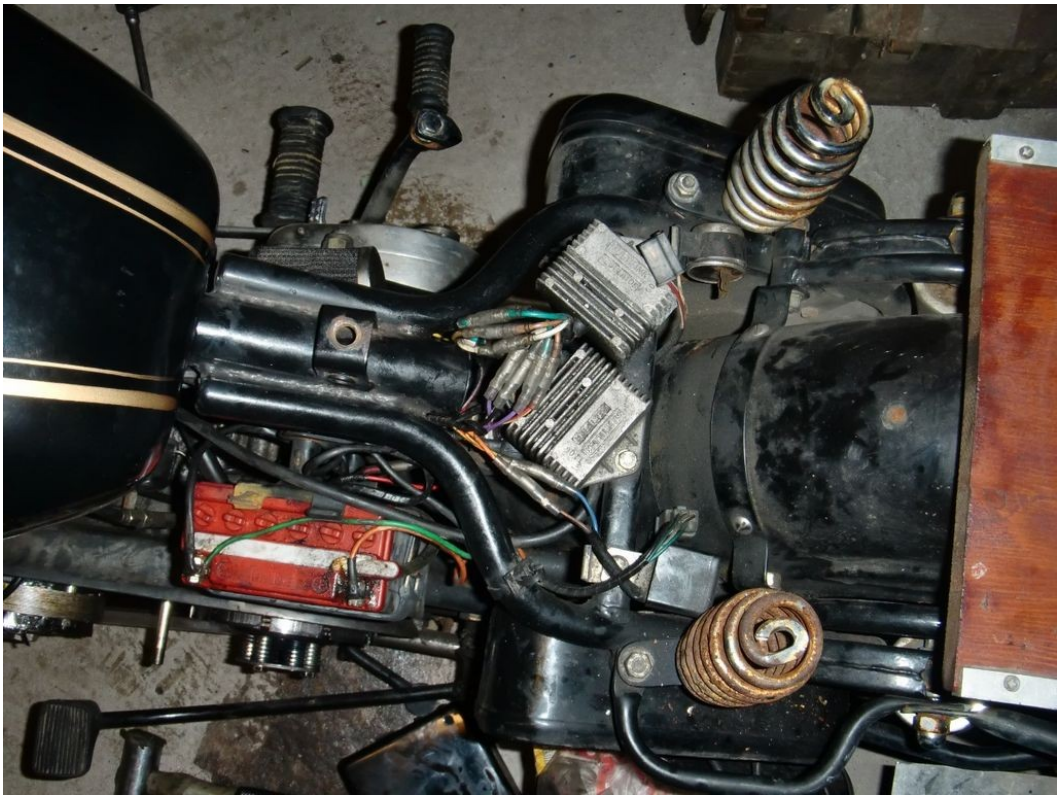
First locate the alternator. There are three wires attached to it, the other end of them is attached to the regulator rectifier. These are the charging phases. In this case, they are all black as they go into it.

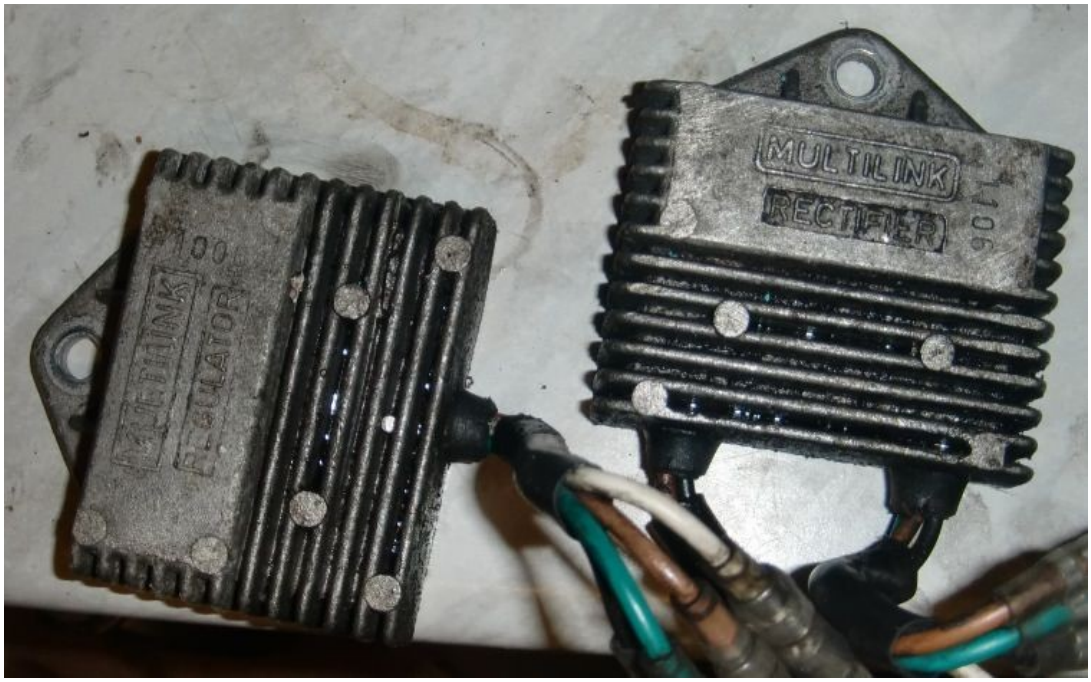
Now concentrate on the remaining two or three wires that are leaving the regulator rectifier. The earth wire in this case it is white on black. The live wire is attached to the main fuse and is blue on black. The remaining wire is the switched live. It is and it's red on black.

