

SECTION 7 GLOW PLUG SYSTEM

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GENERAL DESCRIPTION

In the diesel engine, air alone is compressed in the cylinder; then, after the air has been compressed, a charge of fuel is sprayed into the cylinder and ignition occurs, due to the heat of compression. Eight glow plugs are used to preheat the chamber as an aid to starting (Figure 7-1).

Control of the glow plugs has been accomplished by moving the logic for controlling the heat of the plugs to the PCM. The new logic can incorporate the higher accuracy of digital processing compared to the previous analog controller. Additionally, logic involving engine speed and estimates of engine combustion can be added to the traditional time and temperature data used in the previous controller. This capability yields more optimum heat times for the glow plugs, thus pre-glow times can be kept to a minimum for short wait to crank times and maximum glow plug durability.

GLOW PLUGS

Figure 7-1

These are 6-volt heaters (operated at 12 volts) that turn "ON," when the ignition switch is turned to the run position, prior to starting the engine. They remain pulsing a short time after starting, then are turned "OFF."

A "GLOW PLUGS" lamp, on the instrument panel, provides information on engine starting conditions.

GLOW PLUG RELAY

The glow plug relay (Figure 7-2) is mounted at the rear of the left cylinder head. It is a solid state device which operates the glow plugs.

The PCM uses a B+ signal to control the solid state circuitry of the glow plug relay.

CIRCUIT OPERATION

A normal functioning system operates as follows:

- A. Key "ON," engine not running and at room temperature.
 1. Glow plugs "ON" for 4 to 6 seconds, then "OFF" for about 4.5 seconds.

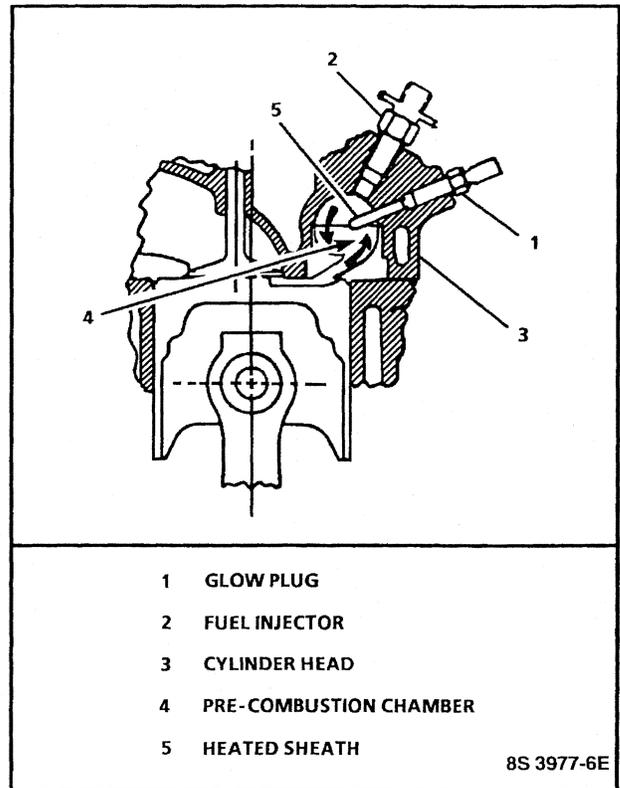


Figure 7-1- Diesel Engine Glow Plug Location

2. Then cycle "ON" for about 1.0 second, "OFF" for about 3.0 seconds, and continue to cycle 1.0 "ON," 3.0 "OFF," for a total duration (including the initial 4 to 6 seconds) of about 16 seconds.
- B. If the engine is cranked during or after the above sequence, its possible the glow plugs will cycle "ON"/"OFF" after the engine control switch is returned from the crank position, whether the engine starts or not. The engine does not have to be running to terminate the glow plug cycling.

7-2 DRIVEABILITY AND EMISSIONS (DIESEL)

All the times shown above are approximate, because they vary with initial engine temperature. The initial "ON" time and cycling "ON"/"OFF" times vary also, with system voltage and/or temperature. Lower temperatures cause longer duration of cycling.

