



Rex's Guide to Lucas Dynamos

Information - 12V conversions - Flashing the dynamo - Field coil connections

The dynamo with its fully regulated output would appear to have been an ideal choice when compared to the early unregulated 6 volt motorcycle alternators. The alternator took nearly two decades before becoming more popular but had semi-conductor technology been further advanced alternators would have taken precedence far sooner. The only form of voltage regulation available for permanent magnet alternators in the 1950s & 60s was load matching the system's needs to the output by either connecting the alternator windings to oppose each other when less power was needed or switching in extra windings when more power was demanded. This was crude to say the least and required an oversized battery with plenty of electrolyte to soak up surges in power and cope with overcharging. Dynamos may seem like a better option compared to an uncontrolled alternator but they don't like vibration, grease, oil or dirt and something as basic as a dirty commutator will cause nuisance charging problems. Also they don't like to be overworked, the low resistance of the armature windings gives them a tendency to drive themselves to destruction if too high a load is placed on them. For this reason dynamo regulators must control current and the voltage. Dynamos also need regular maintenance, the armatures were not well balanced and unfortunately servicing tended to be overlooked until they failed. Most dynamos were made before the 1970's, at a time when routine servicing and maintenance was expected and considered normal, however the writing was on the wall and the designers knew it, hence they continued with the alternator despite the lack of voltage control. In comparison the alternator is maintenance free and gives much higher output, modern diodes make it easy to control. In today's throwaway society owners are often surprised to learn that they are expected to regularly inspect, adjust and maintain components such as the vehicle's dynamo if it is to continue working.

A well set up and maintained dynamo works perfectly well and many of the so called 'problems' are caused by age, wear or a lack of servicing. We also see a large number of faults due to repair methods that could be referred to as 'temporary' at best. Today's market is also flooded with low quality dynamo regulators which often compound problems. Age is a major factor, the windings used to be insulated with shellac which has a finite life of up to 50 years (under ideal conditions). Shellac is a natural substance and degrades with time, moisture and thermal cycling (as all insulators do). An armature made in the 1960s and never used is unlikely to be of any use now as the shellac will have degraded. At the time of writing fifty years has past since 1970, few dynamos were made after so the vast majority of dynamos we see for repair are well over fifty years old. However none of these issues can be laid at the dynamo manufacturer's door.

Rex's workshops carry out dynamo overhaul work, however we do not re-used old armatures or field coils. We are happy to leave the external patina as is, should the customer request this, however we do not consider that old windings will prove satisfactory if pressed in to further service, even if they test as expected on the growler. It's beggar's belief that some companies will soak old windings in electric motor vanish or re-wrap them, possibly painting the outside for good luck then tell the customer they have been properly repaired, the only option for aged wire is renewal. At Rex's we will only carry outwork to the highest standards and use the best quality parts available so that your dynamo is returned to a condition where it will continue, if correctly maintained, to give many more years of service.

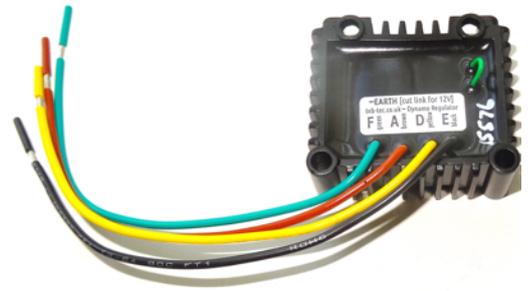


The choice of voltage regulator is equally important as the quality of the overhaul. Dynamos need BOTH voltage and current control, without these features it's easily possible to drive the dynamo to the point it burns out the field winding and/or the armature.

12 Volt Conversions - The Options

Replacing the voltage regulator for a solid-state - 12 volt unit.

It is entirely possible to simply swap the 6 volt regulator for a 12 volt item. This tends to leave the dynamo requiring a slightly higher armature speed before it reaches the point where charging commences compared to when it was regulated to 6 volts. A good solid state regulator will minimise this effect. Only regulators specially designed and perfected to control the dynamo safely at 12 volts give reliable results. Before re-regulation is a viable option the 6 volt dynamo must be in tip top condition.



