



Service/Parts Topics

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|--------------------|---------------------------------------|-------------------|
| Date July, 2001 | Application: Automotive/Industrial | T1073 |
| No. 01T10-2 | Fuel Type: Diesel Only | File Group: 10 |

Subject
Flame Start System

| Publications Affected by This Service/Parts Topic | | | | |
|---|---------------------------|----------------------------|------|-------|
| Engine | Operation and Maintenance | Troubleshooting and Repair | Shop | Other |
| C8.3 | | 3666003 | | |

NOTE: Publications identified as **Other** include the following:
¹Master Repair Manual, ²Parts Catalog, ³Specifications Manual, ⁴Alternative Repair Manual, ⁵Wiring Diagram, ⁶Features Manual

This service/parts topic provides flame start procedures for the C8.3 Troubleshooting and Repair Manual, Bulletin 3666003. The procedures being updated are:

- Flame Start System - Checking (010-064)
- Flame Start Plug (010-065) - Remove
- Flame Start Relay (010-066) - Initial Check
- Flame Start Temperature Sensor (010-067) - Inspect for Reuse
- Flame Start Plug Solenoid (010-068) - Initial Check
- Flame Start Fuel Line (010-069) - Inspect for Reuse
- Flame Start Oil Pressure Switch (010-070) - Inspect for Reuse
- Flame Start Controller Logic (010-071) - Initial Check
- Flame Start Plug Electrical Circuit (010-085) - Initial Check.

The flame start system is available on the C Series automotive engines **only** with either a 12-VDC or 24-VDC electrical system.

The flame start system burns a small amount of diesel fuel in the intake manifold to aid starting in cold ambient temperature conditions. The system also operates in a poststart mode to reduce white smoke.

The intake cold-start control module monitors engine temperature. When the engine temperature is greater than 7°C [45°F], the flame start system will **not** be activated. Below 7°C [45°F], the system will operate as follows:

Preheat Cycle

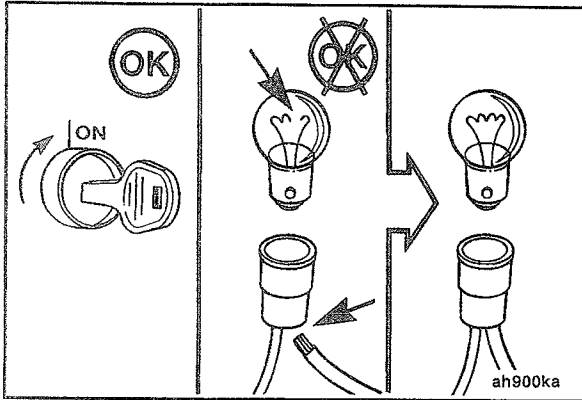
1. When the engine temperature is below 7°C [45°F], turn the ignition key to the RUN position. When the key is in this position, the WAIT-TO-START lamp will illuminate for approximately 25 seconds. The engine should **not** be cranked until the WAIT-TO-START lamp shuts off. If the engine is cranked before the preheat cycle is complete, the process is aborted. The controller is reset each time the ignition is turned off.

Engine-Starting Cycle

2. When the WAIT-TO-START lamp goes out, the preheat cycle is complete. Depress the accelerator pedal all the way to the floor and crank the engine. The engine **must** be cranked within 30 seconds. If the engine is **not** cranked within 30 seconds, the preheat cycle needs to be repeated (step 1).

Postheat Cycle

3. Postheating occurs as the flame plugs continue to burn while the engine is running. Postheating helps warm the engine faster and eliminates white smoke. Postheating times are determined by the engine temperature upon start-up.



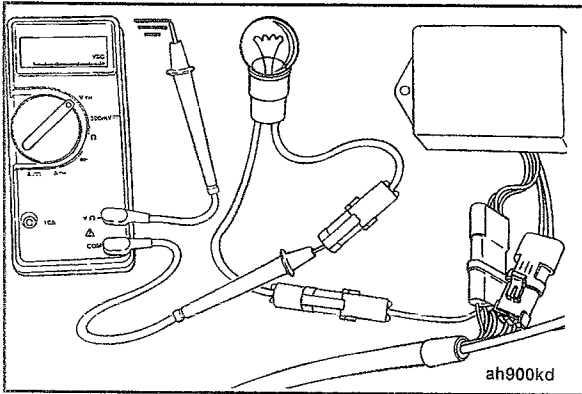
Flame Start System (010-064)

Inspect for Reuse

Turn the key to the **ON** position. The bulb check logic in the controller will turn the wait-to-start light on for 5 seconds.

Check the wait-to-start lightbulb.

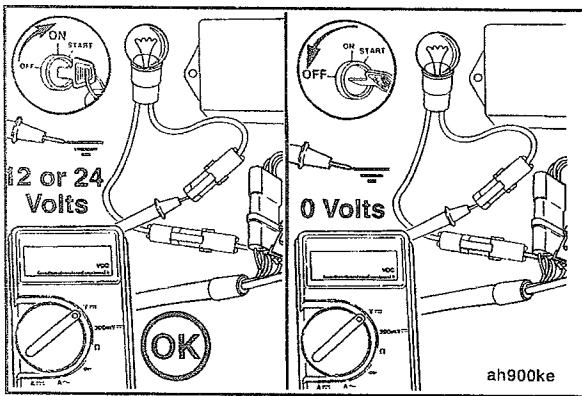
- Check for broken filament in the bulb.
- Check the socket and wiring.
- Repair bulb socket or wiring, if necessary.



