

General Information

The Delco Remy 21-SI series alternator features a solid-state regulator that is mounted inside the end frame. See [Fig. 1](#). The only moving part in the assembly is the rotor, which is mounted on a ball bearing at the drive end, and a roller bearing at the rectifier end. See [Fig. 2](#).

Since the vehicle's system is negative ground, the output terminal connects to the starter's B (positive) terminal.

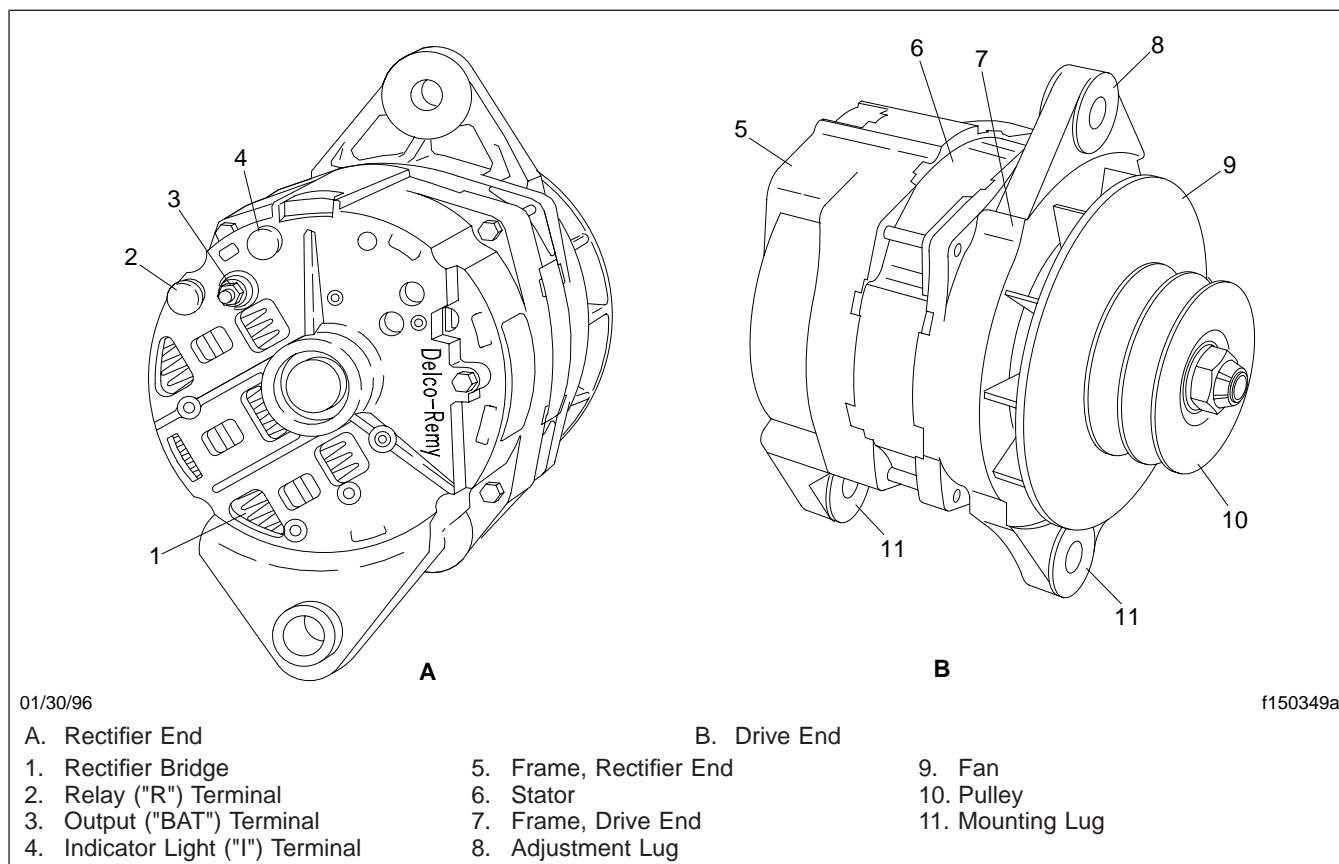


Fig. 1, 21-SI Alternator (exterior view)

All bearings are sealed so that no periodic maintenance is required. The regulator and diodes are enclosed in a sealed compartment. A fan located on the drive end provides air flow for cooling.

As the rotor begins to turn, the permanent magnetism within it induces voltages in the stator windings. The voltages across the diodes cause current to flow, charging the battery.

Normally only one wire connects the alternator to the battery at the starter, along with a ground return.

