The Charging System
Simple Tests To Verify Properly Operating Charging System & Components

- **VOLTAGE REGULATOR** (Reclaim or OE)
- **"B" STUD CONNECTOR** (Mfg and Placement)
- **BEARINGS** (New: OE or Upgrade)
- **SLIP RING** (Renewed or Replace)
- **RECTIFIER** (OE or Reclaimed)
- **CASE THRU-BOLT** (Coating / Torque)
- **STATOR** (Tested For Rated Output)
- **PULLEY** (Renew & Refinished OAD Pulley – New)
- **ROTOR** (Balanced/Tested to OE Specs)
- **HOUSING** (Re-Condition/Re-Threads)

VIP Quality Products

**Genco Professional Series**

**Auto Value**

**PPM INDUSTRIES**
Question?
If the units are 100% tested at the factory, why is that I seem to get so many bad units?

- A. I'm just unlucky
- B. The units were damaged in shipment
- C. The units are cataloged wrong
- D. They don't really test them at the factory
- E. The units are not really the problem

Answer!
- The product you receive has nothing to do with luck!
- While occasionally products can be harmed in route, and cataloging errors can happen. We do everything possible to ensure only the best quality product reaches your shop.
- The vast majority of problems can be traced to some other member of the “Electrical Team” on the vehicle
Ohm's Law

The Basis For Everything You With Alternators

Ohm's Law

For many conductors of electricity, the electric current which will flow through them is directly proportional to the voltage applied to them. When a microscopic view of Ohm's law is taken, it is found to depend upon the fact that the drift velocity of charges through the material is proportional to the electric field in the conductor. The ratio of voltage to current is called the resistance, and if the ratio is constant over a wide range of voltages, the material is said to be an "ohmic" material. If the material can be characterized by such a resistance, then the current can be predicted from the relationship:

\[
I = \frac{V}{R}
\]

Electric current = Voltage / Resistance

Electric Current

Electric current is the rate of charge flow past a given point in an electric circuit, measured in Coulombs/second which is named Amperes. In most DC electric circuits, it can be assumed that the resistance to current flow is a constant so that the current in the circuit is related to voltage and resistance by Ohm's law. The standard abbreviations for the units are 1 A = 1 C/s.
The Electrical Team Concept

• The charging system is much more than the alternator
  – Team Members:
    • Battery
    • Cables
    • Tensioner
    • Belt
    • Alternator

Virtually all production vehicles now employ computer management "systems" that incorporates charging function into a platform sub-system.

Many vehicle manufacturers exclude the voltage regulator from the alternator and map the control function within the PCM / ECM. System demands are monitored and managed within the larger needs of the vehicle. Temperature compensation, voltage and amperage load response, and avalanche demand management are examples of the increasing complexity built into today's vehicles. As a result of these system changes, diagnosing and isolating alternator failures has become increasing complex. Relying on traditional diagnostic procedures such as bench testing and source voltage readings are proving to be of less value in isolating a problem in a charging system. OBDII and DMM testing are critical.
Diagnosis Of Electrical Team Has To be Systematic

• **Always Check Battery First!**
  • Check For 12.6 Volts At Battery
    • 12.6 or higher = 100% charged  12.4 or higher = 75% charged
    • 12.2 or higher = 50% charged  12.0 or higher = 25% charged
    • Less than 12.0 = DISCHARGED (Replace or Recharge Before Further Tests)

• **Load Test Battery**

• **Check Belt Tensioner – Is It Loose?**

• **Check Cables & Connections**
  • Confirm Tight Clean Connections
ALTERNATOR VOLTAGE DROP

Drop Testing is Crucial For Good System Diagnostics

• **ALWAYS** Complete A Voltage Drop Testing Before Replacing An Alternator

• Most Times The Original Unit Failure Is Caused By Bad Connections!

• Think of it this way!
  – If you have a 0.8 volt drop on ground side of the alternator, the unit only “sees” 11.8 volts on a fully charged battery
  – Alternator goes wide open to correct drop
  – Alternator overheats
  – Alternator fails!
Voltage drops in the charging circuit can be very difficult to find and cause you many hours of frustration. The following diagrams will help you troubleshoot the charging system.

Some key points to remember are:
Added resistance to the Charging circuit will usually result in decreased alternator performance.
For example: Take a system charging 100 amps, with add 0.01ohms resistance to the B+ or ground circuit. The result is a reduction in system voltage of 1 volt. This lowers overall system performance and will reduce the life of the battery and charging system.
When performing voltage drops always have your positive lead of the multimeter on the connection closest to the alternator.
When performing voltage drop tests, current must be flowing in the circuit. This means we must have the vehicle running, alternator charging and accessories turned on.
Alternator Voltage Drop Test – Step 1

Positive Circuit

With positive lead of the multimeter touching the positive post on the alternator and the negative lead of multimeter touching the positive (+) post (not the cable end) of the battery and the engine running apply a load to the system.

Watching the voltmeter (wired as shown above), the reading on voltmeter should be less than .2 volts.

If the reading is more than .2 volts go to Step 2.
In step 2 you will check the components of the positive (+) circuit.
Alternator Voltage Drop Test – Step 2  
Positive Circuit Components

With the positive lead of the multimeter touching the point closest to the alternator and the negative lead of multimeter touching the point to be measured (remember measure to a post, not the cable end) and with the engine running apply a load to the system.

