DIAGNOSIS AND TESTING

ENGINE CRANKS BUT WILL NOT START

For a complete wiring diagram, **refer to appropriate SYSTEM WIRING DIAGRAMS article** .

Possible Causes
SKIM CODES PRESENT
INTAKE SYSTEM RESTRICTION
ENGINE COOLANT TEMPERATURE (ECT) SENSOR
FUEL SUPPLY CONTAMINATION
GLOW PLUG SYSTEM FAILURE
FUEL DELIVERY SYSTEM FAILURE
ENGINE DRIVE CHAIN/BELT
POWERTRAIN CONTROL MODULE (PCM)

DIAGNOSTIC TEST

1. **PCM CODES PRESENT**
    1. With the scan tool, read the PCM DTCs.

       Does the scan tool display any PCM DTCs?

       Yes

       - Perform the appropriate PCM DTC procedure.
       - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

       No

       - Go To 3
2. **SKIM CODES PRESENT**
    1. With the scan tool, read the SKIM DTCs.

       Does the scan tool display any SKIM DTCs?

       Yes

       - Refer to **DIAGNOSIS AND TESTING** and perform the appropriate SKIM DTC procedure.
       - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

       No

       - Go To 3
3. **CHECK FOR INTAKE SYSTEM RESTRICTIONS**
    1. Turn the ignition off.
    2. Ensure vehicle has adequate fuel supply in fuel tank.
    3. Inspect all air intake and Turbocharger related hoses/tubes and connections.
    4. Inspect the air filter for excessive dirt, soiling or other problems that may cause restricted air flow.

       Were any problems found?

Yes

- Repair or replace as necessary.
- Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

No

- Go To 4

4. **ECT SENSOR**
    1. Using a temperature probe, check the vehicle temperature near the ECT Sensor.
    2. Turn the ignition on.
    3. With the scan tool in sensors, read the ECT Sensor temperature.
    4. Compare the temperature probe reading with the scan tool reading.

    Are the two readings within 10B°C of each other?

    Yes

    - Go To 5

    No

    - Repair as necessary.
    - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .
5. **GLOW PLUGS**
    1. Check the glow plugs for proper operation.

    Are the glow plugs operating properly?

    Yes

    - Go To 6

    No

    - Repair as necessary.
    - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .
6. **CHECK THE FUEL DELIVERY SYSTEM**
    1. Perform the CHECKING THE FUEL DELIVERY SYSTEM diagnostic procedure. Refer to **DIAGNOSIS AND TESTING**.

    Is the fuel delivery system operating properly?

    Yes

    - Repair as necessary.
    - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

    No

    - Go To 7
7. **ENGINE DRIVE CHAINS**
    1. Make sure the Engine Drive Chains are installed correctly and the camshaft and crankshaft gears are timed correctly.

    Were any problems found?

Yes

- Repair as necessary.
- Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

No

- Replace and program the Powertrain Control Module in accordance with the service information.
- Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

LACK OF ENGINE POWER

For a complete wiring diagram, **refer to appropriate SYSTEM WIRING DIAGRAMS article** .

Possible Causes
INJECTOR QUANTITY ADJUSTMENT
BRAKE SWITCH PROBLEM
EGR SYSTEM PROBLEM
AIR LEAKS IN THE INTAKE SYSTEM (INCLUDING INTERCOOLER)
BOOST PRESSURE PROBLEM
FUEL DELIVERY SYSTEM FAILURE
ENGINE DRIVE BELT/CHAIN
FUEL INJECTOR(S)
FUEL INJECTION PUMP
TURBOCHARGER

DIAGNOSTIC TEST

1. **CHECKING ENGINE OIL LEVEL**
    1. Check that the engine oil level is correct.

    Is the oil at the correct level?

    Yes

    - Go To 2

    No

    - Correct the engine oil to the proper level.
    - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .
2. **CHECKING FOR PCM DTCS**
    1. Turn the ignition on.
    2. With the scan tool, read the PCM DTCs.

    Are there any DTCs present?

    Yes

    - Diagnose and repair the PCM DTCs before proceeding.
    - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

    No

    - Go To 3

3. **CHECKING THE BRAKE SWITCH ADJUSTMENT**
    1. Check for proper Brake Switch adjustment.