General Information

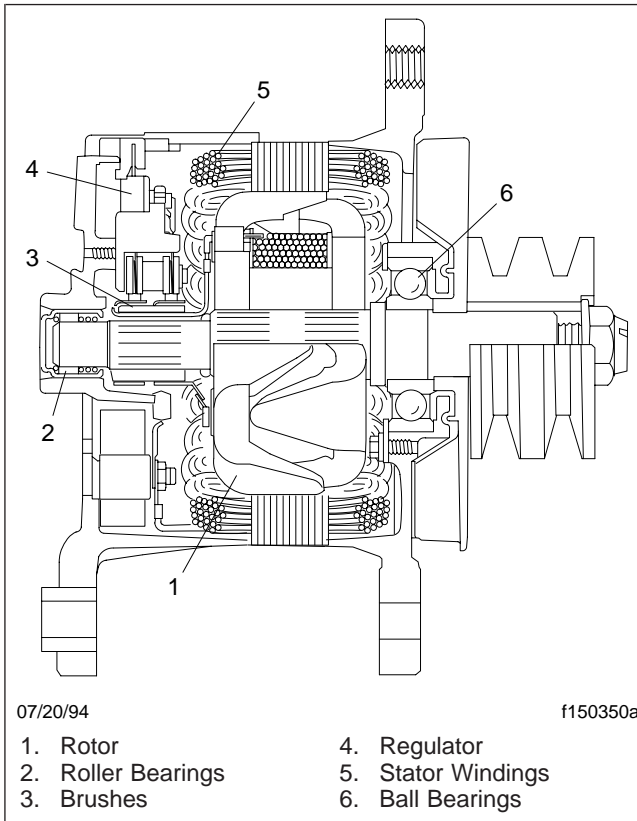


Fig. 2, Delco Remy 21-SI Alternator (cutaway view)

Delco Remy Alternator Removal and Installation, Caterpillar CFE

Removal

1. Disconnect the batteries.
2. Mark all electrical leads and disconnect them from the alternator. See [Fig. 1](#).

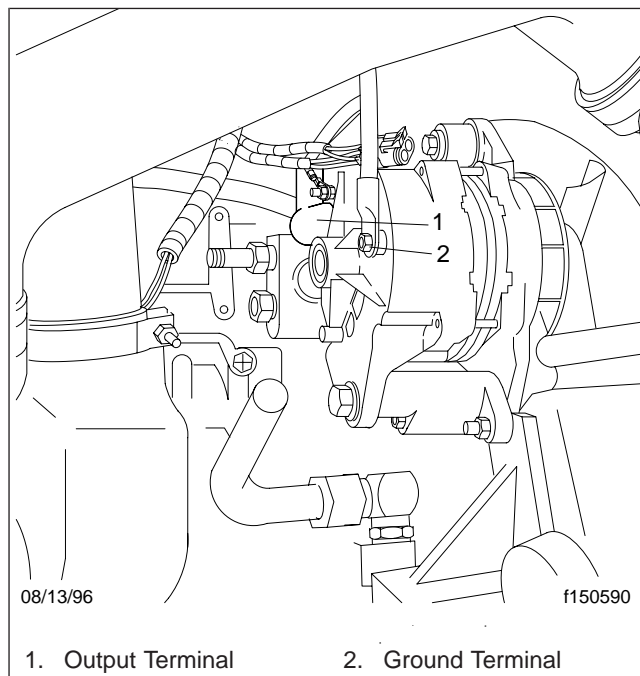
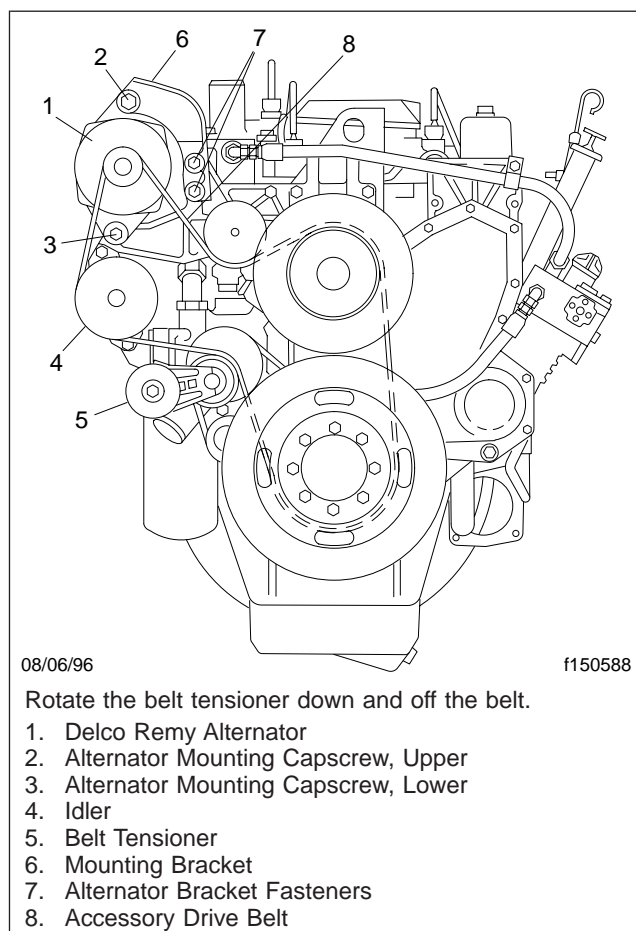


