The Alternator

We all know that this just consists of a coil of wire with a permanent magnet whizzing past it, (stator and rotor). There is no way of controlling the magnetic field, so the output we get we have to regulate in some way to keep the battery charging under control. Firstly we have to change the generated AC into DC-we use a rectifier. Then if we have the original 6V system the output coils (electricity quantity) are switched in and out by the ignition/light switch.(Typically the PRS8.) If the system is upgraded by us or the manufacturer to 12V we use the Zener Diode to regulate. (Or Regulator/Rectifier, but nothing wrong with the Zener!) Early or late? The late 50s and early 60s saw a rotor of 70mm which is up to RM18 while the RM19 came in from the mid 60's with a rotor of 74mm. The 70mm is now only available at auto jumbles as 'old tired stock' while the 74mm is still current. This dimension change applies to the stator as well. If you do have a 'worn out' stator of 70mm and you have a decent rotor then one way is to rewind the stator, (if you can find a company to do it!) which might be cheaper than buying both parts as new in 74mm.

Testing the Stator

As it is a coil of wire it must have two ends (Yes I know a lot of our stators have three wires) so our first test is, is there continuity through this coil? 1 to 3 ohms is the ball park figure. While at the same time this coil should not have any connection to the earth of the bike. If you don't have a multi-meter then a bulb test is very good, often a bit more instructive.

Disconnect the alternator wires from the bikes wiring. Use a headlamp bulb; you know - the one with one filament left! Fit the bulb up with a pair of wires so that you can connect it to the alternator wires. Start engine and at a modest tickover the bulb should light up enough to see that a rev up would blow it! Use the other wire if you have three, and a similar result should be obtained. Do not worry about how bright or what wires to use, just make sure that all wires are used to give an output at some time. If the bulb does light up but is less than 'brilliant' then you might have weak rotor magnets, more anon.

Finally connect one end of the lamp to the engine and the other end to any one wire, there should NOT be any bulb lighting. This would indicate a good stator. Three wires? Time and again, I am told that 'I have a 'three phase alternator'! No sir. The sign of a three phase stator is nine pole pieces, ie the grey metal pieces inside. Output Hi or Low? 6V or 12V? only the part number can help us now, there are quite a few, so look for the 47*** number, this will tell all. You don't have such a list? I do!

The Rotor /Testing

The early 70mm outside diameter rotor came in different widths at times, but as they are all tired by now and we need more output, do not concern yourselves with these rotors too much, if it is there and it works, fine. The later 74mm are just about all the same thickness and they all have 6 magnets, ie they are all the same electrically (magnetically) despite different numbers, 54212006 being the most common and most prone to failing.

Condition? Mostly sorted by giving it a good looking over. Is the centre steel tube coming loose? Is there grey powder 'throwing' from the centre? Does it show signs of having touched the stator? (shiny bits and deep scoring). Are the magnets coming adrift? Is the woodruff key slot worn? Are the magnets any good? The latter needs a magnetic probe (I have one!) but there is still plenty you can check. Hold out a medium spanner or large screwdriver, will the rotor hold its own weight on all six magnets? If not then it is not worth putting back on the bike. (Kick it under the bench now if it's on the floor!) For a real test of magnetism we do a full output test.

Full Output test

Now we have to be a little more electrically clever, do you have/can you use a multimeter? Have you got a friend who has/can? You need a 10AMP DC range on you meter. You do NOT need a 1 ohm resistor (Lucas suggestion). This test is the same for 6V and 12V and 3 Phase and High Output (with a little reservation we are coming to). Find the output terminal of the Rectifier or Regulator/rectifier. Disconnect its output lead. This might be a BROWN/BLUE wire and will be the Negative terminal if we have a Positive earth system. Connect the 10A DC meter between the output terminal and the wire you just pulled off of it. Lights on should NOT cause any current to flow, if it does then you've got the wrong wire (you might be on a battery lead). Start the bike, and put on all the lights. Rev up to 3000 or so and for the RM21 you should see close to 9 amps. If you have some 3 phase or high output then you should pass the 10 amps about 2500 revs.

The rotor/stator gap should be a MINIMUM of 8 Thou, any less will cause contact, heat, electrical output failure and huge expense to say nothing of a seized engine and even an accident!