Voltage Check

NOTE: The battery positive signal is provided by the chassis.

- Set the digital multimeter, Part Number 3376898, or equivalent, to measure the voltage in volts.
- Connect the leads of the multimeter to the chassis lead of the wait-to-start light and a suitable ground.

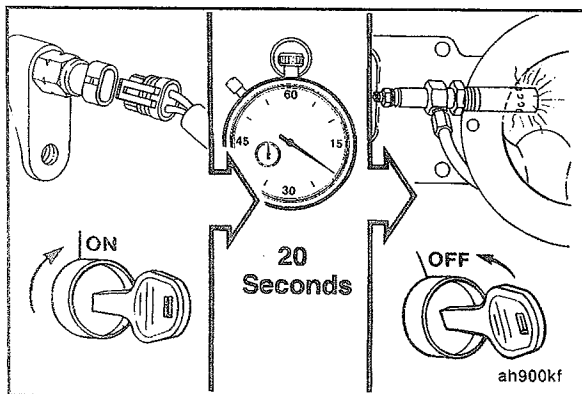


Turn the keyswitch to the **ON** position.

The multimeter **must** indicate vehicle system voltage.

Turn the keyswitch to the **OFF** position.

Repair the chassis wiring if necessary.



Flame Start Plug Electrical Circuit (010-085)

Initial Check

Disconnect the flame plug temperature sensor and install a 10,000-ohm resistor.

Remove the air intake crossover tube.

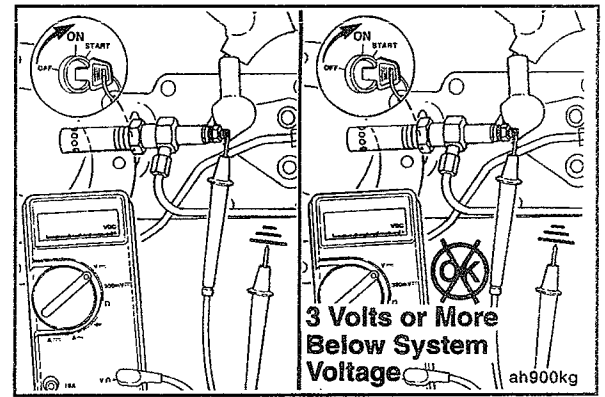
Turn the key to the **ON** position. Inspect the glow plug. The glow plug should be red when functioning properly.

Turn the keyswitch to the **OFF** position.

If the glow plug is functioning properly, proceed to the Flame Plug Solenoid - Checking.

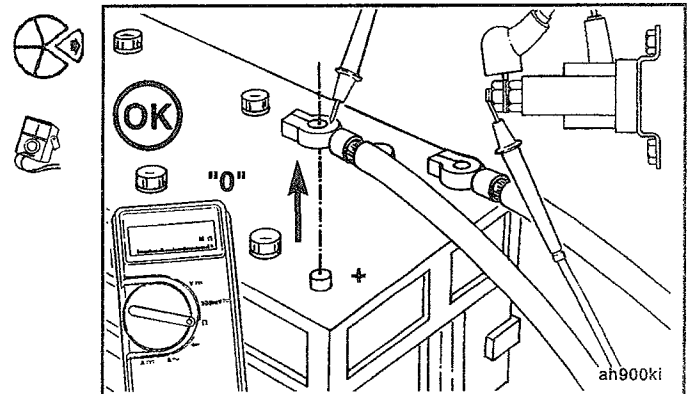
Voltage Check

- Set the digital multimeter, Part Number 3376898, or equivalent, to measure voltage (volts).
- Connect the leads of the multimeter to the flame plug electrical connection and a suitable ground.
- Turn the keyswitch to the **ON** position.
- The multimeter **must** indicate at least 3 VDC below the vehicle system voltage.
- Turn the keyswitch to the **OFF** position.
- If the voltage check is acceptable, proceed to the Flame Plug Electrical Heater - Check.

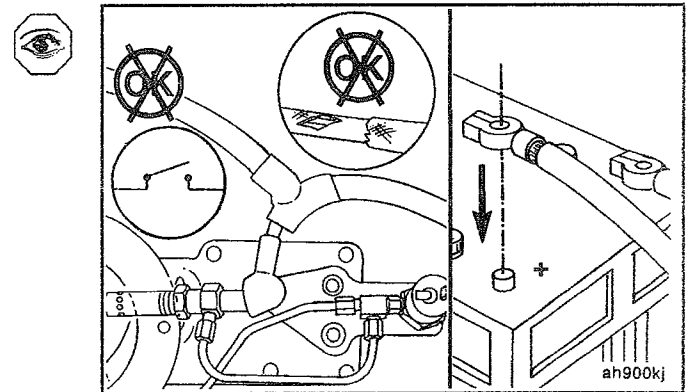


Resistance Check

- Disconnect the battery positive terminal.
- Set the digital multimeter, Part Number 3376898, or equivalent, to measure resistance (ohms).
- Connect the leads of the multimeter to the relay and the battery positive cable.
- The multimeter **must** indicate zero or little resistance.
- Repair/replace as necessary.