Fig. 1, Electrical Connectors

3. Insert a breaker bar in the belt tensioner and rotate the tensioner down and off the accessory drive belt. See [Fig. 2](#).
4. Holding the belt tensioner down, remove the accessory drive belt from the vehicle.
5. Remove the two alternator mounting capscrews. Remove the alternator from the vehicle.
6. Inspect the drive belt. For instructions, see [Section 01.00, Subject 100](#).

Installation

1. Install the alternator on the engine. Install the top and bottom alternator mounting capscrews, but do not tighten them yet.



Rotate the belt tensioner down and off the belt.

1. Delco Remy Alternator
2. Alternator Mounting Capscrew, Upper
3. Alternator Mounting Capscrew, Lower
4. Idler
5. Belt Tensioner
6. Mounting Bracket
7. Alternator Bracket Fasteners
8. Accessory Drive Belt

Fig. 2, Alternator Installation, Caterpillar CFE Engine

CAUTION

CAUTION: Be sure to route the accessory drive belt correctly. If the belt is not routed as in [Fig. 2](#), the water pump pulley may rotate in the wrong direction, allowing the engine to overheat.

2. Install the drive belt on the pulleys, as removed. If installing a new pulley or a new alternator, tighten the pulley nut 75 lbf-ft (102 N-m).

NOTE: The Caterpillar belt tensioner automatically adjusts the accessory drive belt to the correct tension. If the belt slips, repair or replace the tensioner. For instructions, see the engine manufacturer's service literature.

3. Tighten both alternator mounting capscrews 65 lbf-ft (88 N-m).

**Delco Remy Alternator Removal and Installation,
Caterpillar CFE**

4. Connect all leads to the back of the alternator as removed. Tighten the output terminal nut 100 lbf·in (1140 N·cm). Tighten the ground terminal nut 65 lbf·in (740 N·cm).
5. Spray any exposed terminal connectors with dielectric red enamel. See [Table 1](#).

Protectant Material	Approved Brands
Spray-On Application	MMM 1602 IVI–Spray Sealer, Red Electric Grade; order from the PDC
Brush-On Application	Glyptal 1201EW– Low VOC, Red; order at www.glyptal.com or 1-800-GLP-1201

Table 1, Approved Dielectric Red Enamel

6. Connect the batteries.
7. Before returning the vehicle to operation, test the alternator DC output voltage. For instructions, see "Alternator Voltage Output Test" in [Troubleshooting, 300](#).

Delco Remy Alternator Removal and Installation, Cummins B

Removal

1. Disconnect the batteries.
2. Mark all electrical leads and disconnect them from the alternator. See [Fig. 1](#).

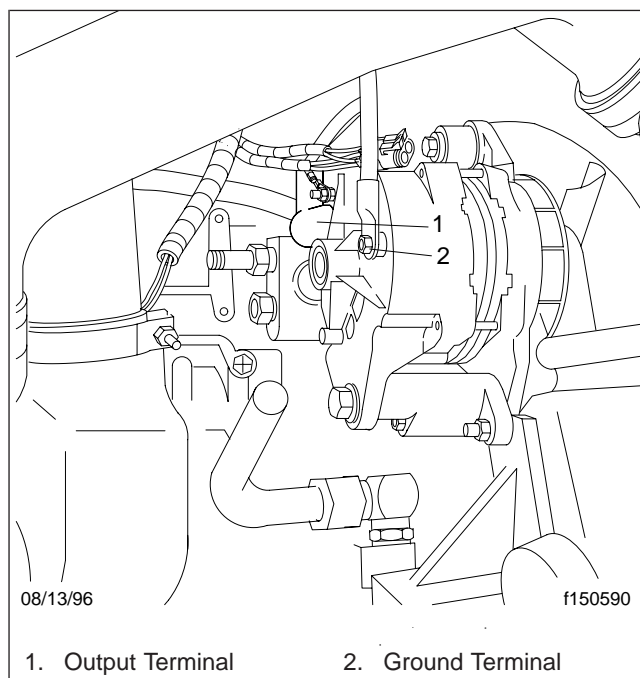


Fig. 1, Electrical Connectors

3. Remove the alternator belt from the alternator pulley. See [Fig. 2](#).
 - 3.1 Insert a breaker bar in the belt tensioner and rotate the tensioner up and off the belt.
 - 3.2 Holding the tensioner up, take the belt off the alternator pulley.
 - 3.3 Slowly release the belt tensioner, and remove the breaker bar. It is not necessary to remove the belt from the vehicle.
4. Remove the alternator. See [Fig. 3](#).
 - 4.1 Remove the alternator mounting capscrew (Ref. 8) from the link (Ref. 7).
 - 4.2 Remove the nut and washer (Refs. 5 and 4) from the pivot capscrew (Ref. 1).