Positive points: This is by far the cheapest and simplest option. Rex's supply a British designed and manufactured regulator that comes as 6 volt. The clever part is by cutting a wire loop the same unit becomes 12 volt. There are other companies producing their own versions but normally in either 6 or 12 volt meaning you'll need to buy another unit if you had a 6 volt regulator. You will not be surprised to learn that experience has proven only the more expensive solid state regulators work correctly when converting a 6 volt dynamo to 12 volt. It's for good reason we do not supply a budget dynamo controller even though we are able to obtain them.

Negative points: Slightly higher revs are needed before charging commences. Some models drove the dynamo at higher than crank speed, the BSA A10 springs to mind, there isn't usually a problem with these machines. However other slow revving models may exhibit reduced charging rates at normal cruising speeds. Another item to consider is the final drive gearing, has this been set to allow lower engine RPM at cruising speeds.

Dynamo drive ratio kits

There are companies who offer very well-made kits that alter the drive ratio to the dynamo, increasing it by 10 percent or more. You have to weigh these up on a case by case basis, a slow running single cylinder side valve is unlikely to be persuaded in to anything as daft as a higher cruising speed so may well benefit from speeding up the dynamo, however a more rev happy twin could easily drive the dynamo too hard. In our opinion such kits tend to be questionable in value as who's to say how the machine will be ridden or what final drive ratios will be used in future.

Rebuilding the dynamo with 12 volt windings

Positive points: Fitting windings that have been designed to supply 12 volts is by far the the best solution. The dynamo will produce the correct output without having to spin the armature faster which ensures there is no extra stress on your dynamo. A 12 voltage regulator is also required and the same advice should be followed in the choice of the regulator. If the dynamo is in need of an overhaul there is strong case for requesting 12 windings as there is little difference in price compared to 6 volt parts. The fully converted dynamo needs no modification to the drive train as the dynamo will give good output without the requirement to spin the armature faster.

Negative points: There is only one and that is cost, doing the job properly is rarely the cheapest option.

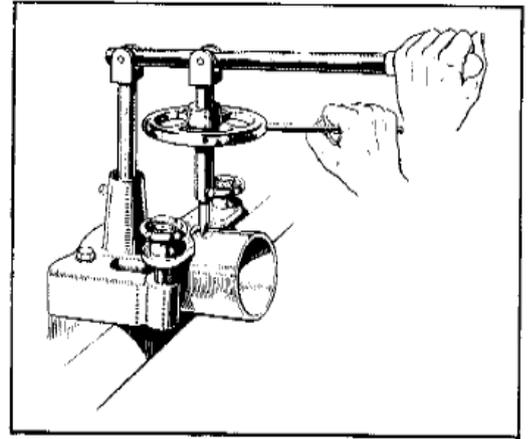
You may be wondering what the fuss over 12 volts is about, 6 volts worked quite happily for all this time. In many cases you would be right to think this, after all the conversion does nothing to increase the power produced. The reasons are subtle, converting to 12 volts ensures more of the power generated actually arrives at the bulbs, making them brighter. The losses due to the natural resistance in switches and wiring are much reduced in a 12 volt system and, in a nutshell, that is the case for doing the conversion.

Today there is a better choice of 12 volt equipment too, 12 volt batteries are available in a larger choice of sizes and bulbs are available that fit modern equipment, opening up further options.

Further Dynamo Advice

DIY overhaul

For those who are looking to perform their own dynamo overhaul you can refer to the original Lucas manuals that we make available without charge on the 'Technical Support' page of our website. The dynamo manual may be found under the Vintage Lucas Manuals heading. We also stock a good range of Lucas dynamo parts and repair kits that are quality assured and where possible sourced from UK manufacturers. Rex's are happy to offer advice to those doing their own repairs if you e-mail the technical team.



Batteries

AGM batteries are the evolution of traditional wet batteries and offer many advantages with few of the disadvantages. They are trouble-free on classic machines where a voltage regulator is fitted. Lithium batteries, on the other hand, are best avoided as they have exacting charging requirements that old systems cannot meet. AGM batteries are charged with normal chargers and give many years service, typically 5 years or longer. Unlike wet batteries, AGM will tolerate long periods without use, generally they can be left for a year not connected to any charger and you'll find them working perfectly, although this practise is not recommended. It's worth investing in a modern 'intelligent' charger, Mottobatt recommend their own and these work very well but there are other brands that are equally as good. Leaving your battery connected to a maintenance charger will prolong its life greatly. Car battery or old fashioned chargers that have no cut out once the battery reaches full charge must not be used, even if they are trickle chargers. A last point to note is AGM batteries have no liquid acid inside to spill on to your paint or chrome work and can safely be used on their side if required. Rex's stock a wide range of the yellow Motobatts due to the consistently good customer reports they receive.