"No, you lost me. What are those Honda ones?"

Honda use the following wire colours:
Charging phases = Yellow
Live = Red
Earth = Green
Switched live = Black or white on black.

Step 4: Remove the old parts.





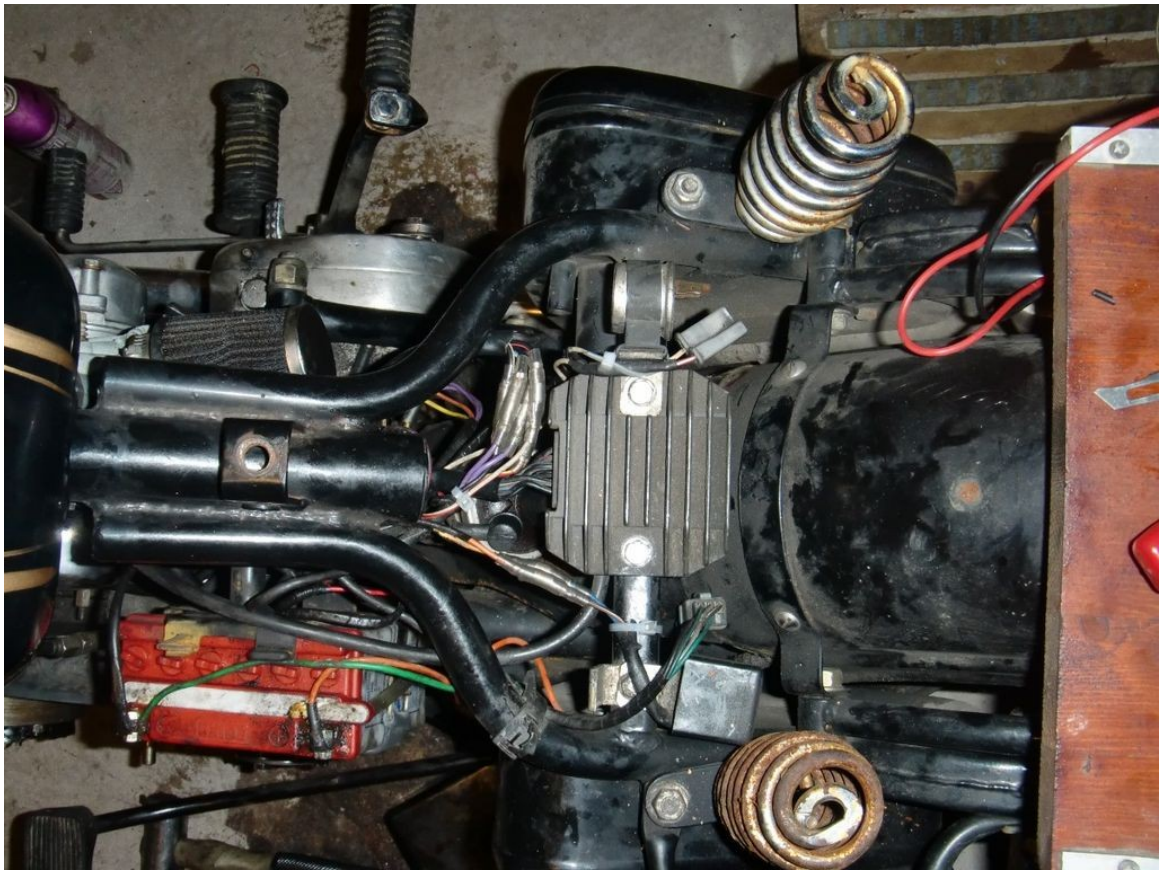
This is a short and easy step.