       Is the Brake Switch adjusted correctly?

       Yes

       - Go To 4

       No

       - Adjust or replace the Brake Switch as necessary.
       - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .
4. **CHECK THE INTAKE SYSTEM**
    1. Inspect the entire Intake System, including the Intercooler for signs of a leak.

       Were any problems found with the Intake System?

       Yes

       - Repair or replace as necessary.
       - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

       No

       - Go To 5
5. **CHECK THE EGR SYSTEM**
    1. Inspect the entire EGR System for signs of a leak.

       NOTE: **Soot streaking around the EGR Valve or system components is an indication of a leak in the EGR System.**

       Were any problems found with the EGR System?

       Yes

       - Repair or replace as necessary.
       - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

       No

       - Go To 6
6. **CHECK THE EXHAUST SYSTEM FOR RESTRICTIONS**
    1. Visually inspect the exhaust system for signs of damage which could cause restrictions.

       Were any problems found with the exhaust system?

       Yes

       - Repair as necessary.
       - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

       No

       - Go To 7

7. **COMPARE THE FUEL PRESSURE ACTUAL READING AGAINST FUEL PRESSURE SET POINT**

NOTE: **This test requires two people. One person to test drive the vehicle while a technician observes the scan tool readings.**

1. With the scan tool, select add the fuel rail pressure to a graph.
2. With the scan tool, select add the fuel rail pressure setpoint to a graph.
3. Select merge graphs.
4. With the scan tool, compare the Fuel Pressure Actual reading with the Fuel Pressure Setpoint on the graph, while cranking the engine on a no start, or while test driving the vehicle under various load conditions such as idle, hard acceleration, cruise and deceleration.

NOTE: **The Fuel Pressure reading should closely follow the Fuel Pressure Setpoint reading.**

Does the Actual Fuel Pressure reading follow the Fuel Pressure Desired/Setpoint reading?

Yes

- Go To 8

No

- Perform the CHECKING THE FUEL DELIVERY SYSTEM diagnostic procedure. Refer to **DIAGNOSIS AND TESTING**.
- Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

8. **FUEL INJECTOR**

WARNING: **High Pressure fuel lines deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. This may be as high as 23, 200 PSI (1600BAR). Use extreme caution when inspecting for high pressure fuel leaks. Failure to follow these instructions may result in possible serious or fatal injury.**

WARNING: **Fuel under this amount of pressure can penetrate skin causing possible serious or fatal injury. Inspect for high pressure fuel leaks with a sheet of cardboard. Wear safety goggles and adequate protective clothing when servicing fuel system. Failure to follow these instructions may result in possible serious or fatal injury.**

NOTE: **An injector that sticks open can cause this symptom. A sticking injector will cause the engine to misfire and emit excessive black smoke from the exhaust system.**

1. Start and idle the engine.
2. With the scan tool, perform the Cylinder Fuel Quantity Correction Test.

NOTE: **A problem injector will be indicated by a significant change in correction quantity as compared to the rest of the injectors.**

Are any of the injectors displaying a significant amount of injection quantity correction?

Yes

- Using the service information, remove and inspect the Fuel Injectors for signs of damage or debris that may cause the injector to stick. Sticking injectors may cause the combustion chamber to become black and oil soaked. Replace Injector(s) as necessary.
- Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

No

- Go To 9

9. **CHECKING BOOST PRESSURE**
    1. Turn the ignition on.

        NOTE: **This test requires two people. One person to test drive the vehicle while a technician observes the scan tool readings.**

    2. With the scan tool in Sensors, read and compare the Boost Pressure (PSI) with the Boost Pressure Desired/Setpoint (PSI) while test driving the vehicle under various load conditions such as idle, hard acceleration, and cruise.

        NOTE: **The Boost Pressure reading should directionally follow (trail) the Boost Pressure Desired/Setpoint reading.**

        Does the Boost Pressure reading follow the Boost Pressure Desired/Setpoint reading?

        Yes

        - Go To 10

        No

        - Check the vacuum supply lines and Turbocharger Actuator operation. If any problems are found, repair as necessary. If no problems are found, replace the Turbocharger.
        - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

10. **ENGINE DRIVE BELT/CHAIN**
    1. Use the service information to ensure the Engine Drive Belt/Chain is installed correctly and the camshaft and crankshaft gears are timed correctly.