Amp/hour

There is no requirement to fit a 6 volt battery with a high amp/hour rating - provided you have a good solid state voltage regulator. For 60 watt dynamos a battery between 5-10 amps is all that is required; 36 watt dynamos can get away with using a 4-8 amp battery. This advice applies equally to 12 volt converted units.

AGM horror stories

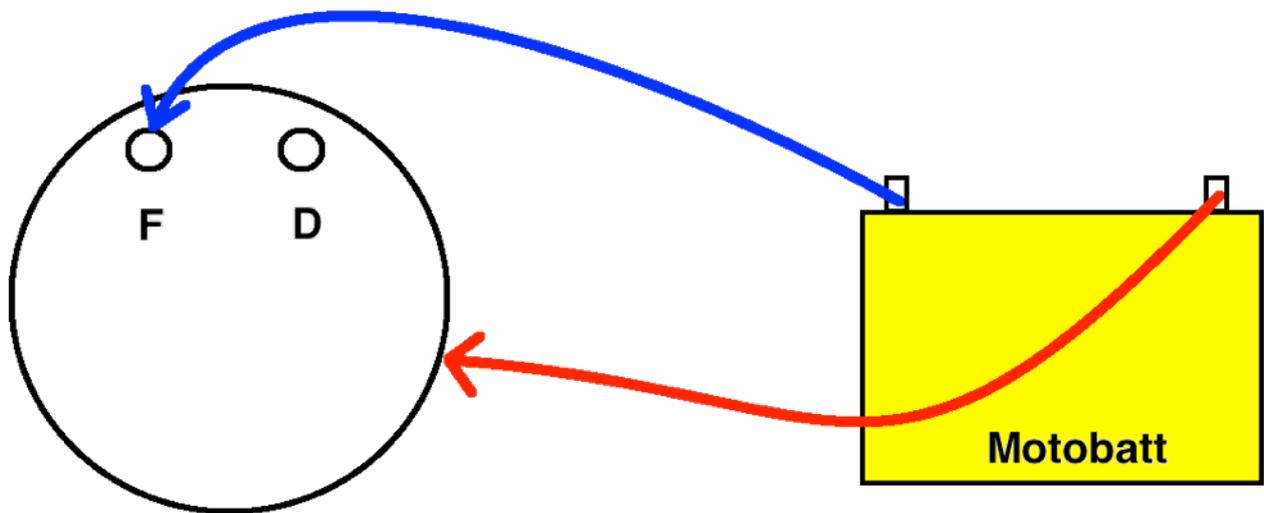
These tend to be just that, stories. AGM batteries do require a good voltage regulator, whether you have a dynamo or alternator. The truth behind tales of woe is usually the same, a corner was cut or things weren't actually as they are being described. Cheap regulators, 'finger trouble' while wiring or batteries bought at very low prices are usually found to be the root of such tales. As with everything, if you follow good advice good results generally transpire.

Flashing the dynamo (or changing the dynamo's earth polarity).

Dynamos are slightly mysterious here, the iron core in the field pole stores some residue magnetism which allows the dynamo to self excite when the battery is flat, so even with a discharged battery a dynamo will start working. This is not covered in much detail in the Lucas manuals, however it is also a very common cause of a dynamo not producing any charge after being rebuilt or when it has been left un-used for a long period. This residual magnetism also dictates if the dynamo body is positive or negative in polarity.

'Flashing the dynamo' is simple to carry out, first disconnect the dynamo from the regulator then if the dynamo is fitted to the vehicle, using temporary wires touch the battery terminal that is not earthed momentarily to the field terminal (F). You will see it spark, hence the term 'flashing'. Do this several times holding the connection for no more than a second each time. The field winding becomes an electro-magnet each time the battery is connected and the pole shoe stores some of

this magnetism ensuring the dynamo will self start and make power with the dynamo body the same polarity as the vehicle's chassis (or frame) next time the engine is started.