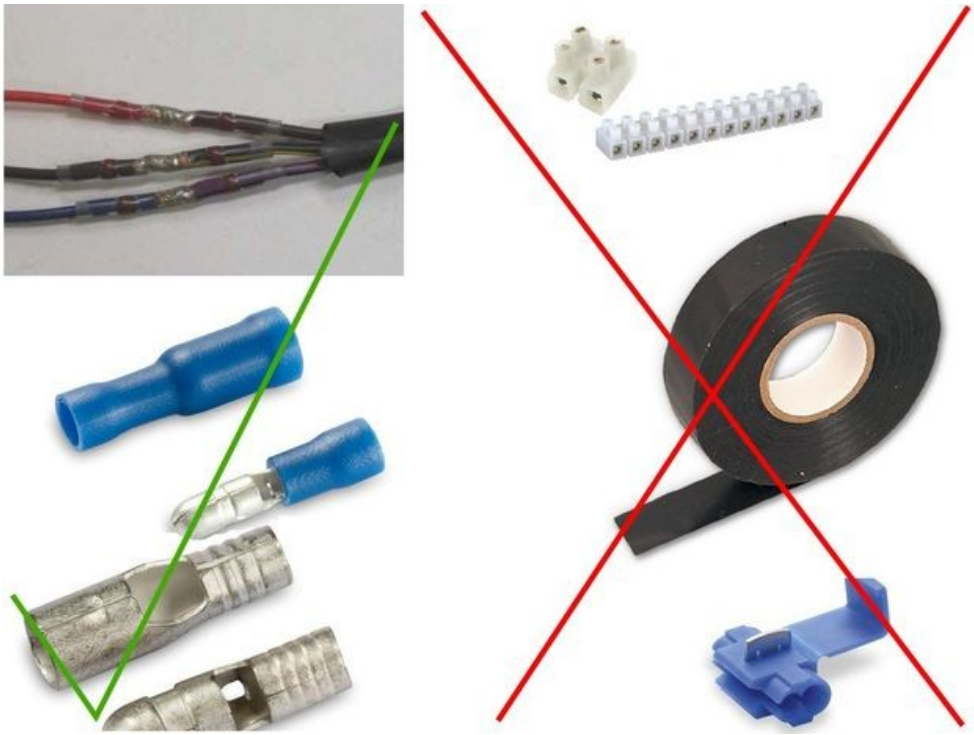
The original regulator and rectifier are two seperate units bolted to the frame under the saddle.

So remove the saddle and have a look for two silver boxes with cooling fins on joined together by a short length of wire. Helpfully they have the words "Regulator" and "Rectifier" respectively embossed on them.

Undo the snap connector attaching the wiring loom to the rectifier. Undo the two bolts and they should lift off.

Step 5: Attach the new part





As luck (or design?) would have it. My ZX6R regulator rectifier lines up perfectly with the captive nuts on the bikes frame. Two M6 bolts is all I needed. It may prove necessary to make a bracket for other models which is something I'll leave up to your own ingenuity.

Once it's physically attached, you need to do the wiring.

THIS IS THE POINT OF NO RETURN. You need to cut the connector block off the end of your wiring loom and off the end of the regulator rectifier and join the wires together.

This would be a good time to express a personal bugbear of mine. Scotchlocks, screw-in chocolate block and bare wires twisted together then taped over have no place at all in motorcycle wiring. They WILL fail because they do not grip the insulation and do not seal the wire to ingress of water.

You need to use either non-insulated crimps with silicone sleeves, pre-insulated crimps or soldered splices and shrinktube. It is also critically important that the crimps are applied with the correct crimping die. Done properly, you can pull with a force in excess of 20kg on a crimp and it will remain attached.

I personally preferr to use non-insulated crimps. I have attached a picture showing these together with the correct crimping tool for fitting them. I'm going to assume you know how to use these tools.

So. You have four wires on the enfield and five or six wires on the reg/rec. That's a tad confusing but not to worry, all will be revealed.

The Enfield only has two charging phases, not three like the Japanese bikes but the regulator rectifier is still prefectly capable of handling this. Connect the two violet coloured wires on the Enfield to two of the charging phase wires. Blank off the spare.

Connect the red wire with the yellow stripe on the enfield to the live wire on the regulator rectifier.