- Inspect the wiring harness and connectors for chafing or shorts to ground.
- If resistance is high or open, check the fusible link in the wiring harness.
- Repair/replace the cable as necessary.
- Install the battery positive terminal.



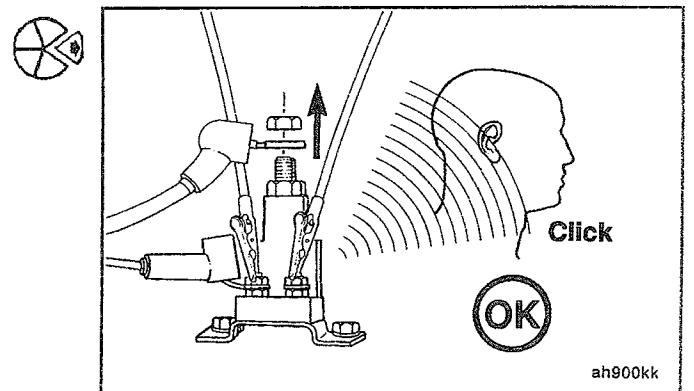
Flame Start Relay (010-066)

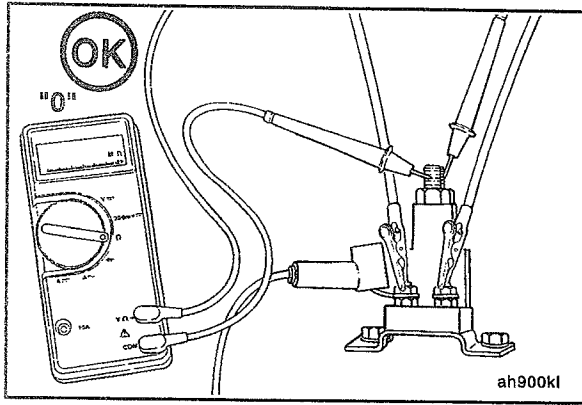
Initial Check

Disconnect the battery lead to the relay.

Apply system voltage and ground to the smaller terminals of the relay.

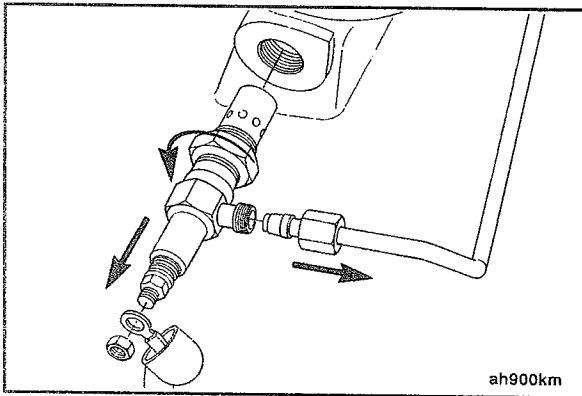
Listen for an audible click to make sure the relay is operating properly.





Apply the system voltage and ground to the smaller terminals of the relay.

- Set the digital multimeter, Part Number 3376898, or equivalent, to measure resistance (ohms).
- Connect the lead of the multimeter to the high-current relay terminal.
- The multimeter **must** indicate zero or little resistance.
- Replace the relay if necessary.



Flame Start Plug (010-065)

Remove



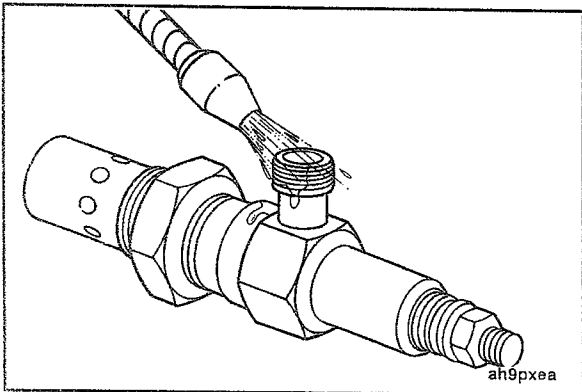
CAUTION

The flame start system has small orifices and a filter that are susceptible to contamination. When any fuel lines are disconnected, make sure no debris enters the fuel system.

NOTE: The electrical connector on the flame plug is susceptible to failures due to excessive torque. Removal or installation torque above 4 N•m [35 in-lb] will fail the delicate electrical heater.

Remove the electrical connector from the plug. Remove the fuel line.

Loosen the flame plug.



Clean

Use a solvent to clean the flame plug filter screen.

NOTE: Do **not** remove the filter screen from the flame plug. If the screen can **not** be cleaned with a solvent, replace the plug.

inspect for Reuse



The flame start system has small orifices and a filter that are susceptible to contamination. When any fuel lines are disconnected, make sure no debris enters the fuel system.

Inspect the fuel sealing surfaces on the flame plug and fuel line for scratches or burrs. Replace the flame plug or fuel line if damaged.

Check the flame plug for plugging and coking.

