Jawa Moped Electrics – Lighting and Auxiliary System.

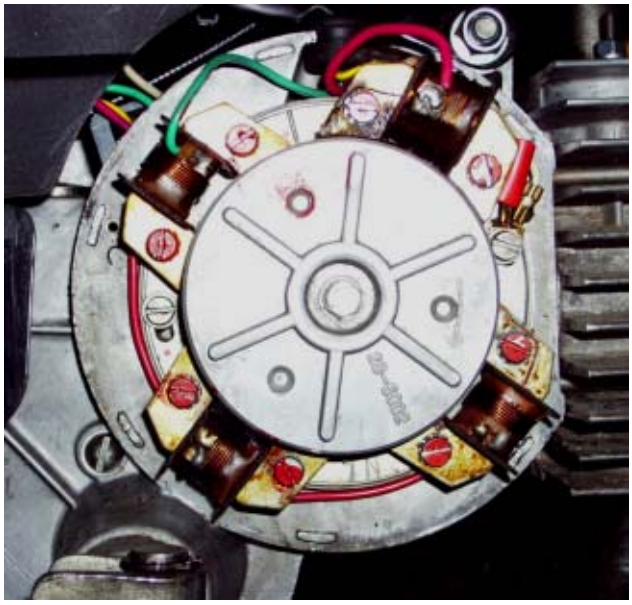
The Jawa / Babetta moped electrical systems are about as simple as you can get, as a result there is very little to go wrong. I am talking here about the true mopeds – types 28, 207, 210. 225 etc., as the Jawetta, Pioneer, scooters & Mustang bikes are slightly different.

System description

The power for lights, horn etc is supplied from a permanent magnet Alternating Current generator. The rotor, the solid drum in the centre, has a series of permanent magnets and so doesn't need a slip ring, commutator, brushes or coils to generate the magnetic field. The stator, the static ring around the outside of the rotor, has 4 coils attached to it, three of these are for lighting and auxiliary circuits the upper most one being for ignition. The ignition is completely separated from the auxiliary circuits the only common point being a shared earth return through the frame. See my Ignition Data Sheet for details.

The simplest Babetta has only a 6v 5w tail lamp, and a non-dip 6v 15w headlamp, then other models added some or all of – an electric horn, dipping headlight, speedo light, stop light and indicators. The equipment differed for different models and for different markets. In each case the output of the generator is matched to the standard equipment fitted. The lighting/auxiliary coils on the stator can have different size varnished copper wire used for the windings, a different number of turns of wire and different heights of coil former to vary the power output from each coil. The three coils are connected either as all three in series with a single output wire as on a moped with only head and tail lights, or as two in series providing one output for head and tail lights and the third, not connected to the other two, as a separate output to the horn and/or stoplight. Many of the generators carry a small plate riveted to the outer edge of the stator ring, showing part number and generator output rating(s). There are ratings of 20watt, 32w, 30+10w etc.

The electrical equipment all operates on the Alternating Current supply from the generator without any rectifier to convert it to Direct Current as would be normal on larger motorcycles. There is nothing wrong with lights working on AC – all the lights in your house are on an AC supply – but the horn and indicators, if fitted, need special attention (see below). AC systems cannot normally be used with a battery so one is not fitted unless required for indicators. There is no regulator to stabilise the voltage so that the voltage produced at no load (no lights switched on) will vary widely – from about 12vAC at tick over up to 40vAC or more at full revs. When any electrical equipment is switched on it applies a load to the alternator output which reduces the voltage produced. As long as everything is left as standard, the voltage will be limited to between about 5 to 9volts. It is therefore critical to stick, as closely as possible, to the original bulb wattages and electrical equipment to ensure that the electrical load is matched to the alternator output.



A 20 Watt, single output generator.

The variable voltage will make the lights very bright when at full speed but cause the lights to dim significantly at lower revs, like when stationary with the engine ticking over. Bulbs can sometimes blow at sustained high revs because the voltage will be a little higher than the nominal 6v. Operation of one item can effect other items. For instance; sounding the horn can cause the stop light to dim at low speed. Of course, everything stops working when the engine stops running.

I suspect that the lack of a rectifier, regulator and battery was not entirely a cost saving decision but rather a genuine attempt to keep the system as simple, and hence as reliable, as possible. However it does make it difficult if you want to alter the electrical equipment (more on this below).

Headlamp

All mopeds have a headlamp fitted as standard but sometimes the headlamp is a single filament 6v 15W or 21W bulb and sometimes a twin filament 6v 15/15W with a dip/main switch on the handlebars. There are a couple of different fittings for these, take the old bulb with you if you need to buy a replacement. In most cases the headlamp is switched on by a rocker switch in the back or bottom of the headlamp housing.

