

Standard WW2 Jeep Generating Equipment: Auto-Lite Type B Generator, Current Voltage Regulator & Cut Out

Written & Compiled by John GIBBINS 20th June 2016

Foreword:

Pressure = Volts [voltage]

Flow = Amps [current]

The automotive starter motor needs a battery & batteries need re-charging after starting plus other drain when then engine is not running.

Batteries are charged using regulated DC current & at the time of these G503 vehicles the generator [dynamo] was in use on most vehicles for this purpose.

The battery is used for starting. With engine speed above idle the generator re-charges the battery to full charge reasonably quickly. Above idle the full electrical load of the vehicle is generally catered for by the generator. The G503's load includes ignition system, lights, horn, siren etc.

Should the G503's load exceed the generator's capacity the battery supplements the generator output. @ idle speed the generator's output is lower than battery voltage so the cutout disconnects the battery & generator. This stops battery drain & protects the generator.

Then the battery has to cope with the full electrical load & @ night if the headlamps are on they will dull. As engine speed increases the cutout re-connects the generator to the load. The battery is quickly replenished....& the lights brighten from above battery voltage now coming from the generator.

This switching on & off when returning to idle speed by the cutout puts generator load on the engine fan belt of between 0.5 to 1kW depending on generator output requirements.

Start the vehicle, run @ idle watch the ammeter then rev the engine. What happens to the ammeter? Back @ idle, turn the lights on now rev the engine. Does the fan belt squeal as you rev the engine when the lights are on but doesn't when the lights are off? Observation of the ammeter in particular tells a story, does it not?

The introduction of alternators @ a later date have added capacity to cope with not demands on the battery, but to run numerous accessories.

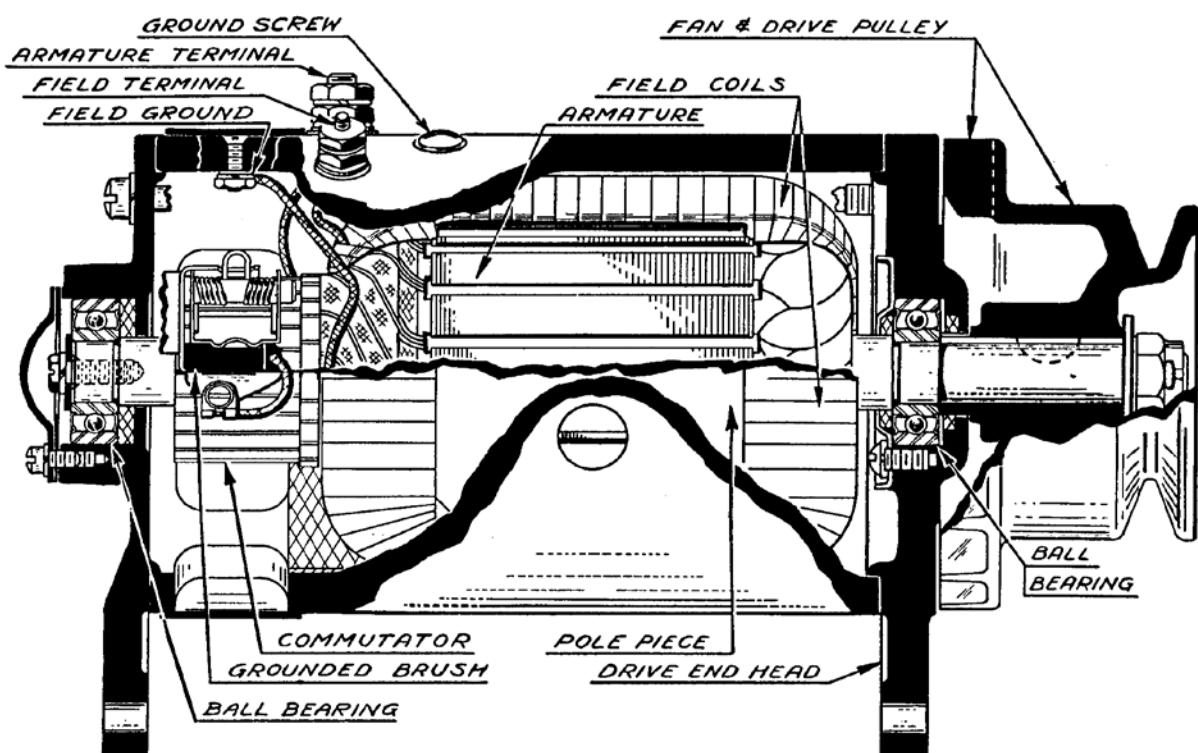
Alternators produce AC current on 2 slip rings then the current is converted to DC by the use of diodes & transistor switching devices. Generators achieve the same conversion using the commutator.

