

DIESEL FUEL SYSTEM - LONG CRANK/WHITE SMOKE/SURGE

Related Links

Diagnosis: Pre-Diagnostic Troubleshooting Procedure

White Smoke and/or Misfire After Cold Start

Engine Surges at Idle

Engine Noise

Engine Will Not Start/Hard to Start

Possible Causes
Air in fuel supply
Coolant leaking into combustion chamber
Active Diagnostic Trouble Codes (DTC's)
In very cold ambient temperatures, engine block heater is malfunctioning (if equipped)
Engine Coolant Temperature sensor malfunctioning
Engine Control Module (ECM) incorrect calibration
Fuel filter restricted
Fuel grade not correct or fuel quality is poor
Fuel heater element or fuel heater temperature sensor malfunctioning
Fuel Injector malfunctioning
Fuel injector hold-downs loose
Fuel injector protrusion not correct
High pressure fuel pump malfunctioning
Intake/Exhaust valve adjustment not correct (too tight)
Intake manifold air temperature sensor malfunctioning
Intake manifold heater circuit not functioning correctly in cold weather
Internal engine damage
Restricted fuel supply side of fuel system

Preliminary checks:

^ Repair active DTC's before proceeding.

^ Check for normal white smoke at cold start-up that stops within one minute and is more noticeable when cold.

^ Ensure the customer's concern is not related to situations which may increase normal white smoke; idle time, engine temperature, fuel source, cold ambient temperature, high altitude.

NOTE:

Steps 1 through 4 should be performed BEFORE the engine is started.

1. Temperature sensors: Using the appropriate scan tool, before starting engine after an overnight soak, verify that the Intake Air Temperature (IAT), Engine Coolant Temperature (ECT), Inlet Air Temperature, and the Battery Temperature sensors are showing similar and appropriate temperatures. - Are the sensors showing similar and appropriate temperatures?

a. Yes >> Go to Step # 2.

b. No >> Repair the appropriate sensor or circuit as necessary. Refer to the diagnostic procedures available in TechCONNECT under: Service Info > 9 - Engine > Diagnosis & Testing. >> Go to Step # 12.

2. Pressure sensors: Using the appropriate scan tool, before starting engine after an overnight soak, verify that the Intake Manifold Pressure and Inlet Air Pressure sensors are showing similar and appropriate pressure. - Are the sensors showing similar and appropriate pressures?

a. Yes >> Go to Step # 3.

b. No >> Repair the appropriate sensor or circuit as necessary. Refer to the diagnostic procedures available in TechCONNECT under: Service Info > 9 - Engine > Diagnosis & Testing. >> Go to Step # 12.

NOTE:

The Inlet and Baro sensors will read in Inches of Mercury (Hg) while the Intake and Boost sensors will read Pounds per Square Inch (PSI). The values displayed on the scan tool will not be the same, 2 in. Hg = 1 PSI.

3. Fuel Rail Pressure sensor: Using the appropriate scan tool, before starting engine after an overnight soak, verify that the fuel rail pressure reads 0 (+/-500 PSI). - Does the fuel rail pressure read 0 (+/-500 PSI)?

a. Yes >> Go to Step # 4.

b. No >> Repair the fuel rail pressure sensor or circuit as necessary. Refer to the diagnostic procedures available in TechCONNECT under: Service Info > 9 - Engine

> Diagnosis & Testing. >> Go to Step # 12.

4. Intake Air Heater: Verify the intake air heater is operating properly. Refer to the detailed service information available in TechCONNECT under: Service Info> 14 - Fuel System > Fuel Injection > Intake Air Heater> Operation. Is the intake air heater operating properly?

a. Yes >> Go to Step # 5.

b. No >> Repair the intake air heater or intake air heater circuit as necessary. Refer to the diagnostic procedures available in TechCONNECT under: Service Info > 9 - Engine> Diagnosis & Testing. >> Go to Step # 12.

5. Start the engine: Start the engine following normal starting procedures and allow the engine to run at idle. Determine when the white smoke disappears. If the white smoke disappears within one minute, it is normal. If the engine is operated in cold ambient conditions and/or at altitude, white smoke at start-up is expected.

