AMERICAN POWER SYSTEMS, INC®

Troubleshooting Guide for Common Charging System Issues

Overview

Thank you for your investment in American Power Systems products. APS has designed, manufactured and installed alternators and vehicle power systems for over 20 years. This document addresses some of the most common installation errors we have observed and provides troubleshooting guidance.

This guide is not intended for end users; end users should visit an automotive service center for assistance. This guide is designed to assist installers and technicians in identifying whether a problem is related to the alternator and its related hardware, the regulator, wiring, or the lithium battery system configuration.

The steps outlined here provide a structured approach to isolating faults and verifying proper operation before replacing components. Please remember that any specifications provided with your alternator kit, as well as any directions provided by the manufacturer, should be followed whenever they are available.

Finally, this document does not offer safety guidance. Please identify and follow all appropriate safety precautions. Perform these tests with caution, especially when working with a running engine and electrical systems.

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Contact Us

Still experiencing problems? Log a product support ticket on our website: www.americanpowerinc.com/contact-us/get-support. Please include your APS part and serial numbers, as well as vehicle and engine type, so that we may serve you better.

General Alternator Installation Tips

Prior to initiating tests, follow the installation tips below:

Hardware

Alternators should be installed with OE hardware or hardware provided with a kit. In absence of provided hardware, use grade 10.9 metric, or grade 8 SAE bolts.

Proper pulley and belt alignment

- Proper alignment of pulleys is critical. Pulley misalignment can damage an alternator and void the warranty. To verify the alignment of pulleys, use a laser alignment tool.
- Verify belt alignment. Sight down the side of the belt to make sure the edge does not bend. Any deviation you can see with the eye is too much and indicates a problem. Try to move the pulleys back and forth to ensure tight mounting. Pulley should move only minimally along its axis (more than minimal movement will cause belt misalignment). Finally, move all idlers back and forth to check for free rock.

Wire Connections

In general, alternator current directly corresponds with the necessary gauge for its ground and battery positive wires. (Higher current = larger gauge wire)

- Due to high current draw, all system components including the alternator must have both positive and negative connections with appropriately gauged wire.
- When installing wires and cable lugs or terminals, remember that positive and field (if equipped) posts are designed to conduct current and have limited mechanical strength. It is imperative to ensure no pull or side load on the post from the connected wire. Wires must be supported close to the alternator.
- Positive and ground cables should be run directly from the battery to the alternator. A flexible cable may be necessary near the alternator due to engine movement. Ensure there is a properly fused cable on the alternator appropriate for alternator rating.

Operational Observation

- Run the vehicle's engine to achieve normal operating temperature and load the alternator.
- Turn on the air conditioner and turn the steering wheel to activate the power steering pump.
- Test drive the vehicle to ensure proper function of all systems.
- Remember to have the belt and drive system inspected at every oil change and service interval.

Belt tension check

- Check belt tension using a gauge and verify belt length. A too-loose or too-tight belt can cause alternator damage, among other problems.
- Visually observe the belt with the engine running. If you see belt deflection, there's a problem. First check to see if the tensioner has an indicator mark that shows the belt's range of travel. If the mark is not within normal limits, then either the tensioner is weak or sticking, or the belt length is incorrect. Another issue that can cause flutter is a bad alternator decoupler pulley (if applicable).

Belt check for cracks and glazing

- Inspect the belt along the longest run and around an idler pulley that contacts the smooth side of the belt. The ribs of the belt are elongated in this position and any rib cracks are magnified.
- If rib cracks are detected, remove the belt for further inspection. Check the edges of the belt for wear and fraying. Wear on the edges can indicate a misalignment of the pulleys.
- Belts should not be shiny or glazed on the ribbed side.

Belt removal for better inspection

- Remove the belt to inspect the tensioner, pulley and other components more closely.
- Rotate the tensioner pulley by hand and feel for bearing roughness. A rough bearing indicates the potential for immediate failure and that the tensioner should be replaced.
- While rotating the pulley, look for (and remove) an accumulation of any foreign material on its surface.
- With the proper tool, move the tensioner arm as if you were installing a new belt; move the arm through the full range of available travel. By feel, you can detect if there is roughness or sticking of the tensioner arm during this movement. Replace the tensioner if sticking is detected.
- Attempt to move the tensioner arm toward and away from the engine. If looseness is detected, the bushings in the tensioner have worn excessively and the tensioner should be replaced.

Troubleshooting Checklist: 12V OEM Replacement Alternators

Please review and complete the following steps to test your 12-volt OEM replacement alternator.
Battery should be charged to capacity before any testing proceeds.

- **Step 1**: In the engine compartment, locate the primary battery positive (+) and negative (-) posts. Ensure that upgraded cables were added to the OEM cables. They should be soldered and sufficiently tightened.
- **Step 2**: Locate the alternator positive (+) post. Be sure the output post nut is tight.
- **Step 3**: Ensure that there is a heavy ground wire from the alternator mount to where the battery is grounded on the vehicle. If there is no such wire, install one using a 1/0 cable and be sure the output from the alternator to the battery is also a 1/0 cable. Other tips for ensuring proper ground:
    - Do not ground the alternator to the engine. This is not sufficient.
    - (Not applicable if added ground wire): Ensure there is no paint on the alternator mounting bracket (only applies to aftermarket bracket kits). Thick paint on the mounting bracket can cause an insufficient connection to ground the alternator.
- **Step 4:** Loosen the alternator belt and turn the pulley. Confirm that pulley is not in contact with or rubbing the alternator frame. If the pulley is rubbing the frame, please contact us directly for assistance.
- **Step 5:** Ensure that control wire plug is fully inserted into back of the alternator. These plugs are hard to insert.

