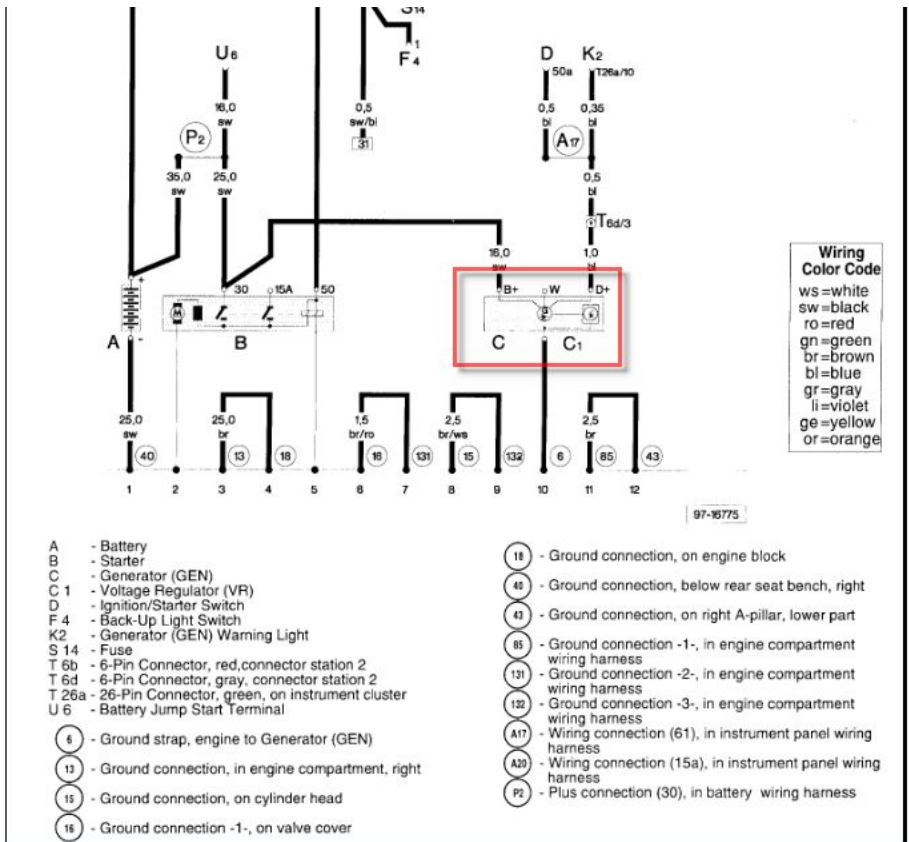


Alternator Troubleshooting

If your alternator is longer charging your battery, there are a few tests and procedures you can use to determine where the fault may be and to correct some issues.

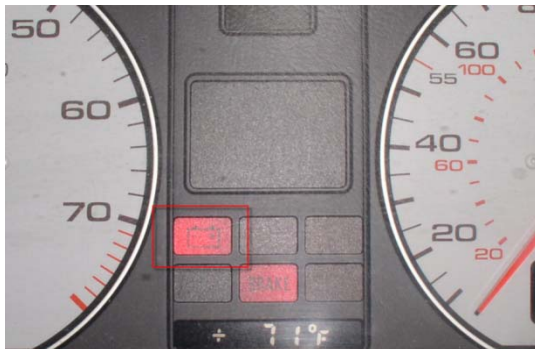
1. Understanding the Alternator circuit

The circuit is very straightforward:

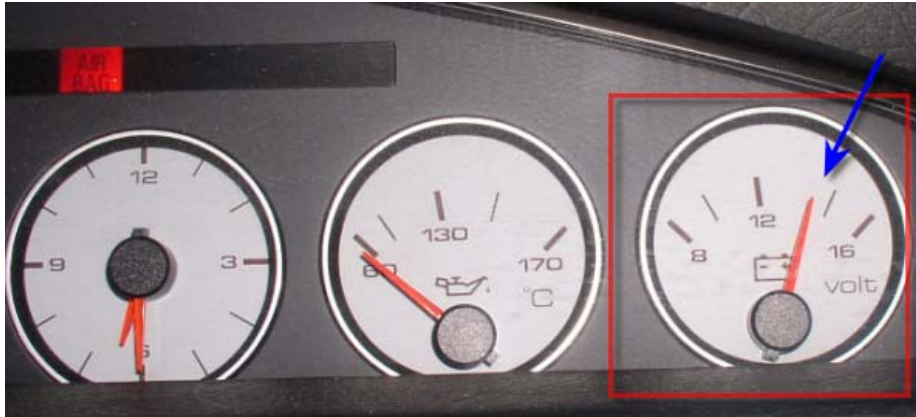


2. How the Alternator should work:

- a. When the key is turned to the "ON" position the battery light should be lit. This indicates there is a good connection between the battery and the alternator