6. Test for injector misfire: Using the appropriate scan tool, perform a "Cylinder Kill" test. Cancel each cylinder one-at-a-time. Note any change in smoke and/or misfire.

Does a single cylinder show a difference in smoke or misfire?

a. Yes >> Go to Step # 7.

b. No >> Go to Step # 8.

7. Diagnose single cylinder white smoke/misfire:

- a. Remove the valve cover.
- b. Inspect the valve lash.
- c. Remove the injector.
- d. Inspect the injector seal washer and High Pressure Connector (HPC). Replace the HPC if it is damaged.
- e. Install the injector. Refer to the detailed service information available in TechCONNECT under: Service Info> 14 - Fuel System > Fuel Injection > Fuel Injector > Installation.
- f. Repeat test for injector misfire. >> Go to Step # 6.

NOTE:

If the same single cylinder is still the cause of the miss or white smoke, replace that single injector and HPC.

NOTE:

Perform the following test if a single cylinder was not identified by the cylinder cutout test to be causing the white smoke.

8. Test for injector leaking fuel into the cylinder. - Using Miller Special Tool, 9011, block the high pressure fuel line at the rail, one injector at a time. Is a single injector the cause of the white smoke and/or miss?

- a. Yes >> Replace that injector and HPC. - Go to Step # 12.
- b. No >> Go to Step # 9.

9. Test for high injector return flow. Perform the "Injector Return Flow Test". Refer to the detailed diagnostic information available in TechCONNECT under: Service Info > 9

- Engine> Diagnosis & Testing. Do the injectors pass the "Injector Return Flow Test"?

- a. Yes >> Go to Step # 11.
- b. No >> Go to Step # 10.

NOTE:

Maximum leakage allowable for all injectors combined is 180 mL (6.1 fl. oz.) (At idle pressure).

NOTE:

It is critical that all HPC nuts are tightened to the correct torque. Refer to the detailed tightening information available in TechCONNECT under: Service Info > 14 - Fuel System> Fuel Injection> Fuel Injector > Installation. Retest when all HPC nuts are properly torqued.

NOTE:

Any injector contributing more than 40 mL (1.4 fl. oz.) is excessive (Example: If total injector leakage is 200mL (6.7 fl. oz.) and blocking cylinder # 1 reduces the leakage to 160 mL (5.4 fl. oz.), cylinder # 1 has excessive leakage).

NOTE:

Test should be repeated to confirm measurements.

10. If the injector return from any cylinder(s) is deemed excessive:

a. Check HPC tip for damage, replace HPC if damaged. Refer to the detailed service information available in TechCONNECT under: Service Info > 14 - Fuel System > Fuel Injection > Fuel Injector > Removal/Installation. >> Go to Step # 12.

b. If HPC tip is undamaged, replace the injector and HPC. Refer to the detailed service information available in TechCONNECT under: Service Info > 14 - Fuel System > Fuel Injection > Fuel Injector > Removal/Installation. >> Verify that a quality fuel filter is used. >> Go to Step # 12.

11. If the engine passes the previous tests and still exhibits white smoke that clears with a warm engine, check the following:

a. Idle Time >> More than 20% is excessive.

b. Engine Temperature >> Verify that the thermostat allows the engine to reach operating temperature.

c. Fuel Source (Cetane) >> Check with fuel supplier or try another source.

d. Fuel Quality (lubricants/detergents) >> May benefit by using a fuel detergent with a lubricity additive.

e. Winter Fuels >> No. 2 diesel not blended for winter conditions.

f. Cold Ambient >> Use block heater where appropriate, limit warm-up time in winter.

g. High Altitude >> Effect will be worse with altitude and cold ambient temperatures.

h. Refer to Service Information >> Refer to the detailed diagnostic information available in TechCONNECT under: Service Info > 9 - Engine > Diagnosis & Testing > Smoke Diagnosis Charts > Excessive White Smoke. >> Go to Step # 12.

12. Repair Complete. - Perform Powertrain Verification Test VER - 1 (Diesel). Refer to the detailed service information available in TechCONNECT under: Service Info > 8 - Electrical/Electronic Control Modules/Engine Control Module> Diagnosis And Testing.