        Were any problems found?

        Yes

        - Repair as necessary.
        - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

        No

        - Test Complete.

CHECKING THE EXHAUST SYSTEM FOR LEAKS

DIAGNOSTIC TEST

CHECK THE EXHAUST SYSTEM FOR LEAKS

1. Turn the ignition off.
2. Raise and support the vehicle in accordance with the service information. Refer to **HOISTING, STANDARD PROCEDURE** .

WARNING: **The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it has cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operating time.**

3. Connect Exhaust Cone (special tool #8404-ECT, Exhaust Cone, Truck) to Air Pressure Regulator (with hose) W-18-MIL-1146AS.

CAUTION: **The air pressure must not exceed 27.6 kPa (4 psi), otherwise engine damage can occur.**

4. Attach shop air to the air pressure regulator.
5. Adjust the Air Pressure Regulator to 27.6 kPa (4 psi)
6. Insert the exhaust cone into the vehicle tail pipe.
7. If the vehicle is equipped with dual exhaust, use a second Exhaust Cone (special tool #8404-ECT, Exhaust Cone, Truck) equipped with the attached plug and plug one side of the dual exhaust pipe. Pressurize the other as described above.
8. Apply MoparB® Air Leak Detector PN 05191804AA (or an equivalent leak finder liquid) to the following areas:
    - All welded joints from the exhaust manifold to 45.72 cm (18 inches) behind the downstream O2 Sensor
    - O2 Sensor seal points
    - O2 Sensor boss welds
    - Flange/joint connection(s)
    - Exhaust manifold to cylinder head connection(s)
    - EGR solenoid gasket base and tube seal points (if equipped)
9. Watch for the MoparB® Air Leak Detector PN 05191804AA (or the equivalent leak finder liquid) to bubble.
10. Use the following definitions to help determine if system or component repair/replacement is necessary:
    - **Type 1 Leak** is defined as a leak where very small foam like bubbles 1 mm (0.04 of an inch) or less appear. Any Type 1 or greater leaks found in welded joints, O2 sensor seal points or O2 sensor boss welds must be repaired or the component must be replaced.
    - **Type 2 Leak** is defined as a leak where larger bubbles pea size, 8 mm (0.3 of an inch) or greater appear. Any Type 2 or greater leaks found in flange or joint connections, exhaust manifold to cylinder head connections, or EGR gasket and tube seal points must be repaired or the components must be replaced.

Leak Location	Repair required if results at 27.6 kPa (4 psi) reveal bubble size:
Welded joints	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor seal points	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor boss welds	Type 1, 1 mm (0.04 of an inch) or greater
Flange / joint connections	Type 2, 8 mm (0.3 of an inch) or greater
Exhaust Manifold to cylinder head connections	Type 2, 8 mm (0.3 of an inch) or greater
EGR gasket and tube seal points	Type 2, 8 mm (0.3 of an inch) or greater

11. If a leak is found that matches the above definition, repair or replace the component as necessary.
12. Once the repair is complete, repeat the procedure to verify that all leaks have been repaired.

Were any exhaust leaks found?

Yes

- Repair or replace the leaking exhaust parts as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to the appropriate service information .

No

- Test complete.

CHECKING THE ENGINE MECHANICAL SYSTEMS

For a complete wiring diagram, **refer to appropriate SYSTEM WIRING DIAGRAMS article** .

Possible Causes
CHECKING ENGINE MECHANICAL SYSTEMS

DIAGNOSTIC TEST

CHECKING ENGINE MECHANICAL

WARNING: Do not attempt to remove or separate high pressure fuel lines. Failure to follow these instructions may result in possible serious or fatal injury.