Generator Workings:

Simply, a wire, when it is passed through a magnetic field, will have an electrical current induced. When electrical current passes through a wire a magnetic field will be produced.

A generator consists of a rotating shaft, wound with copper wires [armature]. This armature rotates between coils of wire called the field windings held in place with soft iron pole pieces. The field windings produce a strong magnetic field that generates alternating current AC in the armature winding. This AC is converted to direct current DC by the commutator. The commutator consists of about 28 copper segments separated by insulating mica on the end of the armature. Two brushes conduct this current from the armature.

Voltage generated increases relative to engine RPM. This would cause batteries to overcharge, damage accessories & generate enough current to damage the armature winding. When the engine [& generator] is @ idle or stopped the current would flow in reverse from the battery through the armature winding causing the battery to flatten & damage the armature winding by trying to run the generator as a motor. The cut out takes care of this.



Source: TM 10 1513 0600 65

TM is a free download www.JeepDraw.com

The Generator:

The generator has two field windings producing a magnetic field the armature rotates through.

The rotating armature produces the electrical power to recharge the battery & operate the various accessories such as the lights & ignition coil. A voltage is applied across the field windings to produce the magnetic field. The regulator controls the voltage & current delivered to the battery & G503's accessories.

Control:

WARNING: Always disconnect the battery when removing or replacing the current voltage regulator cover.

The G503 voltage regulator [VR] keeps the voltage at a set value of $\approx 7.4V$ or $\approx 14.2V$. The reason for higher than battery voltage is there must be a differential otherwise current will not flow to the battery & electrical circuit when needed.

The CVR controls the output to the battery & any operating accessory's needs. If the battery is low or power consuming items like headlights are switched on, the generator output can be up to a maximum of 40 amperes.

<https://www.youtube.com/watch?v=zRk1xbJIBcY>

Shows Mopar Generator & CVR operation

Marty SoCal contributed:

....the voltage output will remain constant up to rated amperage of the generator [40]. The change in charging amps is what causes a charging load to be applied to the fan belt

When the power needed is minimal, the VR limits the generator output stopping the battery overcharging & protecting the electrical system [like the lighting system/headlights] from excessive voltage.

Voltage Regulation:

Simplistically: The VR switches the current to the field coils on & off hundreds of times each second. This levels out to a steady consistent voltage irrelevant to load & is set by adjusting the spring tension on the VR contact points to obtain ≈ 7.4 or $\approx 14.2V$.

This voltage can be measured with a volt meter across the battery terminals. At idle one will read battery voltage ≈ 6.3 or $\approx 12.6V$ & @ RPM generator regulated voltage ≈ 7.4 or $\approx 14.2V$.

Current Regulation:

Again very simplistically: When the battery is low & there is heavy load the voltage regulator will allow continual current to the field windings & the current regulator limits current to the field coils, switching them on & off by opening it's set of points hundreds of times per second. This allows production adequate enough to supply current for those circuits needing same, while protecting the generator field windings overheating & failing.

Adjustment by altering CR spring tension. Hook the **positive lead** of a good quality ammeter to the B [cutout terminal] on the regulator & the **negative lead** to the vehicle battery's negative terminal. Turn on lights & other electrical accessories & @ higher RPM's reading should be $\leq 40A$.

The Cut-Out:

The cut-out is simply a magnetically operated circuit breaker or on/off switch connected in the charging circuit between the battery & the generator.

The cut out contact points are normally held open by a spring @ low RPM or when the ignition is turned off.

With the engine running as the speed of the generator increases the generator's output increases until the magnetic field it creates in the cutout [windings around a steel core] causes the contacts to close very firmly. As engine speed reduces & the generator output decreases to under battery voltage. This reduces the magnetic strength in the cut out core allowing the spring to open the cutout points.

These WW2 Auto-Lite CVR's are very robust & rarely need attention other than after being fooled with or mis-treated or mis-adjusted.

Unless someone has had the CVR bobbins/points pulled apart **there should be no need** for any of the air gaps mentioned in the TM's to be adjusted.

