Generators & Regulators

No longer to be a puzzle.

Flashing The Field
1. Connect jumper from DF to D-
2. Battery minus to D-
3. Touch battery's + to the D+ on the generator.
4. There will be a little spark.
5. May be done with generator mounted on the engine.
6. With the square T6C regulator, lift the D+ from the regulator when flashing.

Flashing the field establishes a small magnetic flux in the field poles.

Generator on the bench or in the car.
Motoring the Generator

Motoring the generator is a check on the field connections. Motoring will also “flash” the field, if proper polarity is observed. A “must do” if the generator has been out for repairs.

1. Jumper DF to D-.
2. Apply battery to D- and D+

The motoring generator will now run “clock-wise” when viewed from the pulley end of the generator. If the fields are correctly connected.

If the generator runs “counter clock-wise”, return the generator to the shop. The field’s connections must be reversed.

Testing The Generator On The Car

When there is a question of generator or regulator not operating?

Lift B+ at regulator.
With engine running about 1200 rpm, and voltmeter connected to D+ and D-, touch DF jumper wire to D-.

If the generator is “good”, the voltage will jump up to about 12 volts.

Don’t leave the jumper on more than time enough to read the meter.
Trouble Shooting the Generator

First check the brushes for length and free to move in the brush box.
Brush length new is 0.74 inches.
Brush springs are in place.
Measure the field resistance.
   6 volt field will be 1 ohm, while the 12 volt field will be 3 ohms.
   A generator from a four cam engine, 12v, measures less than 3 ohms.
To measure the field resistance, lift the DF wire from the generator, and ohmmeter from DF to D+.

A 12 volt generator will work when used on a 6 volt regulated car.
A 6 volt generator will work on a 12 volt regulated car, but not for long.
Do this only in an emergency, and minimize all electric loads.
The field currents will be high.

Commutator

- Mica between the commutator segments
- Brushes new are 0.74” in length.
- Wires are soldered to the risers.
- Wires solder here.

End View of the Commutator
Side View of the Commutator
For proper commutation, a film is desirable on the surface of the copper commutator bars. When first “turned” and “under-cut” the commutator’s surface will be as bright as a new penny. In time as the film develops, the brushes will work better, less wear, and less sparking. (Less radio noise as well.)

A warm brown film is desirable on the commutator’s segments.

**Brushes**

In “industry” a value of 60/70 amps per square inch of brush face area is recommended for good commutation.

In the 356 generators the brush’s contact area is designed for good commutation with about 9 amperes. (optimum, good filming)

A dc generator can operate at 200% of its brush capability for periods of time.

**18 amperes**

Brushes contain metal along with the carbon and other materials and can handle some additional amps. **27 amperes**

The factory manual notes a value of 200 watts for the T6 car. The ‘A’ cars had 160 watt generators.

Doing some math where watts = volts x current we have:

200 watts = 7.3v X current
Or current will be 27.4 amps
**Brushes continued**

Therefore, generators marked 50 amps can not support this high level of current because of brush size.

The Cut-Out contacts in the Regulator can not handle 50 amps, simply too small.

There is a bottom to the barrel.

If the load of the 356 approaches 50 amps, the brushes and commutator get hot and solder will be thrown.

Not only is it important to set voltage, but the current limits must be set to a value equal to or less than 30 amps.

This 30 amps is a short time over-current value.

Watts = 7.3 volts X 30 amps = 219 watts

**Current limit in the Regulator must be set, to avoid solder being thrown, during an over-current condition.**

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**Watt Load On A T6 Car**

<table>
<thead>
<tr>
<th>T6 Electric Loads</th>
<th>Bosch RS/UA 200/6/23 Regulator</th>
<th>Regulator 200 watts 6 volts 23 amps</th>
</tr>
</thead>
<tbody>
<tr>
<td>Headlights 2 ea.</td>
<td>50/40 watts</td>
<td>80 watts</td>
</tr>
<tr>
<td>Fog Lights 2 ea.</td>
<td>35 watts</td>
<td>70 watts</td>
</tr>
<tr>
<td>Back-Up</td>
<td>25 watts</td>
<td></td>
</tr>
<tr>
<td>Wiper</td>
<td>12 watts</td>
<td>12 watts</td>
</tr>
<tr>
<td>Brakes/Turns 2 ea.</td>
<td>18 watts</td>
<td></td>
</tr>
<tr>
<td>Radio</td>
<td>12 watts</td>
<td></td>
</tr>
<tr>
<td>Inst. Lights 5 ea.</td>
<td>0.6 watts</td>
<td>3 watts</td>
</tr>
<tr>
<td>Interior Lights 2 ea.</td>
<td>10 watts</td>
<td></td>
</tr>
<tr>
<td>Front Park 2 ea.</td>
<td>4 watts</td>
<td>8 watts</td>
</tr>
<tr>
<td>Tail Lights 2 ea.</td>
<td>5 watts</td>
<td>10 watts</td>
</tr>
<tr>
<td>Turns Front</td>
<td>18 watts</td>
<td></td>
</tr>
<tr>
<td>Turns Rear</td>
<td>18 watts</td>
<td></td>
</tr>
<tr>
<td>License</td>
<td>5 watts</td>
<td>5 watts</td>
</tr>
<tr>
<td>Total Load</td>
<td>188 watts</td>
<td></td>
</tr>
</tbody>
</table>