GLOW PLUG AFTER START

The PCM provides glow plug operation after starting a cold engine. This after start operation is initiated when the ignition switch is returned to RUN, from the START position. While loss of this function may not cause a cold start complaint, it may result in excessive white smoking and/or poor idle quality after start.

DIAGNOSIS

GLOW PLUG RELAY

The diagnosis of the glow plug relay is part of the "Control Module System" and starts with the "On-Board Diagnostic System Check." This will determine if the system is operating correctly.

If the glow plug system is not working properly, the "On-Board Diagnostic System Check" will direct diagnosis to a Diagnostic Trouble Code (DTC) tree chart or to another system circuit.

GLOW PLUGS

If the system does not operate as described in "Circuit Operation," perform the "Glow Plug System Check." It provides a fast way to determine if the glow plug system is working properly. Use this procedure, whenever there is doubt about correct system operation.

NOTICE: Do Not manually bypass the glow plug relay. Do Not jump start with more than a 12 volt system. The glow plugs could be damaged.

ON-VEHICLE SERVICE

GLOW PLUG RELAY (NON TURBO)

 **Remove or Disconnect**
Figure 7-2

1. Negative battery cables.
2. Wiring connector to the relay.
3. Relay mounting nuts.
4. Relay from the studs on the engine.

 **Install or Connect**
Figure 7-2

1. Relay to the studs on the engine.
2. Relay mounting nuts.

 **Tighten**

- Nuts to 35 N·m (25 lb. ft.).
3. Wiring connector to the relay.

 **Tighten**

- Wiring harness nuts to 5 N·m (44 lb. in.).
4. Negative battery cables.

GLOW PLUG RELAY (TURBO)

 **Remove or Disconnect**
Figure 7-2

1. Negative battery cables.
2. Upper intake manifold cover.
3. Wiring connector to the relay.
4. Relay mounting nuts.
5. Relay from the studs on the engine.

 **Install or Connect**
Figure 7-2

1. Relay to the studs on the engine.
2. Relay mounting nuts.

 **Tighten**

- Nuts to 35 N·m (25 lb. ft.).
3. Wiring connectors to the relay.

 **Tighten**

- Wiring harness nuts to 5 N·m (44 lb. in.).
4. Upper intake manifold cover.
 5. Negative battery cables.