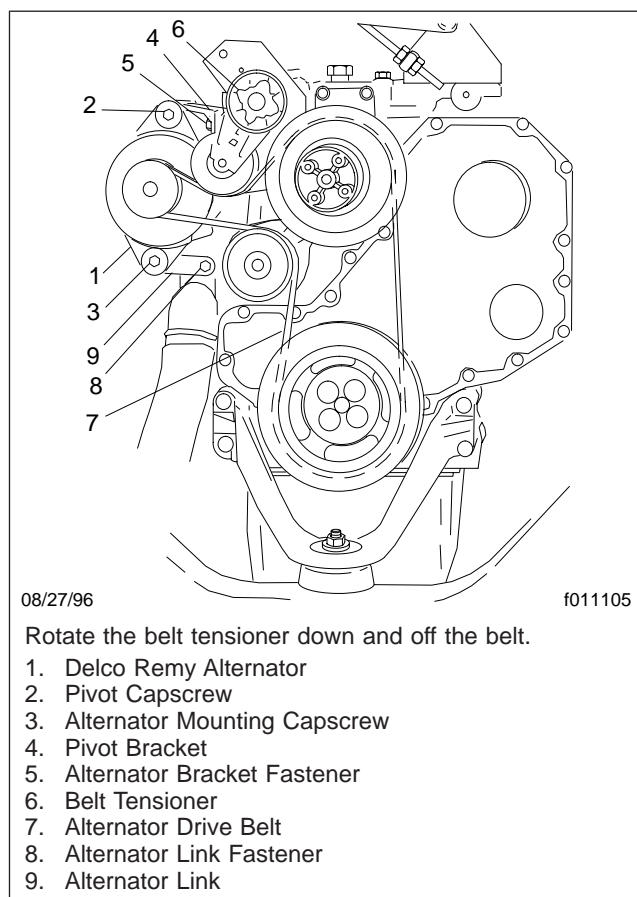


Fig. 2, Alternator Installation, Cummins B Series Engine

- 4.3 Securely hold the alternator to prevent it from falling, and remove the pivot capscrew.
- 4.4 Remove the alternator from the vehicle.
5. Inspect the drive belt. For instructions, see [Section 01.01, Subject 100](#).

Installation

1. Install the alternator on the pivot bracket. See [Fig. 3](#).
 - 1.1 Position the alternator on the bracket.
 - 1.2 Insert the pivot capscrew (Ref. 1) through the alternator and the bracket.

Delco Remy Alternator Removal and Installation, Cummins B

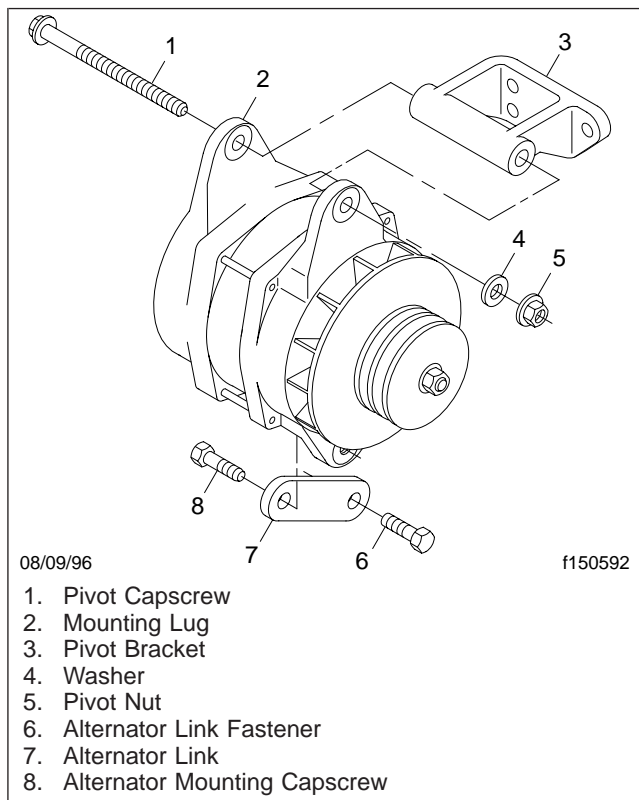


Fig. 3, Mounting Hardware

- 1.3 Install the washer and nut (Refs. 4 and 5) on the end of the pivot capscrew.
2. Install the alternator mounting capscrew, and tighten it 16 lbf·ft (21 N·m). Tighten the pivot nut 40 lbf·ft (54 N·m).
3. Install the drive belt on the pulley as removed. If installing a new pulley or a new alternator, tighten the pulley nut 75 lbf·ft (102 N·m).

NOTE: The Cummins belt tensioner automatically adjusts the drive belt to the correct tension. If the belt slips, repair or replace the tensioner. For instructions, see the engine manufacturer's service literature.

4. Connect all leads to the back of the alternator as removed. Tighten the output terminal nut 100 lbf·in (1140 N·cm). Tighten the ground terminal nut 65 lbf·in (740 N·cm).
5. Spray any exposed terminal connectors with dielectric red enamel. See [Table 1](#).

Protectant Material	Approved Brands
Spray-On Application	MMM 1602 IVI-Spray Sealer, Red Electric Grade; order from the PDC
Brush-On Application	Glyptal 1201EW- Low VOC, Red; order at www.glyptal.com or 1-800-GLP-1201

Table 1, Approved Dielectric Red Enamel

6. Connect the batteries.
7. Before returning the vehicle to operation, test the alternator DC output voltage. For instructions, see "Alternator Voltage Output Test" in [Troubleshooting, 300](#).

Troubleshooting

Many alternators have been replaced that later investigation reveals were working properly. This may be due to incorrectly diagnosing the problem.

IMPORTANT: Before testing, make sure:

- All belts are correctly tightened;
- The wiring and terminals are clean and in good condition;
- All terminal nuts are torqued and properly protected.

Delco Remy has an alternator testing tool called the Intelli-Check Alternator Analyzer. See [Fig. 1](#). This tool (DR 10457848, a single tester, or DR 10457865, a four-pack of testers) is to be used as a quick check of the alternator to see if it is working correctly.

NOTE: If you do not have the Delco Intelli-Check Tester, or if the alternator rated output is above 145 amps, or if a total vehicle charging system analysis is required, see "Alternator/Charging System Testing."

Intelli-Check Alternator Analyzer

The following information includes a pre-test procedure and operating instructions for the Delco Intelli-Check Tester, and is similar to the procedures provided by Delco with the Intelli-Check Tester.

Pre-Test Procedure (Engine Off)

1. Inspect the alternator connections to verify that all terminals are secured and tight. Verify that the sense wire is connected to the sense terminal on vehicles equipped with remote-sense alternators.
2. With the engine off, connect the red alligator clip to the output terminal of the alternator. Connect the black alligator clip to the alternator ground. An optional ground connection is to the body of the alternator. The tester LEDs will illuminate and then go off as it performs a self-test.
3. After 4 seconds the tester will activate. The following LEDs may illuminate depending on the condition of the batteries:
 - **GOOD** (green) LED indicates the battery voltage is above 12.8 and has a surface charge. The surface charge must be re-

moved before proceeding with the alternator test. To remove the surface charge, do the following:

- A. Turn on the headlights and blower motor for 2 minutes without restarting the engine.
- B. Reset the tester by disconnecting, then reconnecting the tester alligator clips. The analyzer will again perform its self-test.
- C. Repeat the applicable steps of the Pre-Test Procedure.

- **NO CHARGE** (red) LED indicates the battery voltage is below 12.8. This LED should illuminate for most tests. Proceed with the alternator test.
- **LOW BATTERY VOLTAGE** (blue) LED indicates the battery voltage is below 12.35. If the batteries will start the vehicle, proceed with the alternator test. However, after completing the Intelli-Check alternator test, perform the procedures under "Alternator/Charging System Testing" to determine the condition of the rest of the charging system.

Tester Operating Instructions (Engine Running)

1. Start the engine using onboard batteries only. If the batteries will not start the engine, they must be charged for 2 hours. Start the test again after charging the batteries.
2. Verify the engine is at idle and all electrical loads are off.
3. Depress the accelerator to governed speed, hold for 10 seconds, then return to idle.
 - If the **GOOD** (green) LED illuminates, proceed to the next step.
 - If any LEDs illuminate indicating over-charge, partial charge or no charge (the three red lights in the **DEFECTIVE** section), replace the alternator and run the complete test again.
 - If the **LOW BATTERY VOLTAGE** (blue) LED illuminates, evaluate the charging