Both these actions other than testing actually polarize the generator--

Contribution by Gindi on testing:

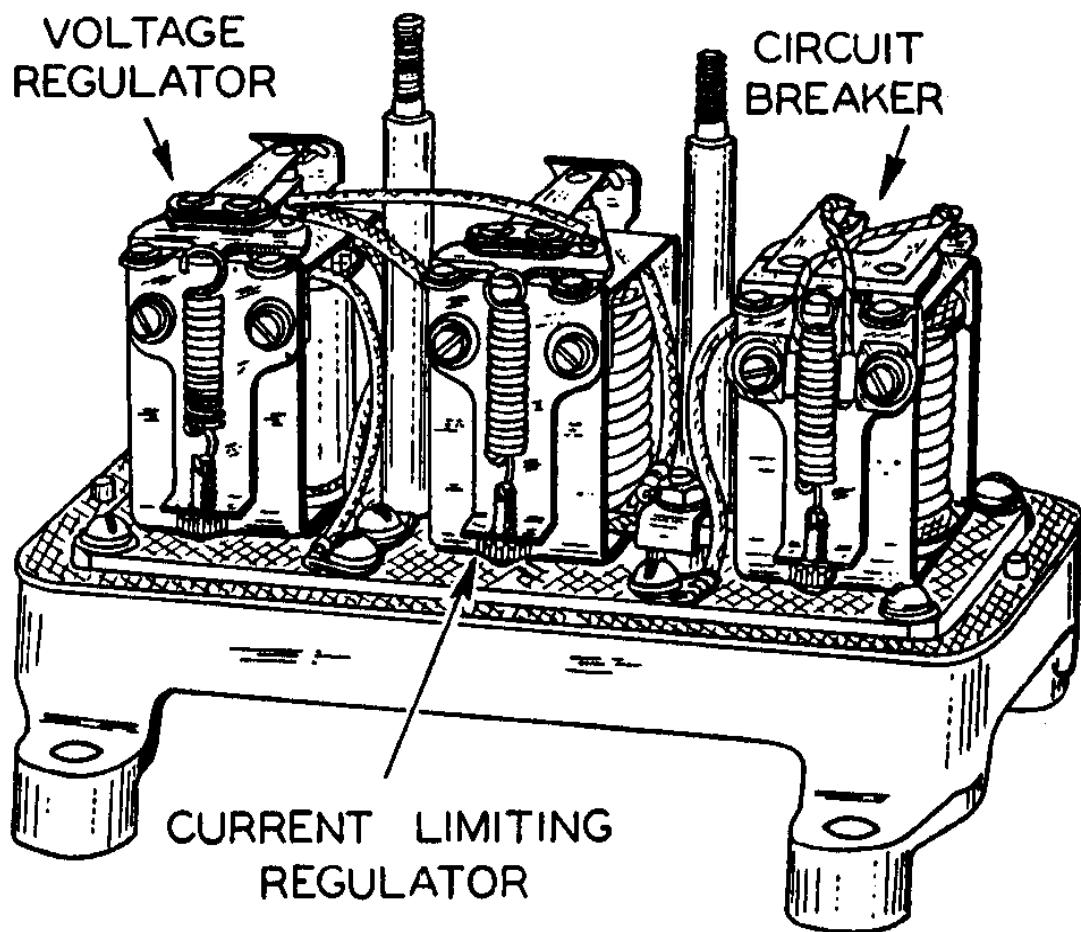
When I have a Jeep that seems to not be charging. Run @ high idle & hook the positive battery terminal directly to the generator DF [field terminal]. I keep that lead on the DF & watch the amp gauge.

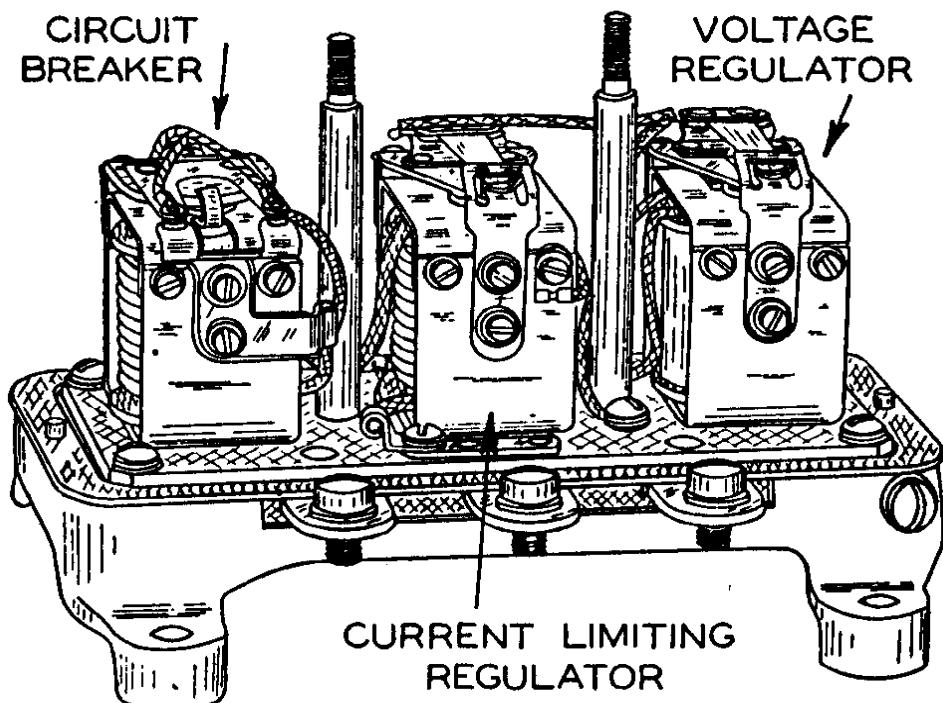
If the generator is working well the field windings are getting full battery & this results in the generator producing maximum current output [40 amps so not too long].