NOTE: The following items should be checked as a possible cause of a Driveability or No-Start problem:

- Engine Valve Timing - must be within specification.
- Engine Compression - must be within specifications.
- Camshaft Lobes - check for abnormal wear.
- Camshaft Position Sensor - check the camshaft position sensor tooth for debris and deterioration.
- Crankshaft Position Sensor - check the crankshaft tone wheel for debris and deterioration.
- Engine Exhaust System - must be free of any restriction.
- Engine Drive Chains and Sprockets - must be properly positioned.
- Vacuum System - must operate properly and be free of any vacuum leaks.
- Fuel - must have adequate supply and must be free of contamination (debris, water and gasoline).
- Fuel Injectors - must not be plugged or restricted.
- Fuel Lift Pump - must operate properly (where applicable).
- Fuel Injection Pump - must be producing the correct output volume and pressure.
- Inspect the Fuel Lines, Fuel Filter and Fuel Pressure Relief Valve for signs of restriction and leaks.

NOTE: Check for any Technical Service Bulletins that may relate to the problem.

Are there any problems evident?

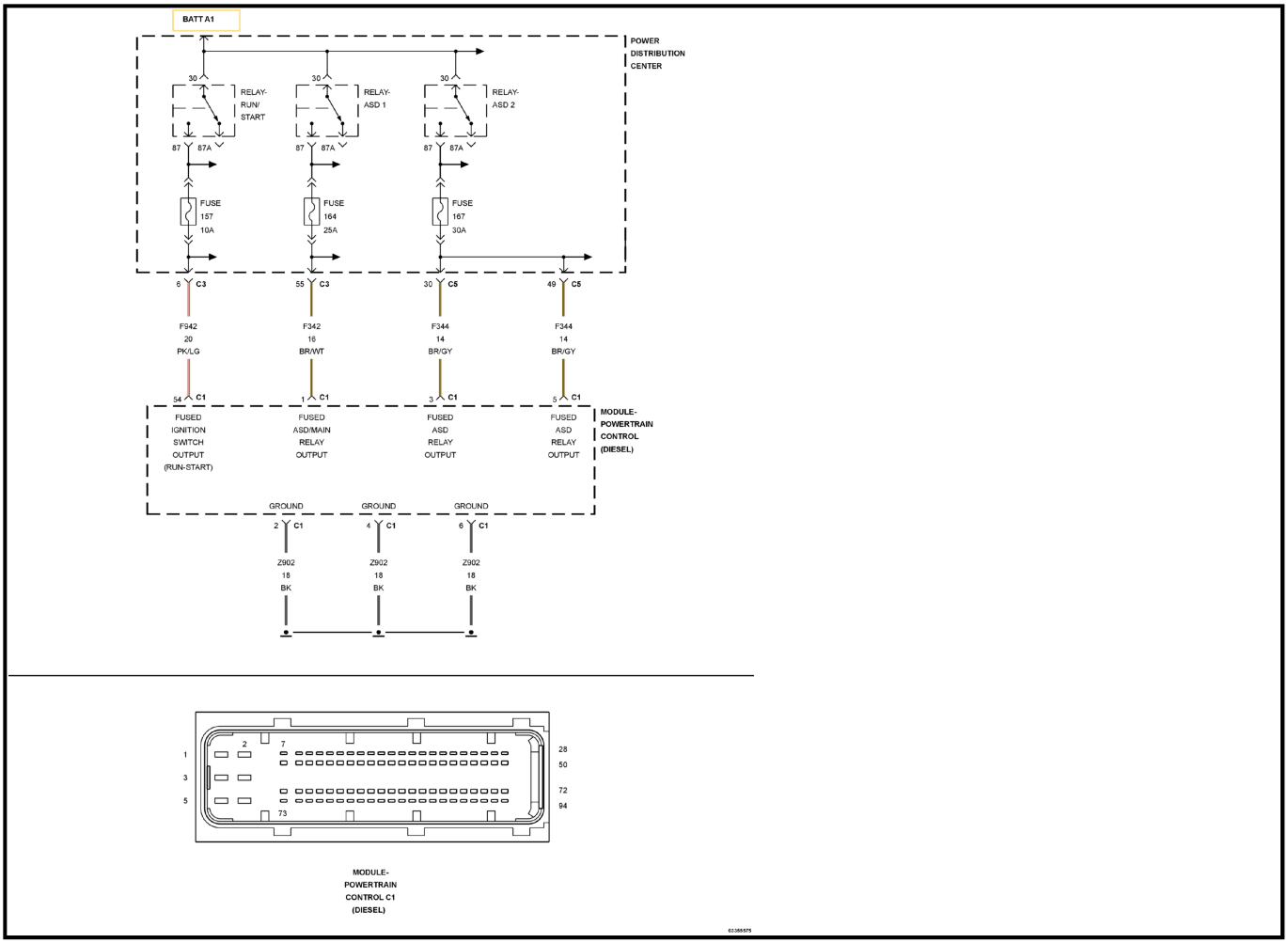
Yes

- Repair as necessary.
- Perform the PCM VERIFICATION TEST - 2.0L DIESEL. Refer to the appropriate service information .