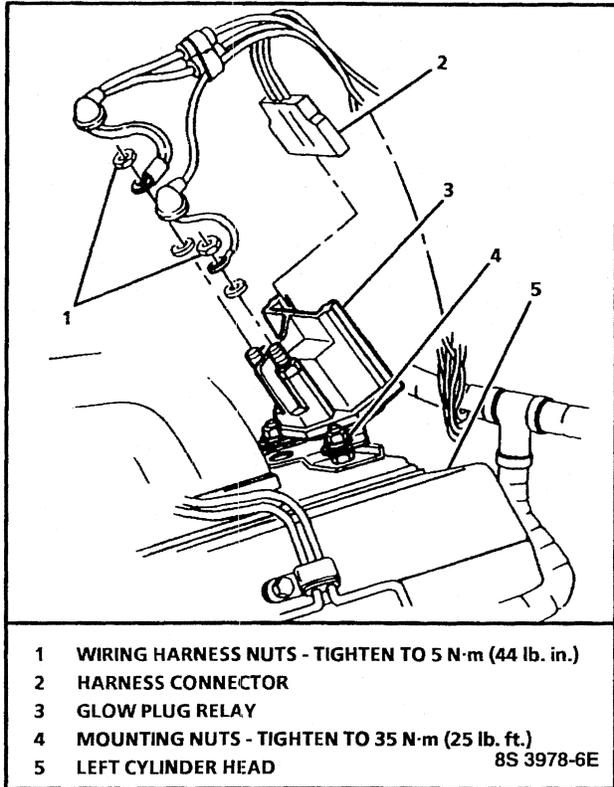


Figure 7-2 - Glow Plug Relay

GLOW PLUGS

Remove or Disconnect

1. Negative battery cable.
- Both Sides, Non Turbo and Left Side, Turbo:**
2. Glow plug lead wires from the glow plugs, using J39083 glow plug connector remover and installer.
 3. Glow plugs from the engine.
 - Use a 3/8-inch deep-well socket to remove the plugs.
- Right Side, Turbo:**
- Raise the vehicle.
4. Right front tire.
 5. Splash shield from the right front wheel well.
 6. Lead wire from the glow plug in the #2 cylinder.
 7. Lead wires for glow plugs in cylinders #4 and #6 at the harness connectors.
 8. Heat shroud for the glow plug in the #4 cylinder.
 9. Heat shroud for the #6 cylinder.
 - Slide the shrouds back far enough to allow access for unplugging the wires at the #4 and #6 glow plugs.
 - Use J 39083 to disconnect the glow plug wires.

10. Glow plugs from cylinders #2, #4, and #6.
11. Lead wire at the glow plug from cylinder #8 by reaching up from underneath the vehicle.
12. Glow plug from cylinder #8.
 - For easier access to cylinders #6 and #8, it may be necessary to remove the exhaust down pipe from turbocharger and muffler inlet pipe.

Install or Connect

Right Side, Turbo:

1. Glow plug into cylinder #8.

Tighten

- Glow plug to 17 N·m (13 lb. ft.).
2. Lead wire to #8 glow plug.
 3. Glow plugs into cylinders #2, #4, and #6.
 - Install the glow plugs by reaching through the right wheel well.

Tighten

- Glow plugs to 17 N·m (13 lb. ft.).
4. Lead wire to glow plug #6.
 - Slide the shroud over the wire lead and fasten to the studs.
 - Repeat Step 4 for the #4 glow plug.

Tighten

- Heat shroud nuts to 23 N·m (17 lb. ft.).
5. Wires for glow plugs #4 and #6 to connectors at the wire harness.
 6. Lead wire for #2 glow plug.

Inspect

- Wire routing, making sure the lead wires are not rubbing against the exhaust manifold or any part that may harm the wire insulation.
7. Splash shield in the right front wheel well.
 8. Right front tire.
 - Refer to SECTION 3E of appropriate service manual for lug nut torque.

Left Side Turbo and Both Sides Non Turbo:

9. Glow plugs.

Tighten

- Glow plugs to 23 N·m (17 lb. ft.).
10. Lead wires to the glow plugs.
 11. Negative battery cable.