Alternator connections/cable colours.

Since the early/mid 1960s Lucas used the same three colour system on all their alternators 6V, 12V, and high output versions and 3 phase mid and high output.

The late 50s used a variation on the GREEN cables but the colours didn't stand the ravages of time, (to say nothing of the ravages of the British motorcycle primary chain case!)

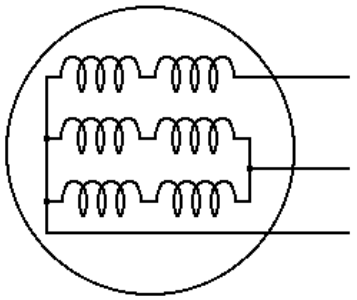
Cable colour From early 60's	**Earlier colours**		**Usage up to and including RM19**(open-wire)
WHITE/GREEN	WHITE	LIGHT GREEN	Common (3 wires *)
GREEN/BLACK	DARK-GREEN	DARK-GREEN	Low Output (1 wire*)
GREEN/YELLOW	LIGHT-GREEN	MID-GREEN	High Output (2 Wires*)

Lucas Alternator cable colours

*The earlier alternators are not encapsulated so you can see the wiring to the coils, hence you can often rewire the connecting leads taking note of the correct colour and the stator wiring you are connecting to.(using old mains lead only creates confusion) Later alternators are encapsulated so you can't see what is going on.

LUCAS alternators - wire colours

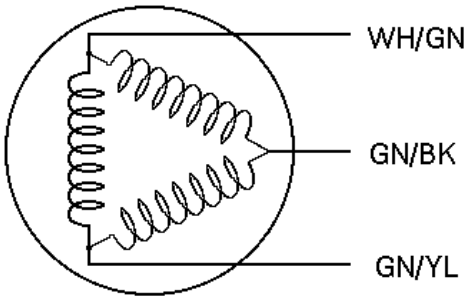
Single - phase alternator (RM13 onwards)



	Original	Later	Later	Latest
	Dk GN	Dk GN	GN/BK	GN/BK
	Mid GN	GN/YL	GN/YL	GN/YL
	Lt GN	GN/WH	GN/WH	WH/GN

[Two-wire alternators use GN/YL and WH/GN leads]

Three - phase alternator



3 Phase.

This phrase trips up a lot of people, just because they see three wires they think they have 3 Phase, which they have heard about-very often it is NOT SO.

As above 3 wires are all Single phase. To have a 3 phase stator you must have 9 pole pieces (not 6). These are known on paper (ie never marked on the unit) as RM24 but there are different outputs which are shown by the numbers (if you can find one on the unit).

Energy transfer another nest of worms. This time we can have 5 wires, Dark red and Black/white and more. They are a whole subject in themselves with separate windings as well. I would refer you to a greater authority on these. But in most cases you can

'find' the three battery charging wires as per above. Any wires that show a higher resistance are most likely for the ignition system.

Wipac

Wipac made a stator of very similar dimensions to the Lucas 74mm item, but with slightly different electrical/colour system. These can in most cases be directly replaced by the Lucas items but which will give you a slightly increased air gap. Considering the age of these Wipac items it is quite remarkable how well they are still performing. These units were mostly used on lightweight Nortons and AJS Matchless of the era.

Wipac 6v alternators are wired as two sets of 3 coils, compared to the Lucas which are wired as 2 coils plus 4 coils.
Thus a Wipac alternator potentially overcharges its battery with lights off.
In the original system, a resistance wire (embedded in the main loom) soaked up the excess charge if no lights were on. (Nominally a 3.9ohm wire wound 5W resistor will do this job)

Wipac 12v alternators (as fitted to Norton Electra, for example) were wired in the Lucas manner; 2 coils (low output) plus 4 coils (high output) (controlled by a 'magic'regulator box on the mud guard)– but keeping to the same (Wipac) colour codes. There is no known visual identification for the 6V-12V versions except electrical testing (but if using 12V with full output not an issue)

Wipac alternator Stator colours

WIPAC COLOURS	**USAGE 6V**	**USAGE 12V** (Electra)
WHITE	Common	Common
L.GREEN	50% output	33.3%
ORANGE	50% output	66.6%