Fuel System Starting Difficulty Diagnostic Tests

September 2011

Additions, Revisions, or Updates

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2 Starting Difficulty/Hard Start/No Start

Check as follows:
1. Will the engine rotate with the starter?
   a. Yes; Go to step 2.
   b. No; Refer to section "Engine Will Not Rotate".
2. Check fuel tank levels; ensure both are above ¼ tank.
   a. If tanks are less than ¼, add fuel and retest. If concern is still present, Go to step 3.
   b. If adding fuel corrected the complaint, release the vehicle.
   c. If both tanks are over ¼ full of fuel, Go to step 3.
3. Check for fuel contamination, including DEF, water, gasoline, kerosene, coolant, etc.
   a. If contamination is found, contact the Customer Support Center (800-445-1980).
   b. If no contamination is found, Go to step 4.
   a. If other fault codes are present along with a starting difficulty, correct the additional fault codes first.
   b. If no fault codes are present, Go to step 5.

NOTE: When inspecting pre-screen stand pipe, fuel should be present on top of the check ball. If no fuel is present, add fuel to top of stand pipe. If the fuel drains down into the standpipe, replace the standpipe.

5. Were the fuel filters just replaced?
   a. Yes; inspect stand pipes, pre-screen check ball and fuel filter o-rings. Repair/replace as necessary.
   b. No; Go to step 6.
6. Perform Automatic FSIC test. Refer to section "Fuel System Integrity Check Routine Operation Overview" for more details on FSIC.
   a. If at any point during cranking there is an audible knock or hydraulic sound, do not attempt to restart the engine.
      Remove EGR hot pipe to inspect for an over-fueling injector.
      For the DD13, Refer to section "DD13 Exhaust Gas Recirculation Cooler Water Manifold Cleaning Procedure to Remove Excess Fuel from the Cooler after an Engine Brake Solenoid, Fuel Injector or a Turbocharger Failure".
      For the DD15 and DD16, Refer to section "DD15 and DD16 Exhaust Gas Recirculation Cooler Cleaning Procedure to Remove Excess Fuel from Cooler after an Engine Brake Solenoid, Fuel Injector or a Turbocharger Failure".
   b. If the engine starts, allow FSIC to complete and Refer to section "Extended Crank Time".
   c. If the engine does not start, repeat start attempt with Automatic FSIC one more time on same log file. If engine still does not start, Refer to section "Cannot Start".
3 Cannot Start

NOTICE: If you were not directed here from “Starting Difficulty” then go to “Starting Difficulty.”

Check the following:

1. Review FSIC log file for starting requirements. Is cranking engine speed over 100 rpm?
   a. Yes; Go to step 2.
   b. No; check battery voltage and perform cranking compression test. Remove accessories and check cranking speed to determine cause of low cranking speed.

2. Is fuel compensation pressure over 35 psi (241 kPa) while cranking?
   a. Yes; Go to step 3.
   b. No; Go to step 9.

3. Does engine state equal “Start” while cranking?
   a. Yes; Go to step 4.
   b. No; correct status of the AUX shutdown switch or starter type.

4. Does Kw/Nw show/stay “ON / Enabled / True” while cranking the engine?
   a. Yes; Go to step 5.
   b. No; repair failure with camshaft or crankshaft sensor; refer to appropriate troubleshooting.

5. Is actual fuel rail pressure over 150 bar?
   a. Yes; Go to step 6.
   b. No; Go to step 7.

6. Is actual fuel mass over 0 mg/St?
   a. Yes; Go to step 7.
   b. No; Go to step 8.

7. Does it take more than two minutes and 30 seconds for fuel rail pressure to drop below 10 bar after cranking?
   a. Yes; replace fuel injectors. Refer to section "Removal of the Fuel Injector".
   b. No; Go to step 8.

8. Is desired fuel rail pressure over 150 bar?
   a. Yes; check for aerated fuel. Refer to section "Aerated Fuel Test".
   b. No; contact the Customer Support Center (800-445-1980).

9. Install ESOC 350, start priming, and attempt to start the engine with Automatic FSIC. Does engine start?
   a. Yes, engine starts. Allow FSIC to complete and Refer to section "Engine Will Start with a Priming Source".
   b. No, engine does not start, and actual fuel rail pressure increases by more than 3 bar. Go to step 10.
   c. No, engine does not start, and actual fuel rail pressure does not increase by more than 3 bar. Inspect the high pressure pump drive gear for slipping on the pump camshaft. Refer to section "Removal of the High Pressure Fuel Pump".