Tail light

The headlamp switch also switches on the tail light which is usually a 6v 4W or 5W BA9 fitting bulb or on some early models was a festoon bulb. On some models with a dipping headlight, neither contact of the tail light is connected to the frame earth but both are fed from either beam of the headlamp bulb. This is to ensure that when the headlamp is switched between dip and main, the tail lamp is momentarily disconnected, otherwise the full power from the generator would go to the tail light bulb and blow it.

Horn

The standard horn, when fitted, is an AC operating version, normal bike DC horns will not work properly on a Babetta, although you might get one to sound at certain engine revs. Similar replacements are available from motorcycle dealers but it must be 6volt AC. The horn is operated by a push button switch on the handlebars that, when pressed, makes the earth connection to the frame. Don't test an AC horn by connecting it across a 6volt battery – it will not sound with a DC supply.

Stop light

A stop light was not always fitted and is not required on a moped in some countries. In the UK it is not needed if the moped is restricted to 25mph maximum speed (see my MoT test data sheet). Where fitted, it can be a second bulb or a twin filament bulb in the tail light. It is usually operated by a push-for-off button switch in one or both handlebar brake lever housings operated by the brake levers.

Speedo illumination

Some mopeds have a 6v 1.2W bulb to light up the speedo. This is switched on with the headlamps. Replacement bulbs will be difficult to find, the nearest normally being a 2W which will be all right to use.

Indicators

These are sometimes fitted if required by local laws. In the UK they were sometimes fitted as a "de-luxe" extra although never required by law on a moped. See my Indicators data sheet for more information.

Fault finding

If you have a non working component it is most likely a faulty bulb. Corrosion of the contact area of bulbs is a common problem, or you can check a bulb by removing it and trying it across a 6v battery. Check the components are wired up correctly against the appropriate wiring diagram which you can get from my "manuals" page. Down-load the one with the same accessories as yours. Don't assume the wiring colours in your moped are the same as the diagram, sometimes different colours might be used in the factory or a previous owner might have changed some wires. If you are in any doubt, follow the colours through to find both ends match up to the correct connection points against the relevant wiring diagram.

Check all terminals are clean and tight, if new terminals have been fitted anywhere, make sure they are making good contact, old wire can corrode inside the insulation & stop a new connector making contact with the wire. If fitting new terminals, scrape the corroded wire back first to reveal bright metal.

If none of your lights or the horn is working it could be a fault with the generator. Check the output wire(s), usually green and/or blue, are making good contact in the multi connector. These wires are soldered onto the coils where they join to the windings of the coils, check these joins look sound, although they shouldn't give trouble unless disturbed or knocked when the cover is off. I have heard of a rotor becoming de-magnetised though this is very unlikely. A specialist repair shop might be able to fix it, or just buy another.

Additions

If you stick to the standard system, apart from the couple of drawbacks discussed above, there isn't a lot wrong with the Babetta electrics. The standard headlights aren't exactly brilliant for night riding on unlit roads, but are as good as you would expect on any moped.

The main problem comes if you try to add additional items to an existing system. There are a few mopeds appearing for sale in the UK at the moment that are made to other countries specification. An example is my black and white Jive model 225 (photo on my "Technical" page) which was made for the Dutch market. It is restricted in speed, and has only a single beam headlamp, tail light and speedo illumination bulb. It has no horn, which is needed in the UK on any two wheeler registered after 1 August 1973, and it has no stop light, which is needed in order to pass a UK MoT test, if it is de-restricted. Fit these as follows.

1. Fit a stop light:- Chances are that a dual function tail light is already fitted, it will just need a bulb fitting and a wire running from the bulb to a stop light switch.
2. Fit a stop light switch:- On my black Jive I drilled and tapped the Domino type front brake lever housings to take a standard Jawa switch and glued a small plastic piece into the end of the lever to press the switch, for the front brake lever only. An alternative would be to fit a standard "spring pull" type switch somewhere, or you can get brake cables that incorporate a switch in the middle of the cable.