Testing with Your Multimeter (VOM)
Next, perform the tests below with your VOM in sequential order and record results.
Test terminal - battery positive to negative

Test Condition	**Test 1** Ignition off Engine off	**Test 2** Ignition on Engine off	**Test 3** Engine on - standard idle No electrical loads	**Test 4** Engine on - high idle No electrical loads
Expected Voltage (+/- 2V)	12.6	12.6	13.8-14.9	13.8-14.9
Observed Voltage				
Actions	If fewer volts, replace or charge battery.	If fewer volts, replace or charge battery.	If voltage is in range, unit is OK.	If voltage is in range, unit is OK. Possible OE plug problem.
	If more volts, go to Test 2.	If more volts, go to Test 3.	If fewer volts, go to Test 4.	If voltage is below range, alternator has no output. Repeat steps 1-5 above.

Troubleshooting Checklist: Alternator Regulator (Externally Regulated)

Prior to troubleshooting your regulator, be sure the battery SOC is below 85 percent.

Check the following items FIRST:

- ALT+ Fuse: Ensure the 15A fuse on the ALT+ (Red) harness wire is installed. The APS/WS500 will usually report a fault if this fuse is missing. However, a blown fuse will also prevent output even with a correct field signal.
- Ground Connections: Double-check all ground connections. Poor grounds can cause many electrical issues. This is crucial even if the APS/WS500 is blinking green.
- Alternator Connections: Verify all connections to the alternator itself (B+, field, and any other connections) are clean, tight, and secure.

LED Status Color

Next, if your alternator is externally regulated (APS/WS500), check the LED status color (red/amber/green).

- Red = indicates error(s); look for error code number. Refer to the Device Error Code Reference Guide and follow the troubleshooting tips associated with the error code.
- Amber = connected via CAN; can still give blink code
- Green = will show upon initial start-up or with non-CAN communication applications

If you see green or amber, check your advisory codes to see what mode you are in (bulk charge, acceptance, float, overcharge, standby). Observe the flashing pattern of the WS500 during engine warm-up. A transition to a faster flash indicates active charging (if the system is functioning correctly). You should see alternator output.

If you have no perceived alternator output, continue:

With the engine running, observe the voltage on the Blue Field wire (between the regulator and the alternator). If the regulator is working, there should be voltage and current.

If there is no alternator output, connect to regulator (via Bluetooth or USB cable). Refer to instructions in the Communications and Programming Guide.

Some common reasons why there is no alternator output:

- Battery is fully charged to manufacturer's recommendation; regulator is OK.
- Configuration settings are within parameters (e.g., feature-in requirement like Victron Lynx BMS). If yes, regulator is OK.
- BMS not requesting a charge. Could be an issue elsewhere.
- Regulator/alternator/battery is over or under temperature (too hot or cold).

Troubleshooting Checklist: 12/24/48V Alternators with External Reg

Please review and complete the following steps. Battery should be charged to capacity before any testing proceeds.

- **Step 1**: Locate the primary battery positive (+) and negative (-) posts. Be sure all the clamps are marine- or milspec-grade. They should be soldered and sufficiently tightened.
- **Step 2**: Locate the alternator positive (+) post. Be sure the output post nut is tight.
- **Step 3**: Ensure that there is a heavy ground wire from the alternator mount to where the battery is grounded on the vehicle. If there is no such wire, install one using a 1/0 cable and be sure the output from the alternator to the battery is also a 1/0 cable.
    - Do not ground the alternator to the engine. This is not sufficient.
- **Step 4**: Loosen the alternator belt and turn the pulley. Confirm that pulley is not in contact with or rubbing the alternator frame. If the pulley is rubbing the frame, please contact us directly for assistance.
- **Step 5**: Ensure that control wire plug is fully inserted into back of the alternator. These plugs are hard to insert.

Testing with Your Multimeter (VOM):

Next, perform the tests below with your VOM in sequential order and record results.
Test terminal - battery positive to negative

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Repeat steps 1-5 above.</td></tr>
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Lithium Battery Charging System

Lithium iron phosphate ($LiFePO_4$) batteries—especially "smart" batteries with built-in BMS—behave *nothing* like lead-acid when it comes to voltage. If you try to diagnose charging performance using old-school voltage expectations, you'll get misleading results.

Key Differences of Lithium Battery Charging System

- Voltage does NOT indicate SOC. A lithium battery at 30% SOC can show the same voltage as one at 90%.
- Lithium accepts very high current when low, which can overload alternators.
- Smart BMS can disconnect suddenly, causing alternator voltage spikes.
- Alternators don't naturally taper current into lithium, leading to heat and stress.

If you have found no issues with the regulator and alternator, the issue may lie with your battery system. Contact your battery manufacturer or installer for troubleshooting advice to make sure it is compatible with the regulator.