Check each component and link in the circuit. Those components with a voltmeter reading of greater than .2 volts should be repaired or replaced. Check the component or link to verify that the voltage drop is now .2 volts or less.

To properly diagnose the charging system, **Check across every connection, cable and component.**

In step 3 you will check the ground circuit.
Alternator Voltage Drop – Step 3
Ground Circuit

With the positive lead of the multimeter touching the negative (-) battery post (not the cable end) and the negative lead of the voltmeter touching the housing of the alternator and with engine running apply a load to the system.

Watch the voltmeter (wired as shown above), the reading on voltmeter should be less than .2 volts.

If the reading is more than .2 volts check components in the ground circuit. Check components as outlined in step 2 but place the positive lead from multimeter to the connection closest to the negative battery post.
Alternator Voltage Drop

IMPORTANT TO REMEMBER

• We want voltmeter reading less than .5 volts!
• We are not looking at system voltage but rather voltage difference
• We must check both sides of loaded circuit
• Often voltage drop (resistance) is on the ground side!
• Check Vehicle Manufacture Service Bulletins
  • Chevy Trucks – Issues with ground at water outlet
    • Solution – take off connection, clean, apply dielectric grease and tighten
  • GM Vehicles Cables - Lead spacer between stacked cables on positive cable crushes and makes bad connection
    • Solution: Always keep these in stock and replace whenever servicing battery
Alternators - Not Business As Usual
GM Vehicles 1999 and Newer

The “All Silicon Voltage Regulator” or “ASVR” has replaced the older CS design. The new ASVR regulator is a computer chip and is a significant improvement over older CS-series voltage regulator designs. Special considerations are necessary when working with ASVR regulators.

- GM service manuals specify that the battery must be disconnected before alternator is removed. Failure to do so may cause voltage spikes when B+ terminal is removed which will damage or weaken computerized equipment.

When disconnecting the alternator from the vehicle:
1. Disconnect the regulator plug
2. Disconnect alternator battery cable
3. Remove alternator from its brackets

When connecting the alternator on a vehicle:
1. Mount alternator to vehicle
2. Connect alternator battery cable
3. Connect regulator plug last

Failure to follow this procedure will “false bias” the regulator resulting in a “no charge” condition. Voltage spikes or improperly applied lamp terminal voltage will damage, weaken and/or severely shorten the regulator's life. Most late model vehicles use the ECM or PCM to turn on the regulator. If a fault code was set when the original alternator failed, the code must be reset for proper alternator operation. If the error code is not cleared, the dashboard warning light may stay on and the alternator may not charge. A scan tool maybe necessary to reset codes.
Information on Voltmeter Gauge Fluctuation Due To Regulated Voltage Control System

Affected Models:
2005-2009 Cadillac Escalade Models:
2005-2009 Chevrolet Avalanche, Silverado, Suburban, and Tahoe:
2005-2009 GMC Sierra, Yukon

TECHNICAL SERVICE BULLETIN
Reference Number(s): 07-06-03-009A Date of Issue July 21, 2008
Related Reference Numbers: 07-06-03-009, 07-06-03-009A
Supersede Note: This bulletin is being revised to add 2009 year models. Disregard bulletin 07-06-03-009 (Section 06 – Engine Propulsion Systems)

VOLTMETER FLUCTUATION CONDITION
Some customers may comment that the voltmeter is fluctuating between 12 and 14 volts on their full-size pickup or utility vehicle. Starting with the 2005 model year, light duty full-size pickups and utility vehicles are equipped with a new “Regulated Voltage Control” (RVC) system. This system reduces the targeted output of the alternator to 12.6 to 13.1 volts when in the “Fuel Economy Mode” to improve fuel economy.

The alternator may exit “Fuel Economy Mode” if additional system voltage is required. Under this condition, the Voltmeter will fluctuate between 12 and 14 volts as opposed to previous non-RVC systems that would generally maintain system output of 14 volts. The fluctuation with the RVC system is considered to be normal system operation and NO repairs should be attempted.
Externally Regulated Nippondenso Alternators

Some NIPPONDENSO alternators are externally regulated. The voltage regulation of these units is provided by the Electronic Control Module or ECU (PCM). To determine if a no charge condition is caused by the alternator or the control module, follow these steps.

1. Examine the alternator. There will be two small wires and one large wire connected to it.
   • If the two small wires are the same color proceed to step two.
   • If one wire is green and the other is green and orange, ground the green wire with a test lead and proceed to step 9.
2. Disconnect the battery.
3. Carefully remove the wiring harness from the case of the alternator.
4. Secure the harness so that no connector touches ground.
5. Reconnect the battery and turn the ignition key to the “ON” position.
6. Measure the voltage at each small wire.
   • One wire will have no voltage present. Make a note of which wire that is.
7. Reconnect harness to the alternator.
8. Ground the wire that had no voltage present with a test lead.
9. Run engine at a fast idle and check for proper alternator output. If alternator is good, voltage will climb steadily. The amount of voltage supplied by the alternator will vary according to battery size and condition.
10. Remove the test lead from the vehicle.
   • Chrysler TSB’s indicate that many of these vehicles develop poor alternator grounds. The ground strap for these alternators must be in place and capable of carrying the entire current output of the alternator.
We Get “em” Started!
You Keep “em” Going!

QUESTIONS?
CONTACT YOUR LOCAL AUTO VALUE STORE

Technical Help Available At:
BBB TECH SERVICE LINE AT (800) 645-1102
Online At http://www.bbbind.com/technical.html