No

- Test Complete.

CHECKING THE PCM POWER AND GROUND CIRCUITS



For a complete wiring diagram, **refer to appropriate SYSTEM WIRING DIAGRAMS article** .

Possible Causes
FUSED ASD RELAY BATTERY SUPPLY CIRCUIT OPEN
(F942) FUSED IGNITION SWITCH OUTPUT (START/RUN) CIRCUIT OPEN
(F942) FUSED IGNITION SWITCH OUTPUT (START/RUN) CIRCUIT SHORTED TO GROUND
(K51) ASD RELAY CONTROL CIRCUIT OPEN/HIGH RESISTANCE
ASD RELAY OUTPUT CIRCUIT(S) OPEN/HIGH RESISTANCE
ASD RELAY OUTPUT CIRCUIT(S) SHORTED TO GROUND
PCM GROUND CIRCUIT(S) OPEN/HIGH RESISTANCE
ASD RELAY

DIAGNOSTIC TEST

1. **PCM GROUND CIRCUIT(S) OPEN**
    1. Turn the ignition off.
    2. Disconnect the PCM C1 harness connector.
    3. Using a 12-volt test light connected to 12 volts, probe each of the PCM ground circuits at the PCM C1 harness connector, cavities 2, 4 and 6.

       Did the test light illuminate for each cavity?

       Yes

       - Go To 2

       No

- Repair the PCM Ground circuit(s) for an open.
- Perform the PCM VERIFICATION TEST - 2.0L DIESEL. Refer to the appropriate service information .

2. **(F942) FUSED IGNITION SWITCH OUTPUT (START/RUN) CIRCUIT OPEN**
    1. Turn the ignition to the Run position.
    2. Using a 12-volt test light connected to ground, check the Fused Ignition Switch Start/Run Output circuit at the PCM C1 harness connector, cavity 54.
    3. Turn the ignition to the Start position.
    4. Using a 12-volt test light connected to ground, check the Fused Ignition Switch Start/Run Output circuit at the PCM C1 harness connector, cavity 54.

       Is the test light on for both ignition switch positions?

       Yes

       - Go To 3

       No

       - Repair the Fused Ignition Switch Start/Run Output circuit for an open.
       - Perform the PCM VERIFICATION TEST - 2.0L DIESEL. Refer to the appropriate service information .
3. **CHECKING THE MAIN RELAY SYSTEM**
    1. Turn the ignition off.
    2. Connect a jumper wire between ground and the (K51) ASD Relay Control circuit at the PCM C1 harness connector, cavity 29.
    3. Turn the ignition on.
    4. Using a 12-volt test light connected to ground, check the Fused ASD Relay Output circuits at the PCM C1 harness connector, cavities 1, 3 and 5.

       Does the test light illuminate brightly for each circuit?

       Yes

       - Test Complete.

       No

       - Go To 4
4. **FUSED ASD RELAY BATTERY SUPPLY CIRCUIT OPEN**
    1. Turn the ignition off.
    2. Remove the ASD Relay.
    3. Turn the ignition on.
    4. Using a 12-volt test light connected to ground, check both Fused ASD Relay Battery Supply circuits (terminal 30) at both ASD Relay connectors.

       Is the test light illuminated and bright?

       Yes

       - Go To 5

       No

- Repair the Fused Main Relay Battery Supply circuit(s) for an open.
- Perform the PCM VERIFICATION TEST - 2.0L DIESEL. Refer to the appropriate service information .

5. **ASD RELAY OUTPUT CIRCUITS OPEN**
    1. Connect a jumper wire between cavity 30 and cavity 87 at the ASD Relay connector.
    2. Using a 12-volt test light connected to ground, check the ASD Relay Output circuit in PCM C1 harness connector, cavities 1, 3 and 5.