   A moped registered after 1 April 1986 should have a stop light operated from both brakes but one brake operation is acceptable for MoT test if it was originally manufactured that way. The testers manual says:- *"A machine should only be failed if you are certain that it was originally manufactured to operate from both controls."* It just depends on your testers interpretation of this rule.
3. Fit a horn:- Standard Jawa type 6vAC horns are available from some of the suppliers on my links page or try your local scooter shop. A good place to fit it is the lower screw holding the air intake to the frame.
4. Fit a horn button:- Any after-market horn push button, fitted on the handlebars. When pressed, this will make the earth connection for the horn via the handlebars to the frame.
5. Connect these to the power:- This is where it can get tricky. There are a few possibilities:-

   a) These mopeds have a 20 Watt generator wired for a single output, so the correct way is to change the

three generator lighting coils for higher powered ones wired in the two-and-one configuration described above, or go the whole way and fit one of the replacement systems available from some suppliers.

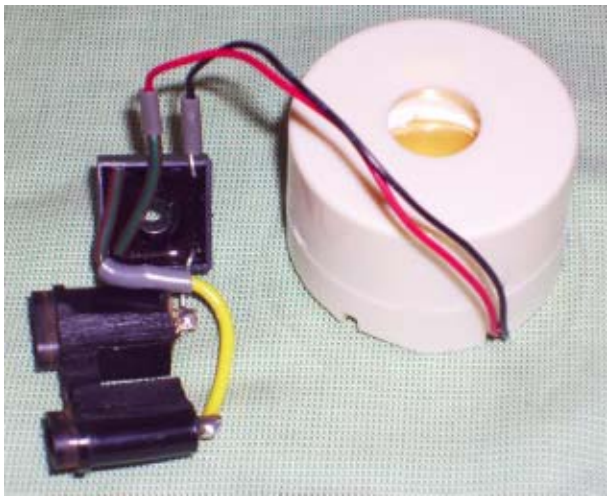
b) A simpler thing is to connect the new items into the existing generator. On my Jive I have broken into the connector in the green wire from the generator and taken an extra feed to the horn, then connected into the yellow wire from the headlamp back to the tail and speedo lights and taken a feed to the stop light via the new stop switch.

This way, without the headlamp switched on, a normal 6v AC horn will sound OK, but there will be insufficient power available from the 20 Watt generator for the horn to work properly with the lights on. Also the stop light will only work with the headlight switched on. This is necessary to limit the voltage received by the stop light, because if used on its own, the stop light bulb will blow at anything over tick-over speed. The low power stop light bulb I have used works fine with the lights on, even at tick-over. See my wiring diagram for this moped. For an MoT test, the lights will have to be off to demonstrate the horn is working but switched on to demonstrate the stop light. Your MoT tester might think that this arrangement is not satisfactory, mine, being a practical bloke, was ok with it.

Obviously, you will need to ride with the headlight and tail light on at all times for the stop light to work. Not a bad thing anyway for any two wheeler and required by law in some countries. An improvement on this system would be to reduce the power requirements of the extras as much as possible. I'm already using a 6v 5w stop light bulb, which gives an adequate light, but instead of the normal, power hungry, electro-mechanical horn, I have made a low powered, fully electronic horn, which is able to work on an AC supply. This horn will sound with the headlight on, even at tick over, without dimming the headlight, although the sound is a bit quieter than without the headlight on.

Electronic horn

I have made my horn from a solid state buzzer and a bridge rectifier all mounted inside the casing from an old Jawa horn. This consumes less than 25mA, against about 10A for a normal electro-mechanical horn. The buzzer is a loud, high power buzzer, nominal 12 volts but useable from 3 to 24 volts DC (Maplin part FK84F). Because the buzzer needs to be DC operated I have incorporated a KBPC1005 bridge rectifier, max.35v rms (Maplin part AG98G) (see pictures).



12 volt Regulated System

It is possible, with just small modifications, to make a better and more reliable system, as I have done on my silver model 225 "Trail" (photo on my "FAQ" page). Because I wanted to fit different lights and try out LED bulbs, I needed to remove the variation in voltage, caused by varying loads, of the standard system.

I made up a replacement stator ring with three matching lighting coils of the highest output, wired all three in series to give a single output. I then connected the 12v AC regulator pictured here across the output and the frame earth. This is a regulator not a rectifier so that the lighting system is still AC operation but the voltage available will not rise above about 13.8 volts and this is adjustable. These are made by Trail Tech in the USA, I bought mine off eBay. They also make a much more expensive combined regulator/rectifier.

By using three of the largest stator coils the system can generate 12 volts at only a small increase of engine revs over tick over. At tick over the voltage drops a little below 12v and the lights dim very slightly, but the voltage in the system will never exceed the 13.8v irrespective of electrical load applied. With this set-up I have used a 12v 23w headlamp, 4w tail lamp, 10w stop light and a standard 6vAC horn which doesn't seem to mind the increased voltage.