- b. When the car is running, the voltmeter should show around 14v and the battery light should no longer be lit:



- c. General Information: The D+ terminal is connected to the stator windings through an extra set of diodes that are separate from diodes feeding the B+ terminal hooked to the battery. So the D+ voltage is free to move up or down quickly as the alternator powers up or down, in contrast to the B+ which may take quite a while to move up to 14V if the battery is heavily discharged. So the dash lamp across the D+ and B+ terminals is a quick indicator of alternator status --obviously it was intended that way :-)
By the way, the indicator lamp is needed to supply the initial excitation current, but then the current through the auxiliary diodes takes over to power up the regulator and rotor windings. (Obviously when the lamp goes out it can't be supplying much current.)
- **information provided by doron (QW)**
3. When the alternator fails to charge the battery the voltmeter will show less than 12 volts. There are a few possible failure points:
- Alternator is bad** (rarely the case, unless it has been abused or has failed mechanically where the bearings are no longer functioning and the shaft has too much play causing the rotor to contact the stator)
 - Voltage Regulator has failed** – the most common failure. Normally the failure is related to the brushes that contact the copper slip rings that extends out the rear of the alternator, although the electronics that make up the regulator can fail as well. The failure would result in either over charging (producing more current than necessary) or under charging the battery – the more often occurring failure.
 - Wiring problem** – more common than the alternator failure, but less common than the voltage regulator failure. Some problem exists between the B+ connection to the battery, the thin Blue wire on the D+ terminal to the ignition or the grounding of the alternator (my failure).

4. Testing Procedures:

- a. **Wiring** – The first thing to do is make sure the Battery Idiot light is lit when the key is in the “On” position. Since the Alternator needs 12v from the battery to produce voltage, the car sends 12v through the ignition switch and the light on the dash through the thin Blue wire to the D+ terminal on the Alternator.
 - i. If the Battery light is not lit, then you need to check whether it is the bulb, the ignition switch or the grounding of the alternator. An easy way to eliminate all wiring issues outside of the alternator ground is to disconnect the blue wire at D+, ground it to the engine (I used an alligator clip to the IM) and then turn the key to the “On” position. If the light now is lit, you know that all the wiring in that part of the system is OK and your problem is elsewhere.
 - ii. If the battery light does not come on, then you need to replace the battery light or the ignition switch, in that order, until it is lit.
 - iii. Another point of failure for the wiring is the 12v connection to the battery from the B+ connector. The simplest way to do this is to use a voltmeter and measure the volts with the car off by touching the red lead to the B+ terminal and the ground wire of the voltmeter to the IM or Head or any metal engine surface. You should see about 12.xx volts. If you do not, then check the cable to the starter and from the starter back to the battery, although if that cable has a problem most likely you will have starting issues.
 - iv. The final point of failure for wiring is a bad ground. There is the obvious ground strap on the passenger side near the motor mount connecting the engine to the chassis. Normally this will never be your problem, unless you have just R&R'd the engine. Another grounding failure is a little more difficult to see. The voltage regulator has a ground connection to the alternator that is made when the contact on the regulator presses against a spring loaded tang on the alternator. If this connection is suspect, then you may get a very dim Battery light or no light at all. Cleaning this connection will solve this problem.
- b. **Voltage regulator** – If you have confirmed that there are no wiring issues, you can test the voltage with the car running at the B+ terminal (or read the meter in your car). If you are not producing near 14v then the voltage regulator may be your issue. These parts are fairly common and inexpensive. They also can be replaced on the car by using a stubby Phillips head screwdriver, just make sure the brushes reseal themselves properly on the copper slip rings. As mentioned the voltage regulator can fail where it provides too much power to the car and can damage the battery.
- c. **Alternator Failure** – you can test the voltage being produced at the B+ terminal with the car running or you can remove the alternator or drive the car to a FLAPS that can test it. This is one way to rule out the alternator as your problem. Also, if the battery light is lit, it is another indication that the alternator is not charging the battery.