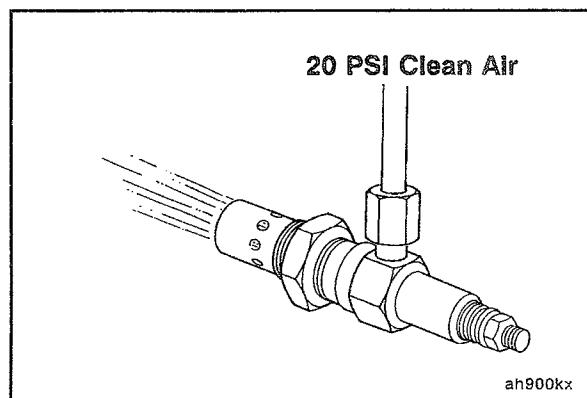
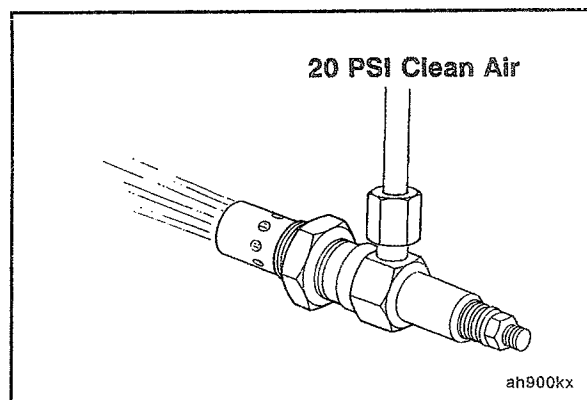
NOTE: The flame plugs have small orifices and will fail if plugged with debris. Make sure **not** to contaminate the plugs.



Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

Apply 138 kPa [20 psi] of clean shop air to the flame plug and listen/feel for airflow.

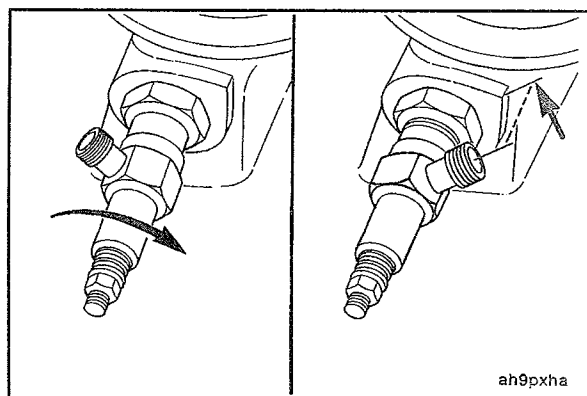
If no airflow is detected, replace the plug.



Install

Install the flame plug with the jam nut installed.

Bottom out the plug into the manifold and back it out two turns until the plug is aligned with the pointer on the manifold.



Do not exceed this torque. Damage to and/or failure of the glow plug will result.

Align the fuel plumbing with the flame plug to make sure the fuel tube is centered with the plug.

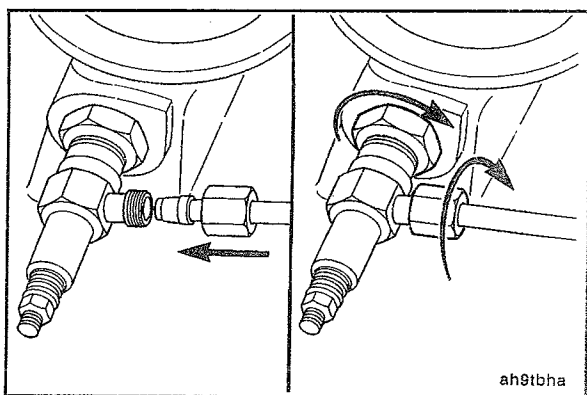
Install the fuel line.

Torque value: Fuel line = 10 N•m [89 in-lb]

Torque value: Jam nut = 25 N•m [221 in-lb]

Install the electrical connections.

Torque value: 4 N•m [35 in-lb]



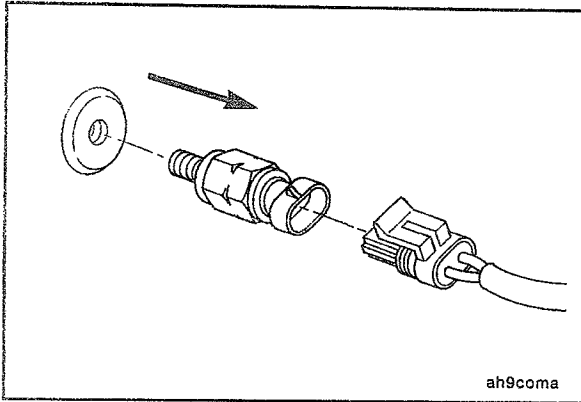
Flame Start Temperature Sensor (010-067)



Remove

Remove the electrical connection to the temperature sensor.

Remove the sensor.



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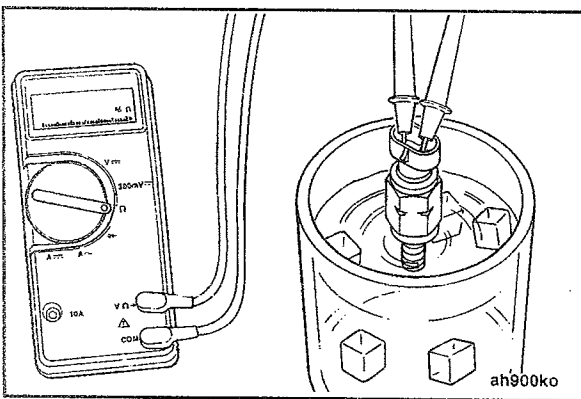


Inspect for Reuse

- Set digital multimeter, Part Number 3376898, or equivalent, to measure resistance (ohms).
- Connect the leads of the multimeter to the temperature sensor leads.
- Record the resistance at the following conditions:

| Temperature C [F] | Resistance (ohms) |
|------------------------------|----------------------|
| Room Temperature 0° [32°] | 1600 800 |

If sensor is 100 ohms over the specified resistance, replace the sensor. With the keyswitch **ON**, check the resistance across pins J1A and J1B.



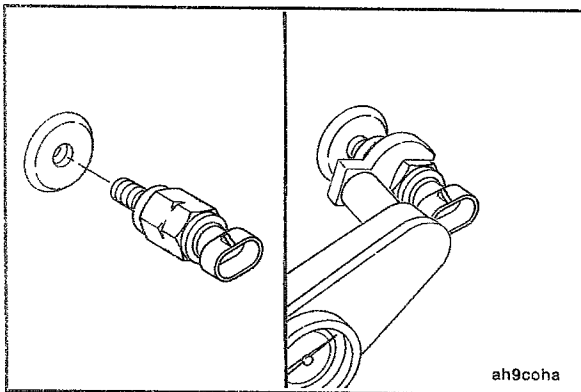
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Temperature Sensor - Install

Install the sensor in the reverse order of removal.

Torque value: 40 N•m [30 ft-lb]

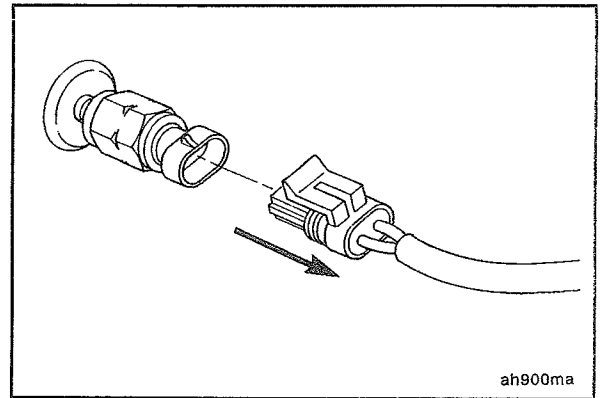


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Flame Start Plug Solenoid (010-068)

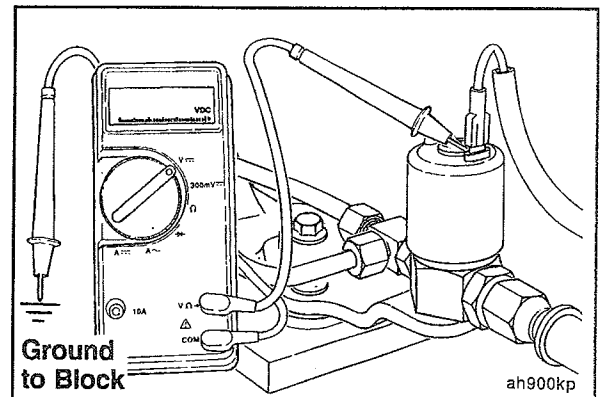
Initial Check

Disconnect the temperature sensor.



Set the digital multimeter, Part Number 3376898, or equivalent, to measure the voltage (volts).

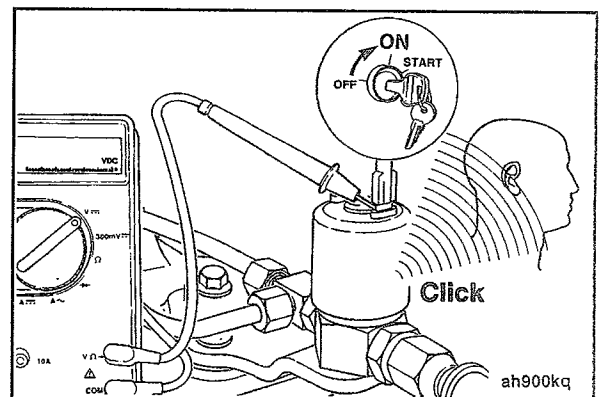
Connect the leads of the multimeter to the flame start fuel solenoid and a suitable ground.



Turn the keyswitch to the **ON** position.

After the wait-to-start light goes out, attempt to start the engine.

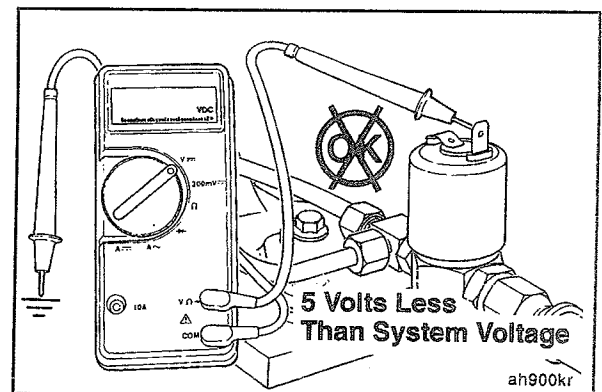
Listen for the solenoid click sound.