       Did the test light illuminate for each circuit?

       Yes

       - Go To 6

       No

       - Repair the Main Relay Output circuit(s) for an open.
       - Perform the PCM VERIFICATION TEST - 2.0L DIESEL. Refer to the appropriate service information .
6. **ASD RELAY**
    1. Turn the ignition off.
    2. Install a known good relay in place of the ASD Relay.
    3. Connect a jumper wire between ground and the ASD Relay Control circuit in PCM C1 harness connector cavity 28.
    4. Turn the ignition on.
    5. Using a 12-volt test light connected to ground, check the Fused ASD Relay Output circuits at the PCM C1 harness connector, cavities 1, 3 and 5.

       Did the test light illuminate brightly for each circuit?

       Yes

       - Replace the ASD Relay.
       - Perform the PCM VERIFICATION TEST - 2.0L DIESEL. Refer to the appropriate service information .

       No

       - Repair the ASD Relay Control circuit for an open.
       - Perform the PCM VERIFICATION TEST - 2.0L DIESEL. Refer to the appropriate service information .

CHECKING THE FUEL DELIVERY SYSTEM

For a complete wiring diagram, **refer to appropriate SYSTEM WIRING DIAGRAMS article** .

Possible Causes
FUEL SYSTEM LEAK
FUEL CONTAMINATION
FUEL LINE RESTRICTIONS
FUEL FILTER RESTRICTED
EXCESSIVE FUEL INJECTOR RETURN FLOW
FUEL LIFT PUMP WIRING
FUEL LIFT PUMP

Possible Causes
FUEL QUANTITY SOLENOID (FQS)
FUEL PRESSURE REGULATOR (FPR)
HIGH PRESSURE DELIVERY PUMP (HPDP)

WARNING: **Follow these safety precautions to reduce the risk of fire and possible serious or fatal injury when performing this test procedure.**

- **Fuel or fuel vapors are highly flammable. A fire could occur if an ignition source is present. Do not expose the fuel or the test equipment used in this procedure to open flames or sparks.**
- **Inhalation of fuel vapors could lead to disorientation and personal injury. Keep the service area well ventilated, or perform this test procedure in an area where there is a building exhaust removal system.**
- **Relieve fuel system pressure before servicing fuel system components.**
- **Use extreme caution when connecting and disconnecting fuel lines.**
- **Considerable fuel leakage may occur when servicing the fuel system. Wear protective eyewear and clothing to protect from fuel splash, and take suitable fuel containment measures.**
- **Wrap a shop towel around the fuel pressure gauge connection to absorb fuel leakage that occurs when connecting the test equipment. Place the towel in an approved container when complete.**
- **Never store fuel in an open container due to the possibility of fire or explosion. Have a dry chemical (Class B) fire extinguisher nearby.**
- **High-pressure fuel lines deliver diesel fuel under extreme pressure from the injection pump to the fuel injectors. This may be as high as 29, 008 psi (2000 bar). Use extreme caution when inspecting for high-pressure fuel leaks. Fuel under this amount of pressure can penetrate skin causing possible serious or fatal injury.**

DIAGNOSTIC TEST

1. **VISUAL INSPECTION**

   NOTE: **For best results, perform Fuel Delivery System test with vehicle at room temperature. Extreme cold temperatures can cause inaccurate results.**

   NOTE: **Make sure that the vehicle has at least 1/8 of a tank of fuel before proceeding with this test.**

   1. Perform a visual inspection of the fuel system for any signs of a fuel leak.

      Were any visual signs of a leak detected?

      Yes

      - Repair as necessary
      - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

      No

      - Go To 2

2. **CHECK THE SUPPLY SIDE FUEL SYSTEM PRESSURE AND VOLUME AT THE HIGH PRESSURE FUEL PUMP**

1. Turn the ignition off.
2. Disconnect the Low Pressure Fuel line at the HPDP inlet.
3. Connect an adapter to the HPDP inlet. (special tool #8978-10, Adapter, Fuel Line)
4. Connect the (special tool #8978A, Decay Tool, Fuel) in-line between the Low Pressure Fuel line and the HPDP adapter.
5. Close the valve to the collection bottle.
6. Turn the ignition on.