Troubleshooting

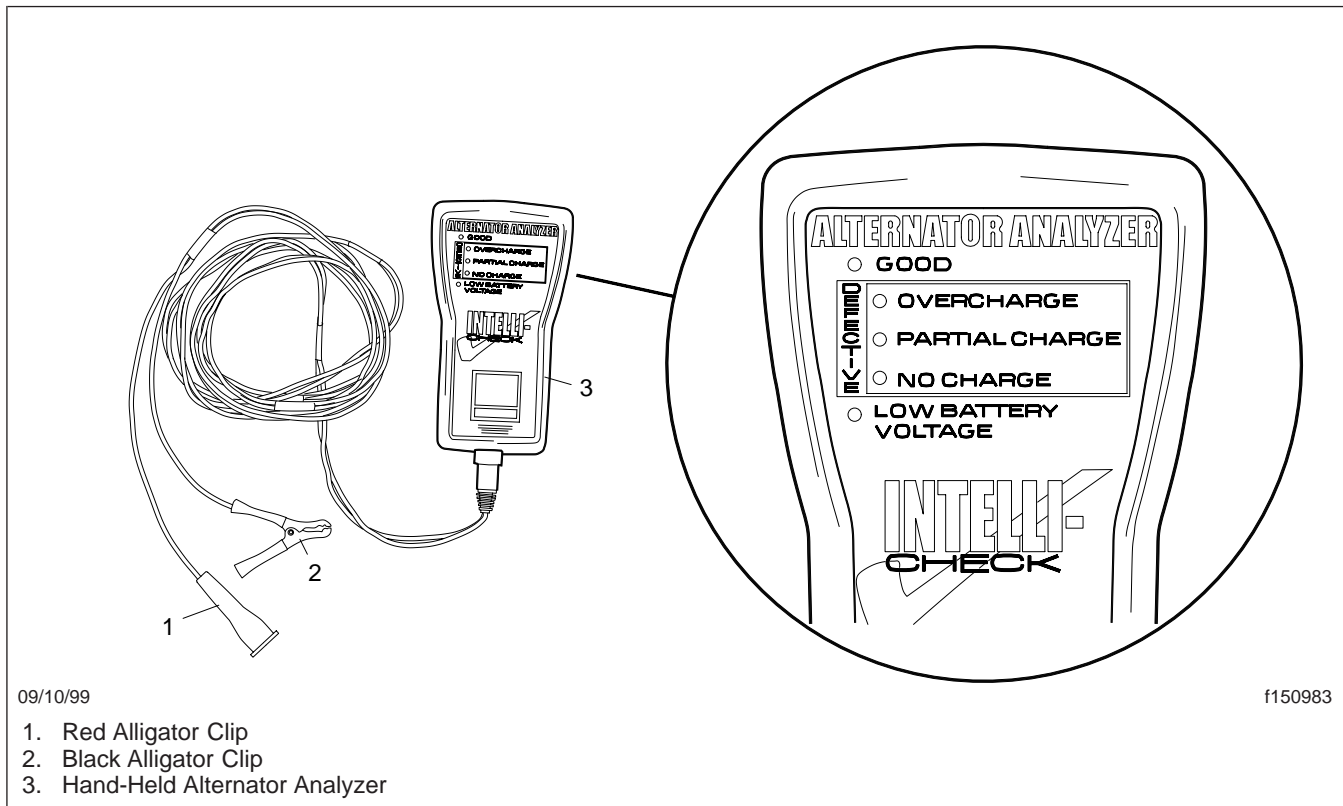


Fig. 1, Delco Remy Intelli-Check Alternator Analyzer

system using the instructions in "Alternator/Charging System Testing."

4. With the engine running, turn on all electrical loads.
5. Depress the accelerator to governed speed, hold for 10 seconds, then return to idle.
6. If the **GOOD** (green) LED illuminates, the alternator is OK and the test is complete.

NOTE: If the alternator tests OK in the above tests, and the customer's complaint is reduced battery or headlight life, see "Alternator/Charging System Testing" to completely analyze the charging system.

7. If any LEDs illuminate indicating overcharge, partial charge or no charge (the three red lights in the **DEFECTIVE** section), replace the alternator and run the complete test again.

8. If the **LOW BATTERY VOLTAGE** (blue) LED illuminates, evaluate the charging system using the instructions in "Alternator/Charging System Testing".

Alternator/Charging System Testing Battery Open Circuit Voltage Test, Alternator Output Voltage Test and Alternator Amperage Output Test

1. Use a digital volt-ohmmeter (VOM) set on the 2-20VDC (or similar) scale to test the battery open circuit voltage (OCV). With the engine shut down and the voltmeter set up as shown in [Fig. 2](#), check for voltage of 12.4 volts or more.

If the OCV is 12.4 volts or more, turn on the vehicle headlights for approximately 3 minutes.

If the OCV is less than 12.4 volts, charge the batteries properly. For instructions, see [Group 54](#).

IMPORTANT: Be sure to disconnect the batteries or remove them from the vehicle before charging.