5. Solutions:

a. **Put a known working alternator in the car. To R&R the alternator:**

- i. Disconnect negative battery lead (make sure you have the radio code)
- ii. Remove the lock carrier
- iii. Remove cover on top of the serpentine belt (10mm bolt on back side)
- iv. Release the tension on the belt by rotating the tensioner with a 17mm wrench and using a drill bit or similar through the retaining hole
- v. Slip the serpentine belt off the PS pump pulley and the alternator pulley so you can see the lower 16mm nut that holds the lower 8mm Allen bolt to the alternator.
- vi. Remove the upper coolant hose from the radiator. Be prepared to capture about 1qt of coolant
- vii. Remove the throttle body and Idle stabilizer air hose (leave it connected to the SMIC)
- viii. Fold the air hose back by slipping it under the coolant hose (which is still attached to the water manifold and the expansion tank)
- ix. You should be able to access the 13mm bolt that holds the 12v black wire to B+ and the 8mm bolt that holds the thin blue wire to D+. Remove both
- x. Remove the 13mm nut from the 6mm allen bolt holding the top of the alternator and slide the bolt out the back. With the PS pulley installed, there is only room to grab the bolt with an open end wrench.
- xi. Hold the 16mm bolt with a wrench and loosen the 8mm allen bolt from the back of the alternator. There is a hole through the mounting bracket that will give you access. I used a ½" drive to loosen the bolt but found it was easier to use a 3/8" drive to undo the bolt completely. When you get the 16mm nut fairly loose you can reach down and grab it with your fingers to undo it the rest of the way.
- xii. With the top bolt off, it should make it easier to wiggle the alternator around to slide the bottom bolt backward. I used large needle nose pliers to grab the bolt and pull the rest of the way out
- xiii. Pull the alternator up and out, twisting it to the left as it makes its way past the hoses.
- xiv. Reverse the process to install

b. **Replace the voltage regulator:**

- i. Do steps i. through ix. above (you can leave the lock carrier attached), the rest is with the alternator still in the car
- ii. With a stubby Phillips head remove the 3 screws that hold the plastic cover to the alternator
- iii. There are 3 clips built into the plastic cover that can be pried back one at a time, and a screw driver can be placed at the edge of the cover and twisted against the alternator body to move the cover away. Do this for all three clips
- iv. Slide the cover off the alternator exposing the voltage regulator

- v. Using the same stubby screwdriver, remove the 2 screws that hold the voltage regulator to the alternator. It is spring loaded so it will pop off when the last screw is out
- vi. Installation is the reverse, but be careful that the brushes are positioned correct on the copper slip rings. You can use a thin piece of plastic to help guide the brushes over the slip rings as you mount the new regulator in place.

c. Correct a wiring problem:

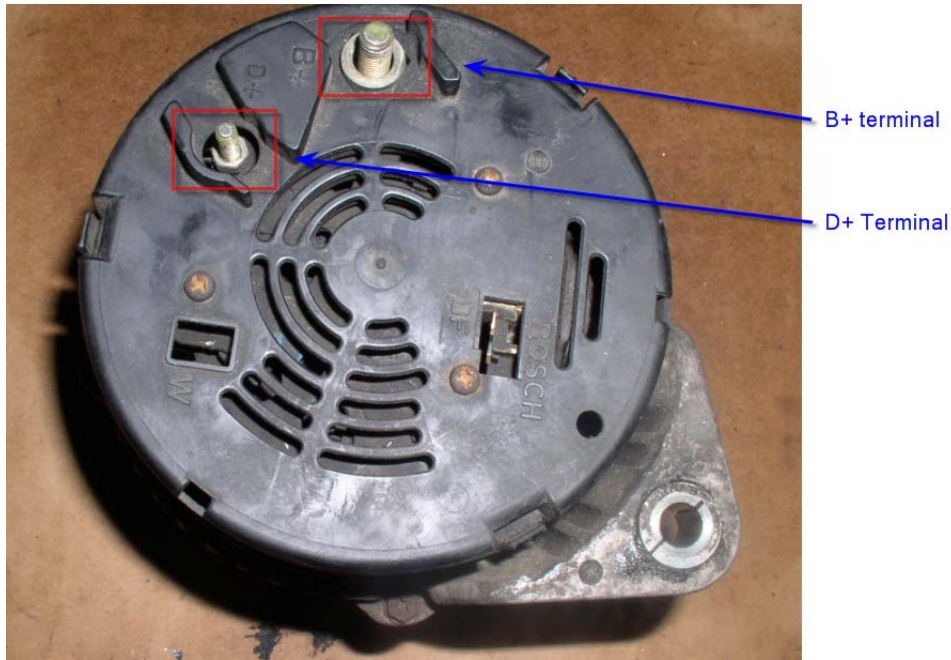
- i. Tighten the loose 12v on B+ or D+ or the ground strap by the passenger motor mount or clean up those connections if corroded.
- ii. Replace any suspect or known bad wires with good ones
- iii. Clean the ground contact on the Voltage regulator to the alternator (my problem):
 - 1. Do steps i. through v. above.
 - 2. With the voltage regulator off, inspect the ground connection.
 - 3. Clean the ground connection on the voltage regulator and the alternator with sandpaper or your favorite contact cleaning regimen.
 - 4. Reinstall the voltage regulator
- iv. Replace the battery warning lamp bulb (need the bulb replace FAQ link)
- v. Replace the ignition switch (need the ignition switch R&R link)

Helpful Pictures:

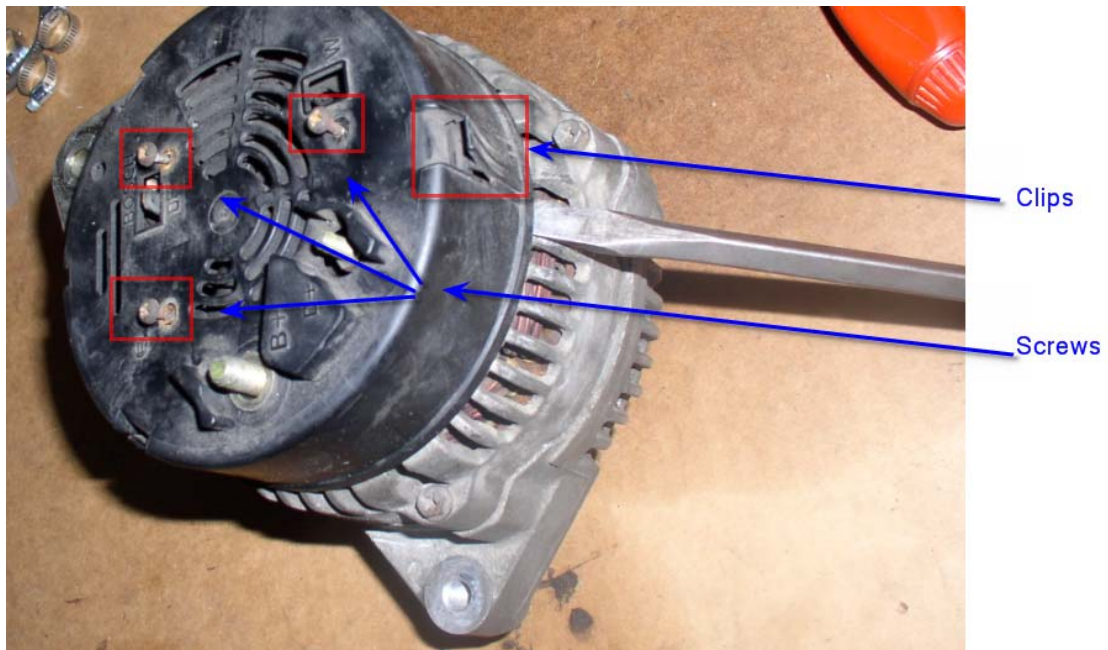
Alternator in car:



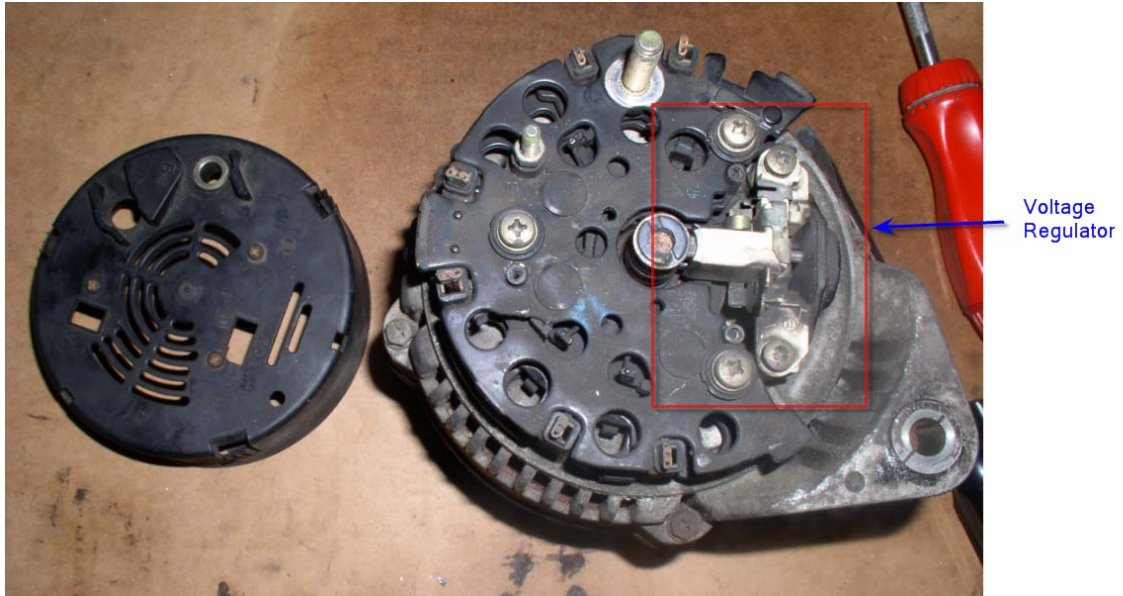
Alternator (out of car):



Cover being removed:



Cover off:



Voltage Regulator off:

