CHARGING SYSTEM

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DESCRIPTION AND OPERATION

CHARGING SYSTEM

DESCRIPTION

The charging system consists of:

- Generator
- Electronic Voltage Regulator (EVR) circuitry within the Powertrain Control Module (PCM)
- Ignition switch (refer to Ignition System for information)
- Battery (refer to Battery for information)
- Battery temperature sensor
- Check Gauges Lamp (if equipped)
- Voltmeter (refer to Instrument Panel and Gauges for information)
- Wiring harness and connections (refer to Wiring for information)

OPERATION

The charging system is turned on and off with the ignition switch. The system is on when the engine is running and the ASD relay is energized. When the ASD relay is on, voltage is supplied to the ASD relay sense circuit at the PCM. This voltage is connected through the PCM and supplied to one of the generator field terminals (Gen. Source +) at the back of the generator.

The amount of direct current produced by the generator is controlled by the EVR (field control) circuitry contained within the PCM. This circuitry is connected in series with the second rotor field terminal and ground.

A battery temperature sensor, located in the battery tray housing, is used to sense battery temperature. This temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. This is done by cycling the ground path to control the strength of the rotor magnetic field. The PCM then compensates and regulates generator current output accordingly.

All vehicles are equipped with On-Board Diagnostics (OBD). All OBD-sensed systems, including EVR (field control) circuitry, are monitored by the PCM. Each monitored circuit is assigned a Diagnostic Trouble Code (DTC). The PCM will store a DTC in electronic memory for certain failures it detects. Refer to On-Board Diagnostics in Emission Control System for more DTC information.

The Check Gauges Lamp (if equipped) monitors: **charging system voltage,** engine coolant temperature and engine oil pressure. If an extreme condition is indicated, the lamp will be illuminated. This is done as a reminder to check the three gauges. The signal to activate the lamp is sent via the multiplexed bus circuits. The lamp is located on the instrument panel. Refer to Instrument Panel and Gauges for additional information.

GENERATOR

DESCRIPTION

The generator is belt-driven by the engine using a serpentine type drive belt. It is serviced only as a complete assembly. If the generator fails for any reason, the entire assembly must be replaced.

OPERATION

As the energized rotor begins to rotate within the generator, the spinning magnetic field induces a current into the windings of the stator coil. Once the generator begins producing sufficient current, it also provides the current needed to energize the rotor.

DESCRIPTION AND OPERATION (Continued)

The Y type stator winding connections deliver the induced alternating current to 3 positive and 3 negative diodes for rectification. From the diodes, rectified direct current is delivered to the vehicle electrical system through the generator battery terminal.

Although the generators appear the same externally, different generators with different output ratings are used on this vehicle. Be certain that the replacement generator has the same output rating and part number as the original unit. Refer to Generator Ratings in the Specifications section at the back of this group for amperage ratings and part numbers.

Noise emitting from the generator may be caused by: worn, loose or defective bearings; a loose or defective drive pulley; incorrect, worn, damaged or misadjusted fan drive belt; loose mounting bolts; a misaligned drive pulley or a defective stator or diode.

BATTERY TEMPERATURE SENSOR

DESCRIPTION

The Battery Temperature Sensor (BTS) is attached to the battery tray located under the battery.

OPERATION

The BTS is used to determine the battery temperature and control battery charging rate. This temperature data, along with data from monitored line voltage, is used by the PCM to vary the battery charging rate. System voltage will be higher at colder temperatures and is gradually reduced at warmer temperatures.

The PCM sends 5 volts to the sensor and is grounded through the sensor return line. As temperature increases, resistance in the sensor decreases and the detection voltage at the PCM increases.

The BTS is also used for OBD II diagnostics. Certain faults and OBD II monitors are either enabled or disabled, depending upon BTS input (for example, disable purge and enable Leak Detection Pump (LDP) and O2 sensor heater tests). Most OBD II monitors are disabled below 20°F.

ELECTRONIC VOLTAGE REGULATOR

DESCRIPTION

The Electronic Voltage Regulator (EVR) is not a separate component. It is actually a voltage regulating circuit located within the Powertrain Control Module (PCM). The EVR is not serviced separately. If replacement is necessary, the PCM must be replaced.

OPERATION

The amount of direct current produced by the generator is controlled by EVR circuitry contained within the PCM. This circuitry is connected in series with the generators second rotor field terminal and its ground.

Voltage is regulated by cycling the ground path to control the strength of the rotor magnetic field. The EVR circuitry monitors system line voltage (B+) and battery temperature (refer to Battery Temperature Sensor for more information). It then determines a target charging voltage. If sensed battery voltage is 0.5 volts or lower than the target voltage, the PCM grounds the field winding until sensed battery voltage is 0.5 volts above target voltage. A circuit in the PCM cycles the ground side of the generator field up to 100 times per second (100Hz), but has the capability to ground the field control wire 100% of the time (full field) to achieve the target voltage. If the charging rate cannot be monitored (limp-in), a duty cycle of 25% is used by the PCM in order to have some generator output. Also refer to Charging System Operation for additional information.

DIAGNOSIS AND TESTING

CHARGING SYSTEM

The following procedures may be used to diagnose the charging system if:

- the check gauges indicator lamp (if equipped) is illuminated with the engine running
- the voltmeter (if equipped) does not register properly
- an undercharged or overcharged battery condition occurs.

Remember that an undercharged battery is often caused by:

- accessories being left on with the engine not running
- a faulty or improperly adjusted switch that allows a lamp to stay on. See Ignition-Off Draw Test in Group 8A, Battery for more information.

INSPECTION

To perform a complete test of the charging system, refer to the appropriate Powertrain Diagnostic Procedures service manual and the DRB scan tool. Perform the following inspections before attaching the scan tool.

(1) Inspect the battery condition. Refer to Group 8A, Battery for procedures.

(2) Inspect condition of battery cable terminals, battery posts, connections at engine block, starter solenoid and relay. They should be clean and tight. Repair as required.

DIAGNOSIS AND TESTING (Continued)

(3) Inspect all fuses in both the fuseblock and Power Distribution Center (PDC) for tightness in receptacles. They should be properly installed and tight. Repair or replace as required.

(4) Inspect generator mounting bolts for tightness. Replace or tighten bolts if required. Refer to the Generator Removal/Installation section of this group for torque specifications.

(5) Inspect generator drive belt condition and tension. Tighten or replace belt as required. Refer to Belt Tension Specifications in Group 7, Cooling System.

(6) Inspect automatic belt tensioner (if equipped). Refer to Group 7, Cooling System for information.

(7) Inspect generator electrical connections at generator field, battery output, and ground terminal (if equipped). Also check generator ground wire connection at engine (if equipped). They should all be clean and tight. Repair as required.

ON-BOARD DIAGNOSTIC TEST FOR CHARGING SYSTEM

The Powertrain Control Module (PCM) monitors critical input and output circuits of the charging system, making sure they are operational. A Diagnostic Trouble Code (DTC) is assigned to each input and output circuit monitored by the On-Board Diagnostic (OBD) system. Some circuits are checked continuously and some are checked only under certain conditions.

For DTC information, refer to Diagnostic Trouble Codes in Group 25, Emission Control System. This will include a complete list of DTC's including DTC's for the charging system.

REMOVAL AND INSTALLATION

GENERATOR

REMOVAL

WARNING: DISCONNECT NEGATIVE CABLE FROM BATTERY BEFORE REMOVING BATTERY OUTPUT WIRE (B+ WIRE) FROM GENERATOR. FAILURE TO DO SO CAN RESULT IN INJURY OR DAMAGE TO ELECTRICAL SYSTEM.

(1) Disconnect negative battery cable at battery.

(2) Remove generator drive belt. Refer to Cooling System for procedure.

(3) Unsnap cable protector cover from B+ mounting stud (Fig. 1).

(4) Disconnect (unsnap) 2–wire field connector at rear of generator (Fig. 1).

(5) Remove generator mounting bolts (Fig. 2) or (Fig. 3).

(6) Remove generator from vehicle.

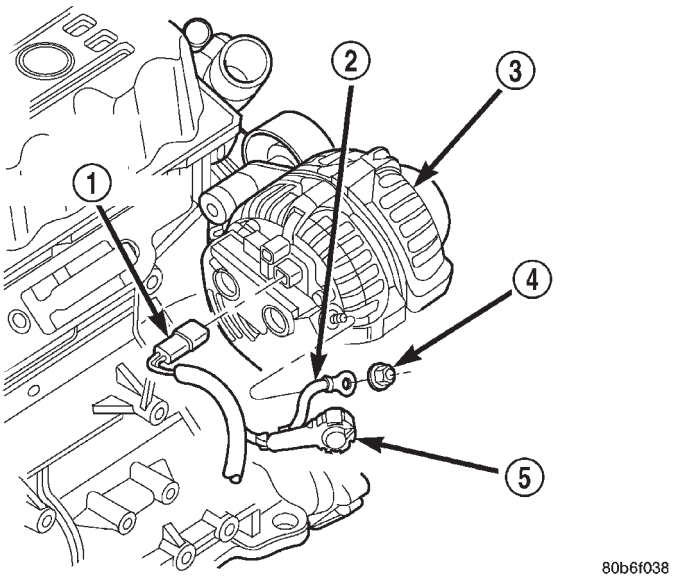


Fig. 1 Generator B+ Cable and Field Wire Connections (Typical—4.0L Engine Shown)

1 – FIELD WIRE CONNECTOR
2 – B+ CABLE
3 – GENERATOR
4 – B+ CABLE MOUNTING NUT
5 – CABLE PROTECTOR

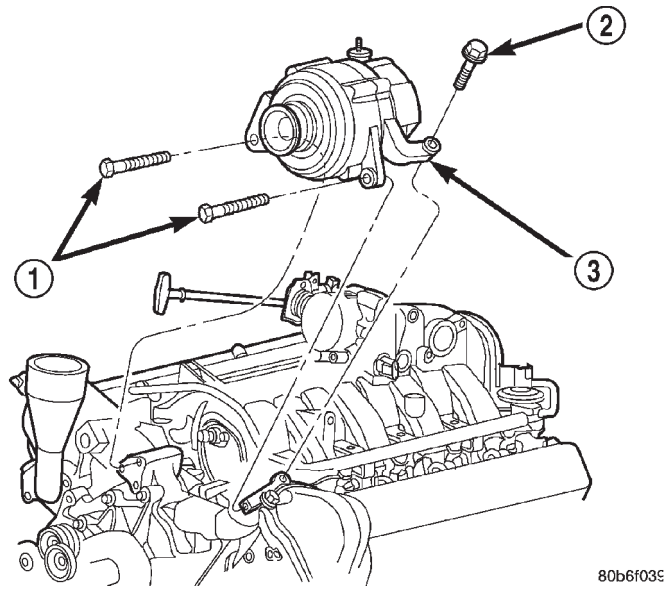


Fig. 2 Remove/Install Generator—4.7L V-8 Engine

1 – LOWER BOLTS
2 – REAR BOLT
3 – GENERATOR

INSTALLATION

(1) Position generator to engine and install mounting bolts.

(2) Tighten generator mounting bolts as follows:

• Vertical mounting bolt 4.7L engine—55 N·m (40 ft. lbs.)

REMOVAL AND INSTALLATION (Continued)