2. Check the alternator output without a load. See **Fig. 3**.

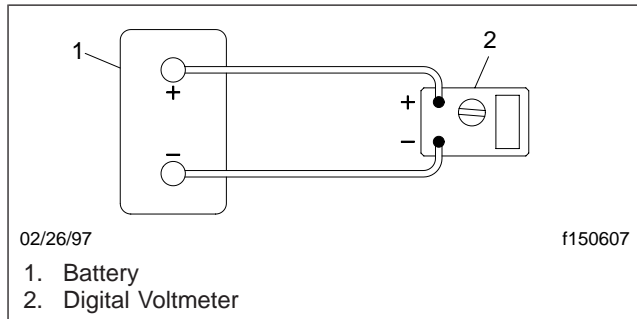


Fig. 2, Setup 1: Battery Open Circuit Voltage (and alternator amperage output)

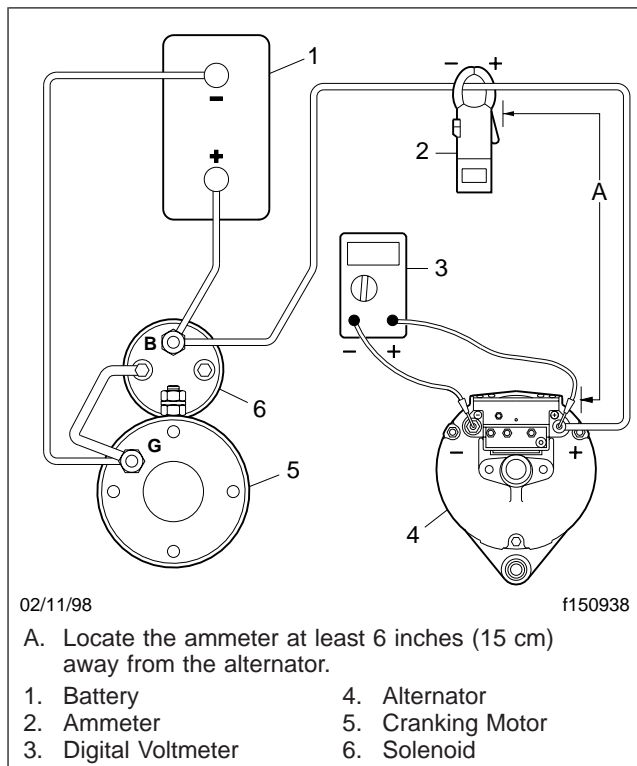


Fig. 3, Setup 2: Alternator Output Test

- 2.1 Start the engine and run it at 1500 rpm for 3 to 5 minutes to stabilize the system before proceeding to the next step.

- 2.2 Connect the positive (+) lead of the digital voltmeter (still set on the 2-20VDC or similar scale) to the alternator (battery) terminal. Connect the negative (-) lead of the voltmeter to the alternator negative (-) ground terminal. See **Fig. 3**.

- 2.3 If the voltmeter reads from 13.8 to 14.2 volts, record this reading (V1) and go to the next step. If the alternator reads less than 13.8 volts and is adjustable, try to adjust the voltage regulator to 13.8 to 14.2 volts. If unable to obtain acceptable output, replace the alternator.

3. Check the alternator output under load. See **Fig. 3**.

- 3.1 Attach a clamp-on induction ammeter around the positive (+) wire. See **Fig. 3**.

NOTE: Locate the ammeter at least 6 inches (15 cm) away from the alternator.

- 3.2 With the engine still running at 1500 rpm, turn on the following electrical accessories to load the alternator until the ammeter reads 60 to 75 amps.

- Both front and rear heater blowers (on HIGH)
- Headlights (high beams)
- Road lights
- Interior lights

NOTE: As an alternate method of putting load on the alternator, connect a carbon pile tester and set it to 60 to 75 amps.

- 3.3 Keep the voltmeter connected as in the previous step; positive (+) lead connected to the alternator positive (+) terminal; negative (-) lead connected to the alternator negative (-) terminal.

- 3.4 If the voltmeter reads from 13.6 to 14.2 volts, record this reading (V2) and go to the next step.

If the voltmeter reads less than 13.6 volts, replace the alternator.

4. Perform an alternator amperage output test.

- 4.1 Connect a carbon pile tester across the vehicle batteries as shown in **Fig. 2**.

Troubleshooting

NOTE: **Figure 2** shows a voltmeter, but the connections for the carbon pile tester are the same.

- 4.2 Attach a clamp-on induction ammeter around the alternator output wire. See **Fig. 3**.

NOTE: Locate the ammeter at least 6 inches (15 cm) away from the alternator.

- 4.3 Start the engine and make sure all vehicle electrical accessories are turned off. Run it at fast speed and adjust the tester to the alternator maximum current output. Record this output value.

NOTE: Ensure that the alternator is turning at maximum available rpms and keep adjusting the tester dial until the ammeter reads its highest value.

- 4.4 Turn off the tester and shut down the engine.

- 4.5 If the output value recorded is less than 85 percent of the rated amperage output, repeat the test. If the output value recorded is still less than 85 percent of the rated amperage output, replace the alternator.

- 4.6 Make sure that all test instruments are removed and that the vehicle wiring is returned to its operational state.

