

# Motorcycle Voltage Regulation and Rectification

## What is the difference between voltage regulation and voltage rectification?

Most motorcycle electrical systems are designed to operate at a preset voltage which is usually 6 or 12 volts. It is normal for this to be specified as a Direct Current (DC) voltage similar to the supply voltage of a battery. The actual figure is generally a little higher than this to allow for the battery charging circuits of the machine.

The voltage regulator is installed between the machines generator (alternator or dynamo) and the battery to ensure that the charging voltage does not rise too high.

A dynamo can be considered a DC generator and does not require a rectifier.

An alternator generates an Alternating Current (AC) and this needs to be converted to DC before it can be used to charge a battery or operated some components of a vehicle electrical system. The process of converting from AC to DC is called rectification and is performed by the rectifier.



A rectifier is installed between an alternator and a voltage regulator and before the battery.

## Why do I need to regulate the charging voltage?

If the charging voltage is too high the battery will be damaged, usually by 'boiling over' on a lead acid battery. If the battery fluid levels are falling considerably over a short period of running, this is a sign of over-charging.

Another problem with high voltages is that damage can occur to other components on your machine such as constant bulb failure and damaged ignition systems.

If the voltage regulator output is too low then your battery will not charge and your machine may not start\run and your lighting may not operate or will kill the engine when used.

## What upgrades are available?

If your machine is equipped with an Alternator...

**Rectification:** The original Selenium plate rectifiers fitted to machines from the 1950's onwards were not very efficient and should be replaced with a modern replacement.

There are two main options...



**A solid state bridge rectifier:** This is essentially four (or more) large diodes mounted inside a square metal or epoxy case. These can be purchased for under £5.00 (GBP) from either motorcycle or general electronics vendors (Maplins, Radio Shack ect..) and should be rated at around 100V\20A.

Or...

**A combined Rectifier Regulator module:** This is a rectifier and a voltage regulator in one module. As well as combining the two functions into one convenient box, they generally have smoothing circuits to output the most efficient clean power for your machine. These can be purchased new or from motorcycle breakers.



As well as the motorcycle battery voltage you will need to know the type of alternator fitted to your machine. Most classic bikes were originally fitted with Single Phase alternators which usually have a 2 wire connection, whilst some have been upgraded to a 3-Phase alternator which usually has 3 wires.

**Voltage Regulation:** Many smaller classic bikes were not originally fitted with any voltage regulation at all, relying on low output alternators or by switching generating coils on\off with the ignition\lighting switches. Other and larger machines were fitted with one or more large Zener diodes encased in a heat-sink usually under the headlight. The zener diode is designed to shunt any excessive voltage to heat and although these may work for years, it is our recommendation to replace them with either a modern solid state voltage regulator module or better still, replace the rectifier and zener with one of the combined Rectifier Regulators mentioned above.

If your machine did not originally have a voltage regulator or zener diode we still recommend fitting one to protect the rest of your electrical system and provide the best possible battery charging.

## If your machine is equipped with a Dynamo...



Dynamo equipped machines were generally fitted with a Lucas CVC Dynamo regulator. This unit regulated the voltage by electro-mechanically switching the supply to the battery from the dynamo on and off very fast. These modules need maintenance and have to be set between a maximum charge voltage and a minimum switch off voltage which is always a bit of a compromise. They also have both moving parts and contacts that wear.

You can buy new and reconditioned CVC regulators but we would recommend an electronic dynamo regulator replacement module. There are many versions of these on the market and the better ones are designed to fit inside the original CVC housing so that they look like standard equipment. In general they should provide a better level of battery charging through a wider engine rev range.



## General information about Dynamos and Alternators

Weak dynamo's should be reconditioned and may need new brushes and/or rewinding. It is possible to buy alternator replacements for some dynamo equipped machines.

If you are replacing the alternator on your machine it is worth considering a 3 phase unit rather than the original single phase replacement as it will generate more power at lower revs and the only downside is that you will also need a matching rectifier and or rectifier regulator module.

When replacing the alternator stator (the wired bit around the outside) always check that rotor is the correct size for the replacement as some of the early Lucas rotors subtly changed dimensions over the years. Also make sure that the rotor still has plenty of magnetic attraction by ensuring that the rotor can support its own weight when magnetically picked up with a screwdriver.