If charging stops when the jumper lead is removed I know the generator is good & the regulator needs attention. If the battery jumper lead doesn't make any difference, the generator is @ fault.

Mike Wolford concurs with Gindi: By connecting the B+ terminal to the generator DF [field terminal] the regulator is by-passed & if the generator is working it will produce maximum output.

Kind of like a dog chasing its tail.





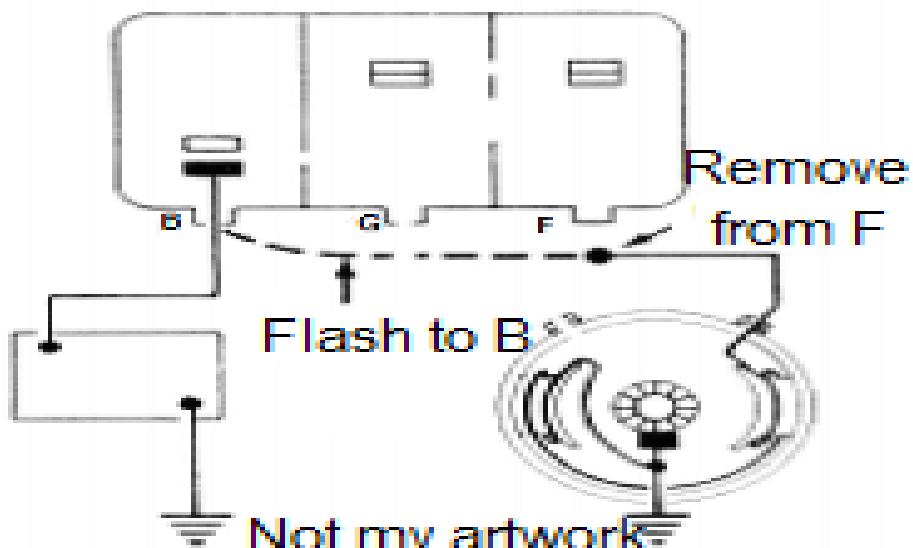
Source: TM 10 1513 0600 66&67

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Polarizing:

JEEP 'B Type' CIRCUIT

Standard WW2 Auto-Lite Generator Regulator
Not to be confused with the 'A Type' circuit used on later & civilian jeeps



There is more than 1 way to do this.

1. In the Jeep's B type circuit disconnect the field wire from the regulator & touch this wire to the circuit breaker/cut-out/battery/ammeter connection.
2. Alternatively as I was taught by the Australian Army: flash a lead direct from the battery's live terminal to the DF field connection on the generator.

About polarizing

Source: <http://www.netlink.net/mp/volks/htm/gen.htm>

Why do generators need to be 'polarized'. Auto generators need some magnetism to get started. This 'residual' magnetism remains in the Field pole pieces even after the engine has stopped.

The next time the generator starts up, the residual magnetism creates a small voltage in the Armature windings. Not enough to charge the battery, but enough to allow the Field windings to draw current. As the Field current increases, the pole pieces create even more magnetism. That makes even more voltage in the Armature, & the cycle continues until the generator is capable of producing maximum output.

What can happen to a generator that has been stored a long time or is freshly re-built? The residual magnetism may decrease to the point where it can no longer get the generator starts producing voltage. In the case of a new generator or one which has been mis-treated, the residual may even be of the *wrong direction* [North and South poles reversed].

Polarization is a simple process used to restore the Field pole residual magnetism *and* ensure the magnetic direction is correct.

Do regulators need to be polarized?

No, regulators are not polarity-sensitive.

But my regulator came with instructions to polarize it....

These instructions actually polarize the generator, not the regulator.

The regulator manufacturer simply wants to ensure that your generator will work properly so you don't blame the regulator.