5. To identify other problem areas within the vehicle, check the operation of the charging system. Set up the voltmeter as shown in **Fig. 2** and **Fig. 3**.

NOTE: For any load at 1500 rpm or more, battery voltage must be within 0.5 volts of the alternator voltage.

- 5.1 If readings at the batteries are within 0.5 volts of the readings at the alternator, the charging system is working correctly. Check other areas of the vehicle to locate the problem.

- 5.2 If the reading at the batteries is more than 0.5 volts lower than the reading at the alternator, do the next step.

6. Check charging system connections, cables and terminals.

- 6.1 Check all connections between the battery, starter and alternator for tightness and signs of corrosion. Tighten and clean as necessary.
- 6.2 Check all cables for breaks or partial breaks. Repair or replace as necessary.
- 6.3 Check each ring terminal for breakage at the point where it attaches to its wire or cable.

See **Fig. 1** for a charging circuit wiring diagram.

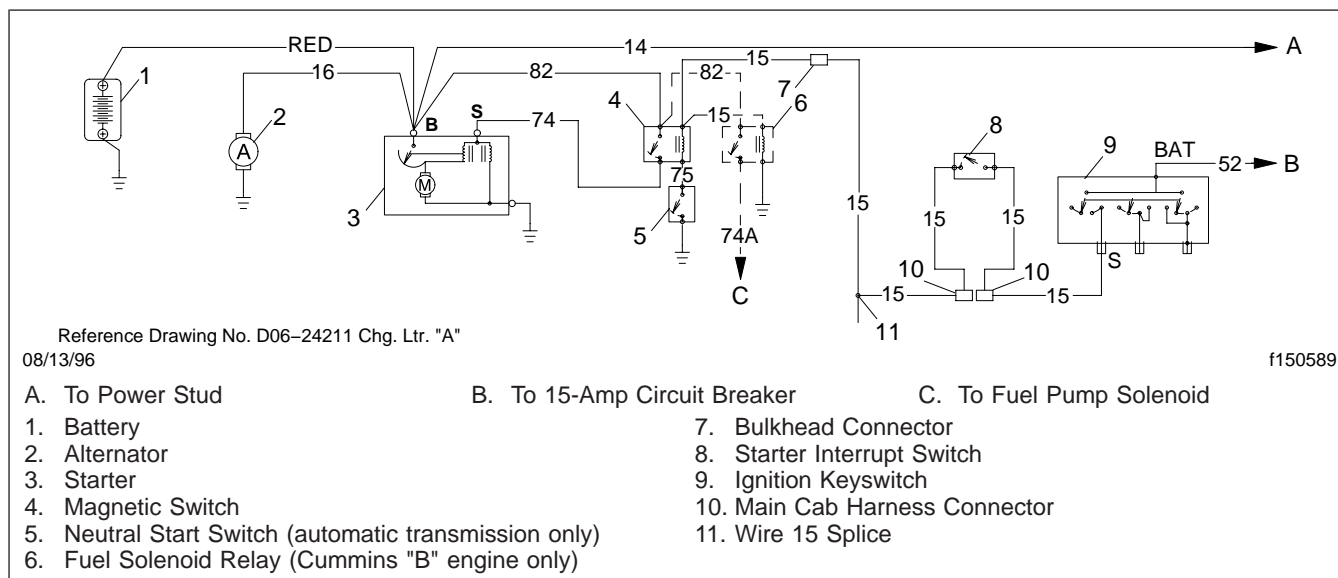


Fig. 1, Charging Circuit Wiring Diagram

Mounting Fastener Torques, Caterpillar Engines			
Description	Grade	Size	Torque: lbf·ft (N·m)
<i>Caterpillar CFE Engine</i>			
Alternator Mounting Capscrews	8PO	1/2-13	65 (88)
Alternator Bracket Capscrews	10.9PO	M12	65 (88)

Table 1, Mounting Fastener Torques, Caterpillar Engines

Mounting Fastener Torques, Cummins Engines			
Description	Grade	Size	Torque: lbf·ft (N·m)
<i>Cummins B Series Engine</i>			
Alternator Mounting Capscrew	10.9PO	M8 x 1.25	16 (21)
Pivot Nut	10.9PO	M10 x 1.5	40 (54)

Table 2, Mounting Fastener Torques, Cummins Engines

Description	Grade	Size	Torque: lbf·in (N·cm)
Alternator Output ("BAT") Terminal Nut	5	5/16-18	100 (1140)
Alternator Ground ("G") Terminal Nut	5	1/4-20	65 (740)

Table 3, Terminal Fastener Torques, All Engines

Specifications

Description	Grade	Size	Torque: lbf·ft (N·m)
Pulley Nut	8PO	1/2–20	75 (102)

Table 4, Pulley Nut Torque, All Engines