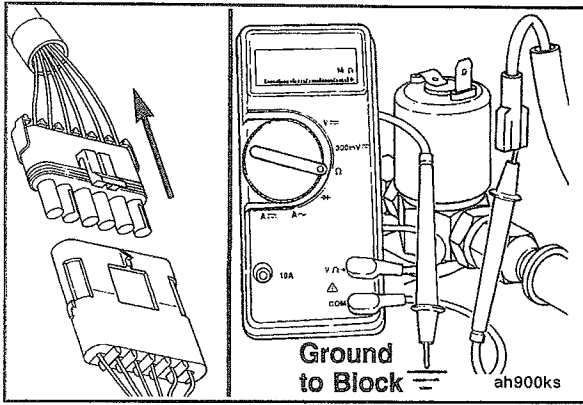


Measure the fuel solenoid connector voltage.

Turn the keyswitch to the **OFF** position.

If the voltage is 5 VDC less than the system voltage, inspect the engine wiring harness and the controller harness for shorts or chafed insulation.



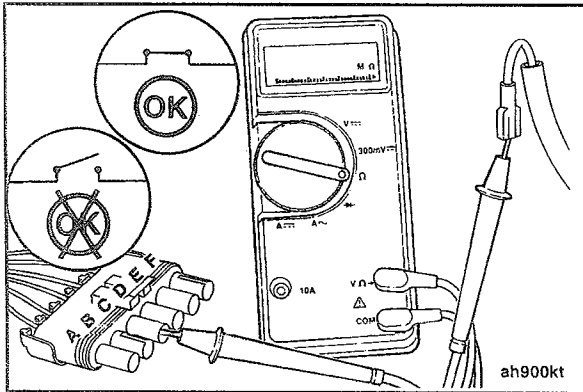


Disconnect the control module connector.



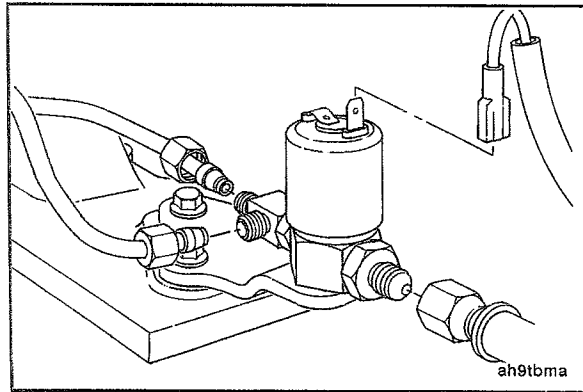
Connect the leads of the multimeter to the flame start fuel solenoid connector and a suitable ground. Resistance **must** be infinite or an open circuit.

If the wiring harness shorted to the ground, replace or repair.



Measure the wiring harness resistance between pin C on the harness connector and the solenoid.

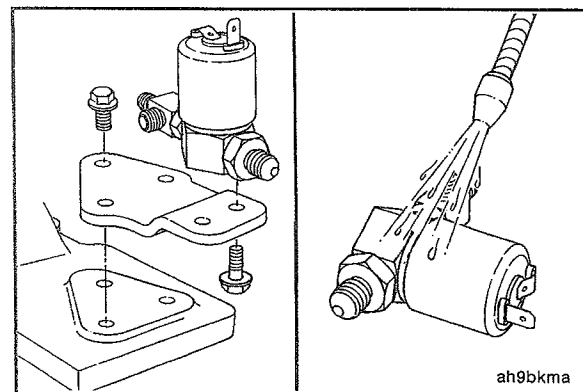
The wiring harness resistance **must** be zero or close to zero. If **not** zero, replace or repair the wiring harness.



Remove

Remove the electrical connector.

Disconnect the fuel lines from the solenoid valve.



Remove the bracket and solenoid assembly from the intake cover.



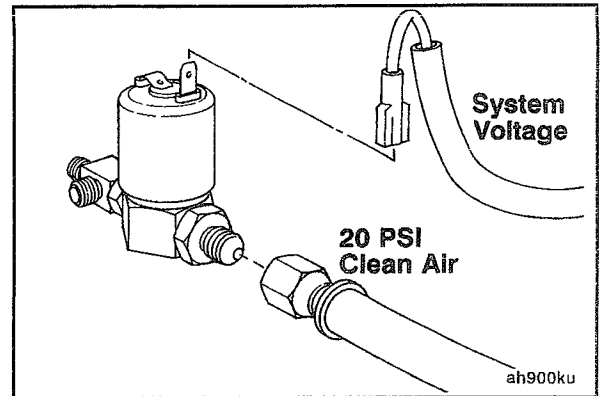
Remove the residual fuel and clean the solenoid.

inspect for Reuse

Apply system voltage and a suitable ground to the solenoid.

Apply a clean supply of 138-kPa [20-psi] shop air in the inlet side of the solenoid valve.

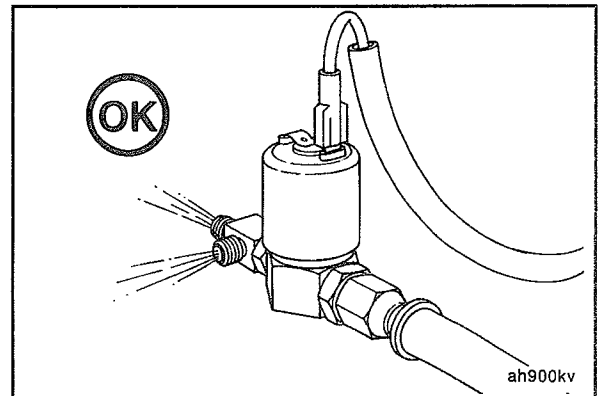
NOTE: The orifice in the solenoid valve is susceptible to plugging. Make sure no debris enters the valve.