Vehicle and regulator polarity

Most solid state dynamo regulators will be either positive or negative earth, you cannot change this feature. However, as you have seen, changing the polarity of the dynamo body is very quick and easy, it can be flashed either for positive or negative earth. The vehicle's earth polarity is also simple to change. To change the vehicle's earth, connect the relevant terminal of the battery to the chassis, the other to the wiring loom and flash the dynamo to match. If there is an ammeter fitted and subsequently it reads in the wrong sense, simply reverse the connections on the back.

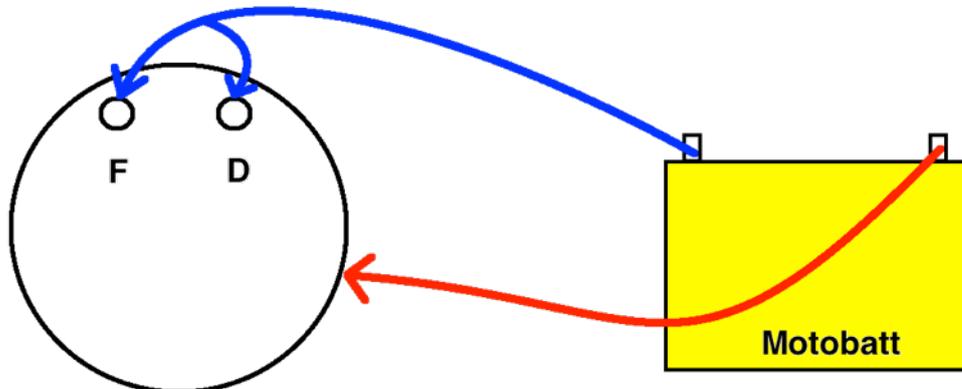
We won't get in discussing if positive or negative earth is best, however if you find yourself with a regulator that does not match your vehicle's earth, changing the vehicle's earth is a very simple remedy with no additional expense.

Field coil connections

We are often asked how the field coils are connected where a dynamo has been built from parts and the information is lost or if the direction of dynamo drive has been altered. One simple way to check is to 'motor' the dynamo with a battery. As when flashing the dynamo, connect the body of the dynamo to the appropriate terminal of the battery for the vehicle's earth. Now connect the field and the dynamo terminals together and connect them to the other terminal of the battery. It should be pointed out that the dynamo must not be attached to the engine and that the armature must be free to turn. If the field winding is correctly connected, the dynamo should motor in the direction of the drive arrow on the body. You will notice that the dynamo will run only in one direction no matter which way you connect the battery.



This is because the dynamo is a DC brush type motor that uses a field coil to produce the magnetic field. When a field coil is used, instead of permanent magnets, reversing the polarity of the battery does not change the direction of rotation. In order to change the direction the dynamo runs you have to change either the field coil connections or the armature connections. In our case it's a simple matter to reverse the field connections.



Going back to the original question, which way do I connect the field windings, if you have connected the field coils correctly, the dynamo will run in the direction of the drive arrow on the body. If you want to use the dynamo on an engine that runs in the opposite direction to the arrow on the body, you must connect the field windings so that the dynamo motors in the opposite direction as the arrow on the dynamo.

When you motor a dynamo with a battery it will also flash the field, so to save you from having to do this again, connect the dynamo body to the same terminal on the battery as the vehicle's earth.

We hope this information has been useful

Our company has a policy of providing free technical guides, where we can, to aid owners and mechanics, however we do not offer a free telephone technical service. If you do have questions these must be e-mailed to the technical team, details can be found below. These will be answered as quickly as our work load allows. Unfortunately our technicians will not come to the telephone to answer your questions, as in doing so they would be neglecting other customers who are having work carried out in our workshops. If we have not published an information leaflet you must conduct your own research in to the matter. Many owner's clubs have excellent technical resources. Most of our technicians are electronics engineers, their skills lay in understanding inner workings of electrical parts, they are not motorcycle mechanics.

Our telephone line is exclusively for sales and is not answered by the technical team. When ordering parts it's advantageous to know the part numbers in advance. If you are not sure we will take down what information you have and a technician will advise the sales team if there is any doubt.

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