10. Review Log file from above start attempt. Does compensation pressure increase above 35 psi (241 kPa) while priming and cranking?
    a. Yes; Go to step 11.
    b. No; remove and inspect two-stage valve. Refer to section "Removal of the Two-Stage Valve".

11. Remove the PLV return line at the filter module and crank engine for 10 seconds. Is there any return flow from the PLV line during cranking?
    a. Yes; replace PLV. Refer to section "Removal of the Pressure Limiting Valve".
    b. No; Go to step 12.

12. Check for aerated fuel. Is the fuel aerated?
    a. Yes; determine cause of aerated fuel and repair as necessary. Refer to section “Aerated Fuel Test”.
    b. No; Go to step 13.

13. Cap the fuel rail at all six fuel injector feed connections using J-48704 injector fuel rail caps and attempt to start the engine. Does the fuel rail pressure reach desired rail pressure?
    a. Yes; Go to step 14.
    b. No; replace the high pressure fuel pump. Refer to section "Removal of the High Pressure Fuel Pump".
14. Does the fuel rail pressure bleed down under 100 bar in less than two minutes?
   a. Yes; replace the high pressure fuel pump. Refer to section "Removal of the High Pressure Fuel Pump". E-mail log files to the Customer Support Center.
4  Engine Will Not Rotate

NOTICE: If you were not directed here from "Starting Difficulty," go to "Starting Difficulty".

Check as follows:

**WARNING: PERSONAL INJURY**

To avoid injury from the sudden release of a high-pressure hose connection, wear a face shield or goggles.

**CAUTION: Electrical Shock**

To avoid injury from electrical shock, use care when connecting battery cables. The magnetic switch studs are at battery voltage.

1. Was this vehicle recently reprogrammed or any modules replaced?
   a. Yes, verify starter type and transmission type are set correctly. Refer to the appropriate Application & Installation manual.
   b. No, Go to step 2.
2. Using DDDL 7.X, check for stored or active codes. Are codes present?
   a. Yes, troubleshoot code(s) first.
   b. No; Go to step 3.
3. Check all battery cables and connections. Are cables and connections OK?
   a. Yes, Go to step 4.
   b. No, reconnect or replace if necessary.
4. Measure and record the voltage at the battery terminals. Refer to OEM guidelines. Was the battery voltage at or above OEM specifications?
   a. Yes, Go to step 6.
   b. No, Go to step 5.
5. Charge the batteries.
6. Load test the batteries according to OEM specifications. Did the batteries pass the load test?
   a. Yes; Go to step 7.
   b. No, replace the defective battery (or batteries) and verify repair.
7. Check for battery voltage between the positive and negative connections at the starter motor. Is battery voltage present at the starter motor connections?
   a. Yes, Go to step 8.
   b. No, inspect the wiring between the battery and starter. Repair or replace as necessary.
8. Attempt to manually rotate the engine using Engine Barring Tool J-46392. Does the engine rotate normally?
   a. Yes, Go to step 9.
   b. No, Go to step 10.
9. Remove and bench test the starter. Inspect the flywheel and ring gear. Repair or replace damaged/faulty components, as necessary.
10. Remove the EGR hot pipe and inspect for raw fuel, coolant or oil. Is there raw fluid present in the hot pipe?
    a. Yes, raw fuel is present. Remove the injectors and inspect for a cylinder that is hydrostatically locked.
    b. Yes, coolant is present. Pressurize cooling system per OEM specifications.
    c. Yes, oil is present. Inspect turbocharger inlet and outlet for oil.
    d. No, Go to step 11.
11. Remove the accessory belts. Go to step 12.
12. Attempt to rotate the engine with the J-46392 barring tool. Does the engine rotate normally with the accessory drive belt removed?
   a. Yes, identify and replace the seized accessory components (i.e. alternator, A/C compressor, water pump, cooling fan, etc.).
   b. No, Go to step 13.

13. Inspect the gear driven components (i.e. turbo compound, high pressure fuel pump, air compressor, etc.) for signs of binding or failure. Are all of the gear driven components OK?
   a. Yes, Go to step 14.
   b. No, replace gear driven components as necessary and verify repair.

14. Obtain a Key ON engine OFF log file and DDEC Reports and contact Detroit Diesel Customer Support Center at (800-445-1980).
5  Engine Will Start with a Priming Source

NOTICE: If you were not directed here from “Starting Difficulty,” go to “Starting Difficulty.”