▲ WARNING ▲

Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

Apply clean shop air to the solenoid and listen/feel for air passage.

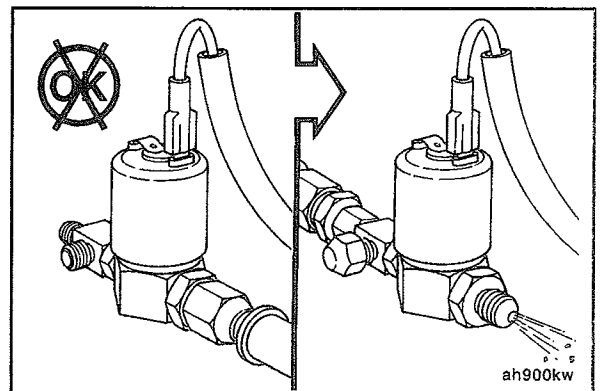


▲ WARNING ▲

Wear appropriate eye and face protection when using compressed air. Flying debris and dirt can cause personal injury.

If the solenoid is plugged, remove the debris by backflowing the valve with clean shop air.

If the solenoid valve does **not** open or is still plugged, replace the valve.

**Install**

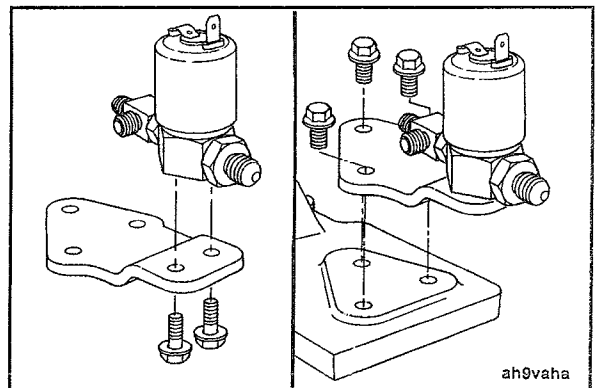
8 mm

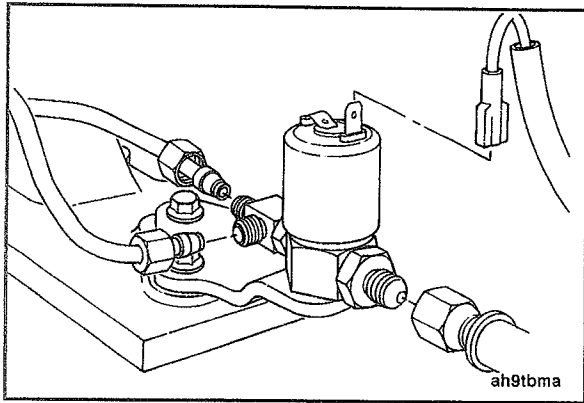
Install the solenoid valve on the bracket.

Torque value: 9 N•m [80 in-lb]

Install the solenoid bracket on the intake cover.

Torque value: 9 N•m [80 in-lb]





Install the solenoid valve fuel supply line.

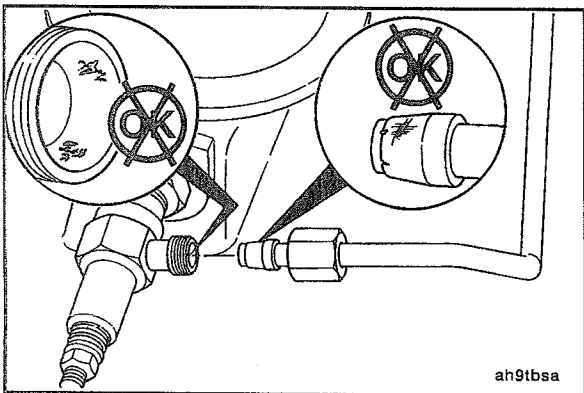
Torque value: 10 N•m [89 in-lb]



Install the solenoid valve fuel lines.

Torque value: 10 N•m [89 in-lb]

NOTE: To prevent leaks, inspect the sealing surfaces and align the fuel lines to the solenoid before tightening the fuel lines.

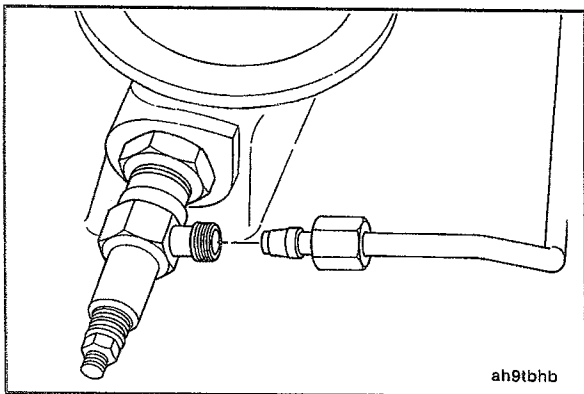


Flame Start Fuel Line (010-069)

Inspect for Reuse



Remove the fuel line and inspect the sealing surfaces for scratches or burrs. Replace the damaged fuel line or the flame plug, if necessary.