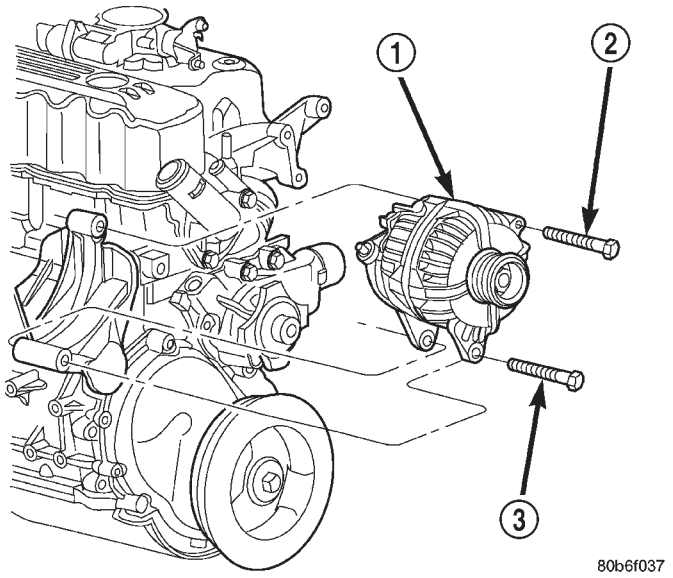


Fig. 3 Remove/Install Generator—4.0L 6–Cylinder Engine

1 – GENERATOR
2 – UPPER BOLT
3 – LOWER BOLT

- Long horizontal mounting bolt 4.7L engine—55 N·m (40 ft. lbs.)
- Short horizontal mounting bolt 4.7L engine—74 N·m (55 ft. lbs.)
- Generator mounting bolts 4.0L engine—56 N·m (41 ft. lbs.)
- B+ terminal nut—11 N·m (95 in. lbs.)

(3) Snap 2–wire field connector into rear of generator.

(4) Snap cable protector cover to B+ mounting stud.

CAUTION: Never force a belt over a pulley rim using a screwdriver. The synthetic fiber of the belt can be damaged.

CAUTION: When installing a serpentine accessory drive belt, the belt MUST be routed correctly. The water pump will be rotating in the wrong direction if the belt is installed incorrectly, causing the engine to overheat. Refer to belt routing label in engine compartment, or refer to Belt Schematics in Group 7, Cooling System.

(5) Install generator drive belt. Refer to Cooling System for procedure.

(6) Install negative battery cable to battery.

BATTERY TEMPERATURE SENSOR

The battery temperature sensor is located under the vehicle battery (Fig. 4) and is attached to a mounting hole on the battery tray.

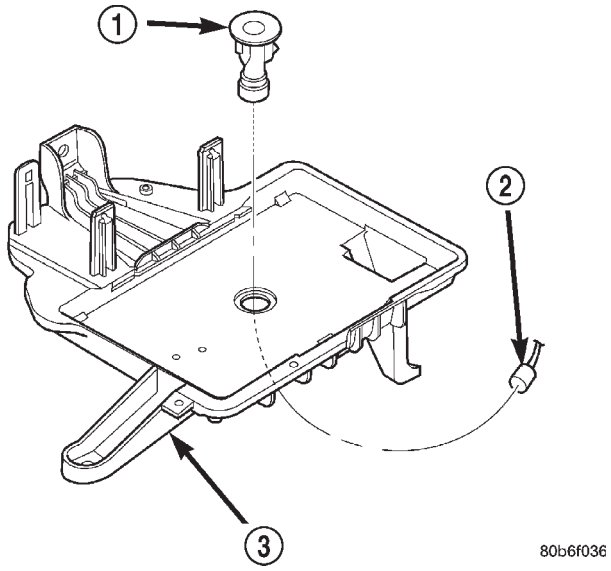


Fig. 4 Battery Temperature Sensor Location

1 – BATTERY TEMPERATURE SENSOR
2 – ENGINE WIRE HARNESS
3 – BATTERY TRAY

REMOVAL

(1) Remove battery. Refer to Group 8A, Battery for procedures.

(2) Remove battery tray.

(3) Pull sensor up from battery tray and disconnect engine wire harness.

(4) Remove sensor from battery tray.

INSTALLATION

(1) Position sensor into mounting hole and attach wiring harness.

(2) Press sensor into top of battery tray.

(3) Install battery. Refer to Group 8A, Battery for procedures.

SPECIFICATIONS

GENERATOR RATINGS

TYPE	PART NUMBER	RATED SAE AMPS	ENGINES	MINIMUM TEST AMPS
BOSCH	56041322	136	4.0L 6-Cylinder	100
DENSO	56041324	136	4.7L V-8	100

TORQUE CHART

Description	Torque
Generator Mounting Bolts—	
4.0L 6–Cylinder Engine	56 N·m (41 ft. lbs.)
Generator Vertical Mounting Bolt—	
4.7L V–8 Engine	55 N·m (40 ft. lbs.)
Generator (long) Horizontal Mounting	
Bolt—4.7L V–8 Engine	55 N·m (40 ft. lbs.)
Generator (short) Horizontal Mounting	
Bolt—4.7L V–8 Engine	74 N·m (55 ft. lbs.)
Generator B+ Terminal Nut	11 N·m (95 in. lbs.)