1. Install ESOC 350, start priming and attempt to start the engine with Automatic FSIC. Refer to section “Priming of the Fuel System Using ESOC 350 Fuel Priming Pump”. Does engine start?
   a. Yes, Go to step 2.
   b. No, Refer to section “Cannot Start”.
2. Remove ESOC 350 priming hose from fuel filter module. Does the engine quit running?
   a. Yes, check the following:
      • Air in fuel system. Refer to section "Aerated Fuel Test".
      • Remove and inspect low pressure pump relief valve. Repair or replace as needed. Refer to section "Removal of the Pressure Relief Valve".
      • Remove and inspect two-stage valve. (stuck in stage 1) Refer to section "Removal of the Two-Stage Valve".
      • Inspect low pressure pump and drive coupler. Refer to section "Removal of the Low Pressure Fuel Pump".
   b. No, allow Automatic FSIC routine to complete. Go to step 3.
3. Once rail pressure drops below 10 bar, restart FSIC and attempt to restart engine without priming source. Does engine restart?
   a. Yes, Go to step 4.
   b. No, first remove and inspect low pressure pump relief valve and repair or replace as needed. Refer to section "Removal of the Pressure Relief Valve”. Then remove and inspect two-stage valve. (stuck in stage 1) Refer to section "Removal of the Two-Stage Valve”.
4. Perform Low Pressure Fuel System leak test. Refer to section "Low Pressure Fuel System - Leak Test". Did pressure drop more than .5 psi in 10 minutes?
   a. Yes, inspect fuel system for leaks. Refer to section "Low Pressure Fuel System - Leak Test”.
   b. No, Go to step 5.
5. Remove the pre-screen filter and inspect the stand pipe and check ball. When the pre-screen is removed, fuel should remain in the stand pipe on top of the check ball and NOT drain back. Did the fuel leak past the check ball?
   a. Yes, replace pre-screen stand pipe.
6 Extended Crank Time

**NOTICE:** If you were not directed here from “Starting Difficulty,” go to “Starting Difficulty.”

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<tr>
<td>DDDL 7.x or higher</td>
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<td>W470589099100</td>
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1. Review FSIC log file using DDDL 7.x or higher. Is engine speed over 150 rpm while cranking?
   a. Yes; Go to step 3.
   b. No; Go to step 2.

2. Check battery voltage. Is battery voltage within OEM specification?
   a. Yes; perform cranking compression test. Remove accessories and check cranking speed to determine cause of low cranking speed. Repair as necessary.
   b. No; charge batteries, check all electrical connections and retest. Repair as necessary.

3. Review FSIC log file using DDDL 7.x or higher and monitor fuel compensation pressure and LPPO pressure/priming port. Refer to section “Priming Port Pressures”.
   a. If LPPO/priming port pressure is normal and fuel compensation pressure is low, install Fuel Doser Test Plug (W470589099100) and repeat Automatic FSIC test. If compensation pressure returns to normal per pressure chart, replace the HC Doser fuel supply pressure control valve. Refer to section “Removal of the Hydrocarbon Doser Fuel Supply Pressure Control Valve”. If compensation pressure remains low, replace the fuel filters.
      Refer to section "Removal of the Fuel Prefilter".
      Refer to section "Removal of the Water Separator/Coalescer".
      Refer to section "Removal of the Final Filter".
    b. If LPPO/priming port pressure is higher than normal and fuel compensation pressure lower than normal, replace fuel filters.
       Refer to section "Removal of the Fuel Prefilter".
       Refer to section "Removal of the Water Separator/Coalescer".
       Refer to section "Removal of the Final Filter".
    c. If LPPO/priming port pressure is lower than normal and fuel compensation pressure lower than normal, Go to step 4.
    d. If LPPO/priming port pressure are normal and fuel compensation pressure are normal, Go to step 4.

4. Check for aerated fuel; Refer to section "Aerated Fuel Test". Is the fuel aerated?
   b. No; Go to step 5.

5. Perform low pressure fuel system leak test. Refer to section "Low Pressure Fuel System - Leak Test". Did the low pressure leak test fail?
   a. Yes; inspect fuel system for leaks. Refer to section "Low Pressure Fuel System - Leak Test".
   b. No; Go to step 6.

6. Remove the gallery bypass valve and inspect for debris. Refer to section "Removal of the Bypass Valve". Was debris found?
   a. Yes; replace the valve. Refer to section "Installation of the Bypass Valve".
   b. No; Go to step 7.

7. Remove and inspect the needle return pressure control valve. Refer to section “Removal of the Needle Return Pressure Control Valve.” Was damage found?
   a. Yes; replace the needle return pressure control valve. Refer to section “Installation of the Needle Return Pressure Control Valve.”
   b. No; contact CSC (800-445-1980).