This calculation does not allow any current for charging the battery.
Generator’s Bearings

Insist on a brand name bearing for your generator. A quality bearing will cost about $10.00. An example would be: SKF, FAG, Fafler, Timken, and others that you know. The bearings specifications should rate the bearing to at least 9000 rpm. Do not use or accept sealed bearings as there is too much friction and heat. A shielded bearing is okay for street use, but for racing use the open bearing. Shields can be picked out of a shielded bearing, making it an open bearing. Then lubricate with electric motor grease.

How the Generator Connects to the Battery

CO = Cut-Out Relay

Generator Warning Light
Switch that enables the blue/yellow wire is not shown.

Generator is not turning, ignition switch closed and the CO contact is open, then the Generator Warning Light will be on.
How the Generator Connects to the Battery

When the generator’s voltage reaches about 6.3 volts, the CO contacts close. This ties the Generator to the Battery, and the red Generator Warning light is now off.

CO = Cut-Out Relay

How the Generator is Regulated

VR contacts vibrate to regulate

7.3 volts regulated

7.3 Volts
0.0 Volts

Voltage Regulating Contacts
Vibrate 50 to 200 times a second.

The pulsating voltage coupled with the sampling rate of the voltmeter will cause the voltmeter’s reading to jump around a bit.

NC = Normally closed.
How the Generator Voltage is Safeguarded

If the voltage starts to climb above 7.3 volts, the normally closed contact opens and the normally open contact closes. This ties D+ to both sides of the field, and the field current goes to zero. Voltage will fall to a minimum with zero field current.

Limiting the Current

Because of high loads (usually extra lights, low battery, or faults) the generator may be called upon to supply a damaging current. This high current demand must be contained to a safe level by the regulator. The CR contacts performs this task.

When the current exceeds the settings of the regulator, CR opens and the current in the field is reduced, causing the voltage to reduce, which lowers the load current.

CR = Current Regulator (contact opens on high current)  CO = Cut-Out (closes at or near 6.3 volts)
How the Generator Disconnects From the Battery

CO = Cut-Out Relay

Key is off, engine has stopped, but the battery voltage is holding the CO coil energized. Then the battery is discharging through the generator to ground.

What to do???
See next slide.
Shutting Down

When the engine is shut down, the CO relay remains picked-up because of its contacts being closed, and the battery voltage is holding the CO relay energized. Since the generator is no longer generating, it now appears as a low resistance. Now the battery pushes a reverse current through the heavy winding of the two winding CO relay. This reverse current is in opposition to the voltage coil, and the CO relay is de-energized opening the contacts.

Here is the pit-fall: if the CO contacts are pushed close with the generator not turning, the contacts will weld together, and the battery will start to discharge. There may be damage to the armature as well.

When driving and the ignition is shut down, if the Generator Warning light remains on, this is your indication that the CO contacts are welded.

What to do??

Start the engine.
Pull the ground strap off of the battery.
Engine stops.
Remove the regulator cover.
Pry the CO contacts apart.

T6C Regulator

The Variode is often found burned. Replacing with a short piece of wire will result in a current limit of about 20 amps.

When the Variode is burned open, there is no over-current control.
Voltage Adjustment

You can’t adjust away a trouble. Trouble shoot first and adjust last.

Factory voltage recommendations are 7.1 to 7.5 volts.
Because of the “gel” type batteries a suggested voltage of 7.3 volts at the generator is recommended.

Lift the B+ wire at the regulator. This removes all loads while adjusting the voltage.

With the engine running at about 2000 rpm, measure the voltage D+ at the regulator.

If the voltage is low, < 7.3 volts, pull the rest post out a bit.
If the voltage is high, carefully place a - bladed screw-driver on the exposed edge of the rest post. Then tap with a hammer. Just a bit is all that is required.

The blued steel spring is made up of two pieces. Take care not to separate the laminations.

The voltage will jump around some. This is because of the vibrating Voltage Regulating contacts and the sampling rate of the voltmeter.

Favor a lower voltage and then check again after some time on the new settings.

You can’t adjust away a trouble. Trouble shoot first, and adjust last.