Install

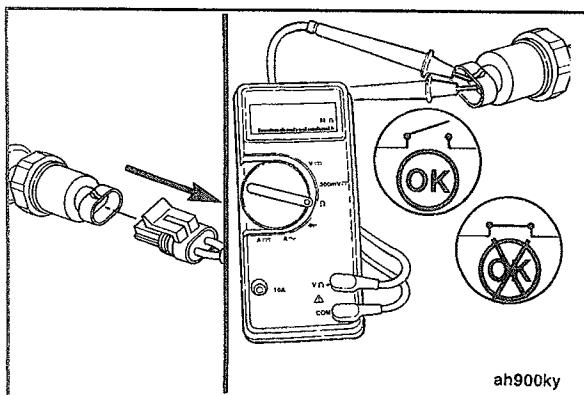
Align the hard-line ends to the end point of the connection.



NOTE: Do not try to force a misaligned fuel line into a connection. This will load one side of the seal and damage the seal.

Install the fuel line.

Torque value: 10 N•m [89 in-lb]



Flame Start Oil Pressure Switch (010-070)

Initial Check

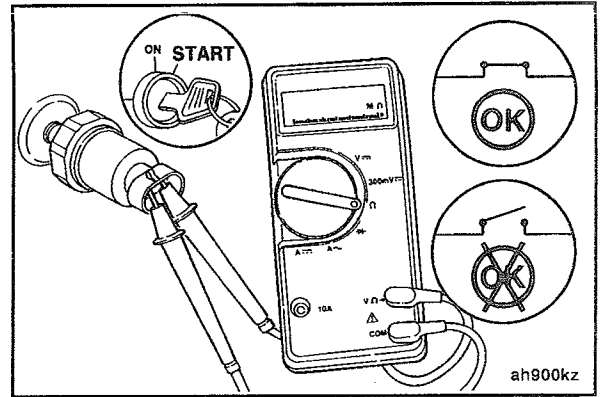


Disconnect the oil pressure sensor.

Connect the leads of the multimeter to the lubricating oil pressure sensor connector.

The resistance **must** be infinite or an open circuit. If the switch is shorted, replace the lubricating oil pressure switch.

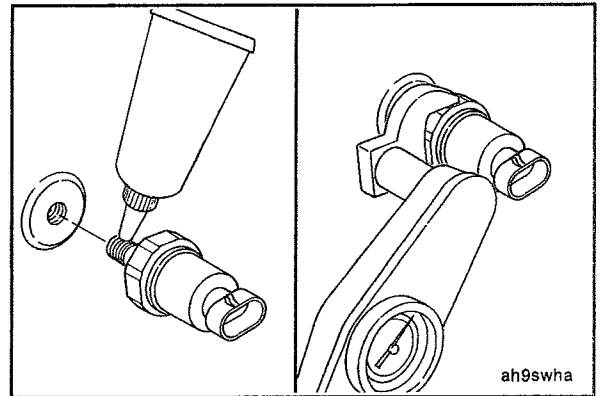
Start the engine (if possible) and measure the lubricating oil pressure switch resistance. If the resistance is **not** zero, replace the lubricating oil pressure sensor.



Install

Install the lubricating oil pressure switch.

Torque value: 20 N•m [177 in-lb]

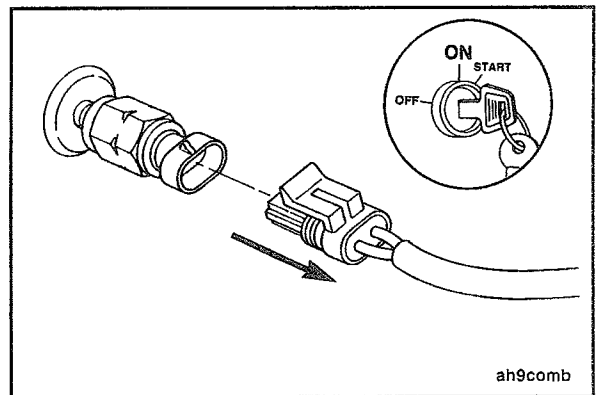


Flame Start Controller Logic (010-071)

Initial Check

Disconnect the temperature sensor connection.

Turn the keyswitch to the **ON** position.



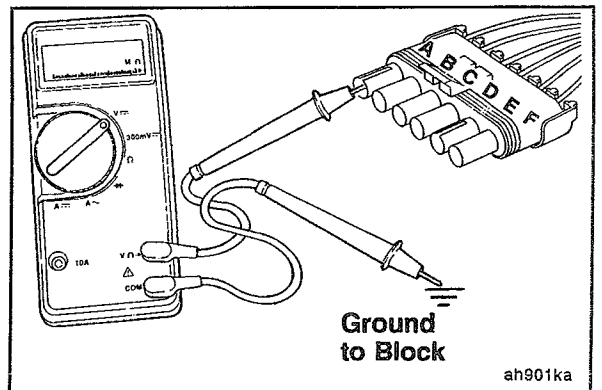
Connect the leads of the multimeter to pin A on the 6-pin connector and a suitable ground.

Measure the voltage.

Check for system voltage.

- The controller has an overvoltage protection circuit that will abort all operations if pin A has sensed an overvoltage condition. Refer to the chart below:

| System Voltage | Overvoltage Limit |
|----------------|-------------------|
| 12 VDC | 18 VDC |
| 24VDC | 30 VDC |



- The wait-to-start light will flash if the temperature sensor is disconnected or failed.
- If the controller does **not** have an oil pressure signal within 30 seconds after cranking the engine, the controller will abort the cycle.
- If the controller malfunctions, replace the controller.