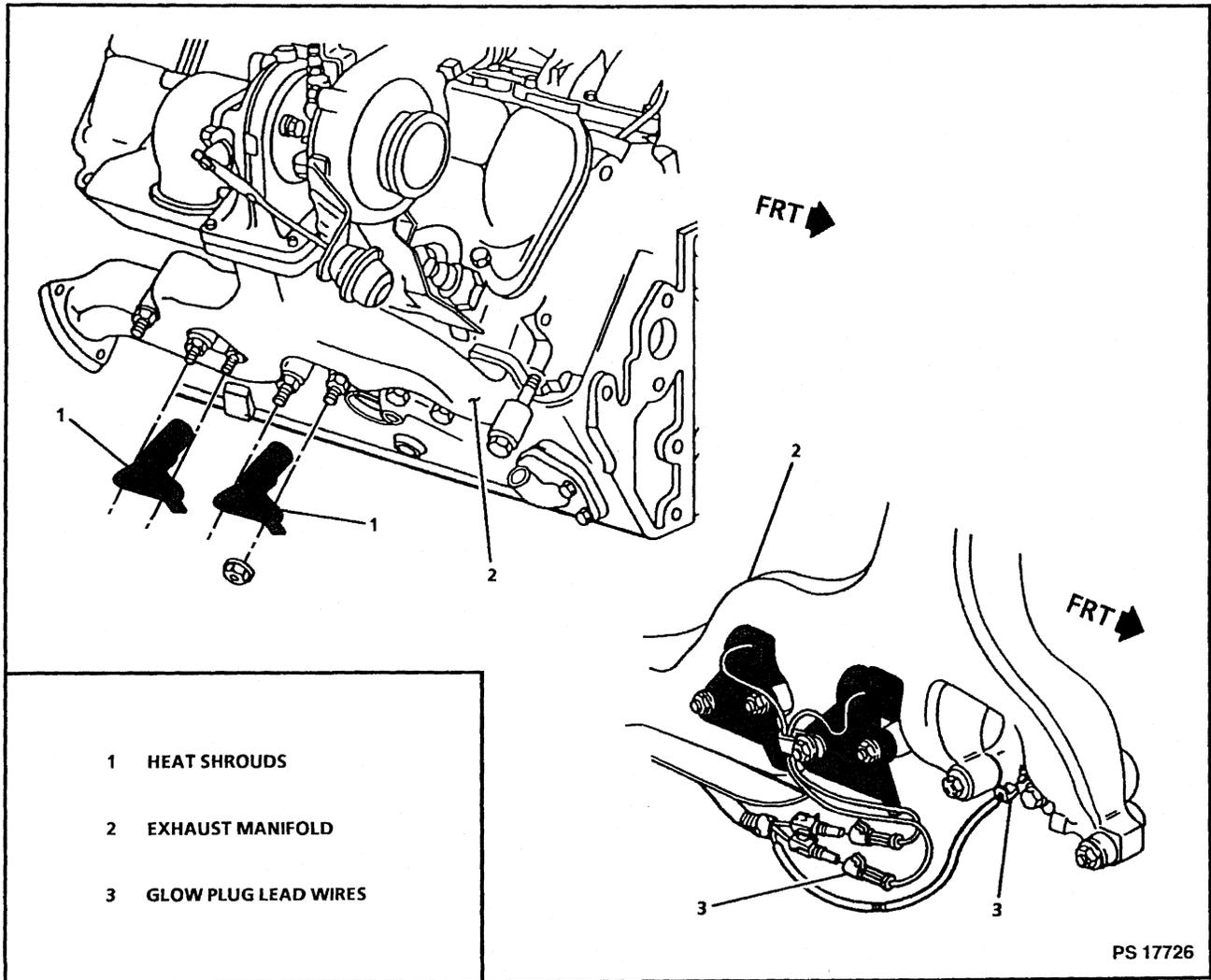
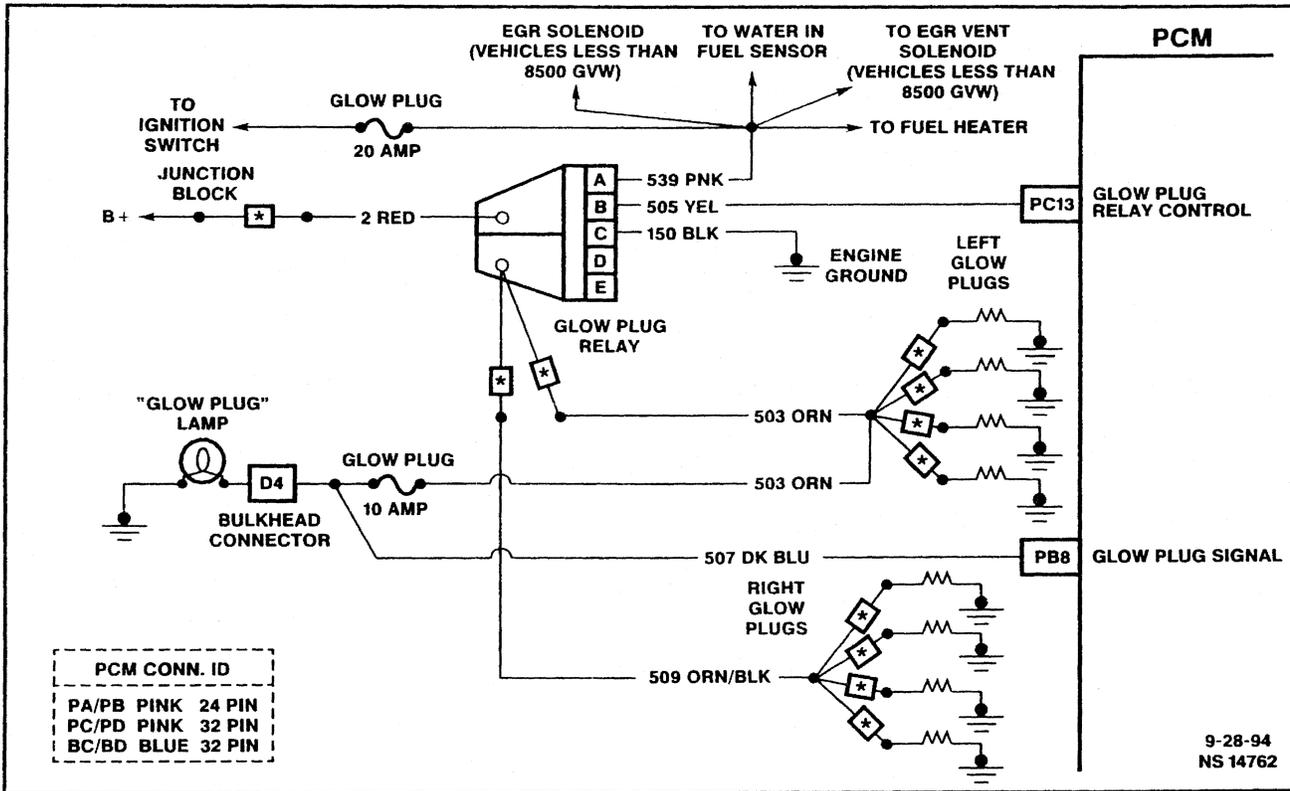