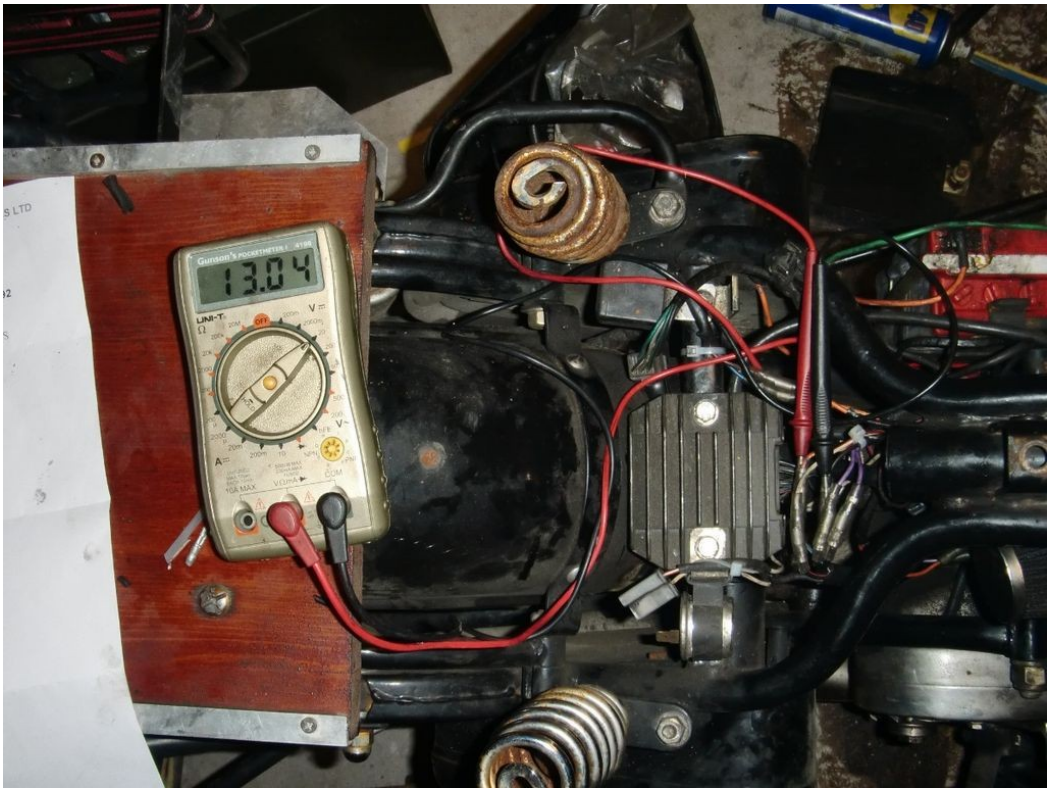
Connect the black wire on the enfield to the earth wire on the regulator rectifier

Now all we need is something to connect to the switched live on the regulator rectifier. Handily, the white on red wire that attaches to the nearby flasher relay is a switched live so we can connect into this. I did it by solder splicing and shrink-tubing a flying wire to the existing one. You could also cut the wire then rejoin it with a double bullet connector.

So once more:
2 x Violet wires -> 2 x Charging phases
Blank-off -> Spare charging phase.
Yellow on red -> Live
Black -> Earth
White on red from flasher relay -> Switched live

You're done. All you need to do now is test it.

Step 6: Testing



You'll need a multimeter for this stage.

Set it to volts DC and connect the probes to the live (yellow on red) and earth (black) wires. You should get a reading of battery voltage (around 12.5 volts or so).

Start the engine. The voltage should stay around the battery voltage of around 12.5 volts at idle. Turning on the sidelights or the brake light should make it drop to around 11 volts. Increasing the revs should make the voltage increase to over 13 volts but not more than 15 volts.

The ammeter on the dash should be sitting in the green at idle and should go slightly more positive when the revs are increased.

If you see over 15 volts, Shut it down immediately. That means it's not regulating the voltage and could burn something out. Check your connections, especially the earth. If it's still doing it, chances are the regulator rectifier unit is faulty.

If you fail to see 13 to 14 volts when the engine is revved or the ammeter stays at zero or in the negative, it is not charging. Check the alternator output by disconnecting the two violet wires and measuring volts A.C. between them. It should go up to around 30 volts when the engine is revved. If it fails to do so, your problem is elsewhere. If it does, double check your connections then suspect a faulty regulator rectifier.

Here's a video of me testing my one:

http://www.youtube.com/watch?v=qnq6DN9RNzU#t=34