Figure 7-3 - Glow Plugs (Right Side Turbo)

PARTS INFORMATION

PART NAME	GROUP
Glow Plug	2.270
Glow Plug Relay	2.510

BLANK



GLOW PLUG SYSTEM CHECK

Circuit Description:

The glow plug system is used to assist in providing the heat required to begin combustion during engine starting at cold ambient temperatures. The glow plugs are heated before and during cranking, as well as initial engine operation. A DTC 29 will be set when the glow plug relay output is found to have a fault. This can be found by comparing glow plug feedback voltage to ignition voltage.

Chart Test Description: Number(s) below refer to circled number(s) on the diagnostic chart.

1. This step determines if the glow plugs are faulty or if the problem lies in the wiring portion of the circuit.
2. If the relay contacts are shorted together, there will be 12 volts supplied to the glow plugs at all times. Since these are 6 volt glow plugs, they will be damaged by the constant high voltage.

Diagnostic Aids: Amp draw test can be used as a quick operational check of the glow plug system. Initial amp draw for the entire glow plug system should be at least 105 amps with a fully charged battery.

GLOW PLUG SYSTEM CHECK

- ASSUMES NO DTC 14, 15 OR 29 IS STORED AND THAT ENGINE COOLANT TEMPERATURE SENSOR CIRCUIT IS OPERATING PROPERLY.
- FUEL SYSTEM "OK."
- BATTERY VOLTAGE ABOVE 12.4 VOLTS.
- CRANKING SPEED ABOVE 100 RPM.
- WITH J 39200 CHECK VOLTAGE AT "BATT" TERMINAL OF GLOW PLUG RELAY. IS THERE MORE THAN 11 VOLTS?

YES

NO

①

- KEY "OFF."
- USING J 39200 CHECK VOLTAGE AT "GLOW PLUG" TERMINAL OF GLOW PLUG RELAY CKT 503 AND 509. IS THERE MORE THAN 1 VOLT?

REPAIR HIGH RESISTANCE OR OPEN IN CKT 2 TO THE IGNITION SWITCH.

NO

YES

- DISCONNECT ALL GLOW PLUGS.
- WITH TEST LIGHT CONNECTED TO B+, PROBE EACH GLOW PLUG SPADE TERMINAL. DO ALL GLOW PLUGS TURN TEST LIGHT "ON"?

② RELAY CONTACTS SHORTED. REPLACE GLOW PLUG RELAY AND ALL GLOW PLUGS.

YES

NO

WITH GLOW PLUG STILL DISCONNECTED, CONNECT THE J 39200 TO GLOW PLUG SIDE OF GLOW PLUG RELAY AND PROBE EACH GLOW PLUG HARNESS TERMINAL. DO THEY ALL HAVE CONTINUITY?

REPLACE GLOW PLUG(s).

YES

NO

SYSTEM OPERATING OK.

REPAIR OPEN IN CKT(s) 503 OR 509.

BLANK