NOTE: **If the scan tool routine is unavailable, it may be necessary to cycle the key or crank the engine to get 15 seconds of fuel pump run time.**

7. Run the Fuel Lift Pump for 15 seconds. Document the pressure reading.
   - **Fuel pressure specification - between 4.0 bar (58.0 psi) and 5.9 bar (85.6 psi).**

   NOTE: **If the pressure reading is too low, skip the volume check and go directly to the results.**

8. Open the valve on the Decay tool to a measuring bottle.
9. Run the Fuel Lift Pump for 15 seconds. Document the fuel volume collected.
   - **Fuel volume specification - minimum of 0.75 liters for 15 seconds.**

Is the fuel pressure and volume within the listed specifications?

Fuel Volume and pressure are both within specification

- Go To 8

Fuel Volume is too low

- Go To 5

Fuel pressure is too low

- Go To 4

Fuel pressure is too high

- Go To 3

3. **CHECK THE HIGH PRESSURE FUEL PUMP LEAK BACK**
   1. Turn the ignition off.
   2. Remove the 8978A Fuel Decay Tool and connect the fuel supply line at the High Pressure Fuel Pump.
   3. Disconnect the High Pressure Fuel Pump return line.
   4. Connect the (special tool #8978A, Decay Tool, Fuel) in-line of the HPDP return line.
   5. Crank the engine for 10 - 15 seconds while evaluating the return flow pressure.

   NOTE: **The return flow should be unrestricted. There should be very little if any pressure on the return flow. Less than 2-3 psi.**

   Is the return flow measuring excessive pressure?

   Yes

- Check for a restriction in the return line to the Fuel Tank. If the line is not restricted, replace the Fuel Lift Pump in accordance with the Service Information.
- Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

No

- Replace the High Pressure Fuel Pump in accordance with the Service Information.
- Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

4. **CHECK THE FUEL PRESSURE WITH FUEL DECAY TOOL DEAD HEADED**
    1. Close the fuel system isolation valve on the pressure gauges.
    2. Crank the engine for up to 10 seconds while monitoring the pressure on the inlet gauge.

    NOTE: **With the fuel flow blocked off the pressure should increase to or near the Fuel Lift Pump internally regulated pressure of approximately 116 psi.**

    Did the fuel pressure increase to the max pressure reading on the gauge?

    Yes

    - Replace the High Pressure Fuel Pump in accordance with the Service Information.
    - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

    No

    - Go To 5
5. **CHECK THE SUPPLY PRESSURE AND VOLUME AT FUEL FILTER HOUSING INLET**
    1. Turn the ignition off.
    2. Remove the (special tool #8978A, Decay Tool, Fuel) from the High Pressure Fuel Pump line. Reconnect the fuel line.
    3. Disconnect the quick connect fitting at the Fuel Filter inlet line.
    4. Connect the

    (special tool #8978A, Decay Tool, Fuel)

    and check the fuel supply pressure and volume at the inlet side of the Fuel Filter housing using the same method as step 2.

    - **Fuel pressure specification - between 4.0 bar (58.0 psi) and 5.9 bar (85.6 psi).**
    - **Fuel volume specification - minimum of 0.75 liters for 15 seconds.**

    Is the fuel pressure and volume within the listed specifications?

    Yes

    - Replace the Fuel Filter in accordance with the service information.
    - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

    No

    - Go To 6
6. **CHECK THE VOLTAGE DROP OF THE FUEL PUMP MOTOR CIRCUITS**
    1. Turn the engine off.
    2. Reconnect the fuel lines.

NOTE: **The Fuel Lift Pump Module harness connector should remain connected to the pump during this test step in order to accurately measure the voltage drop.**

3. Using a voltmeter, back probe the Fuel Pump Motor Feed circuit with the positive lead of the meter at the Fuel Lift Pump Module harness connector.
4. Back probe the Fuel Lift Pump Ground circuit with the negative lead of the meter at the Fuel Lift Pump Module harness connector.

CAUTION: **Use only approved connector back probe tools when back probing a connector so as not to cause damage to the terminals or insulation of the connector. Damage to the terminals can cause poor terminal contact or retention. Damage to the insulation can introduce corrosion due to water intrusion.**

5. Turn the ignition on.
6. With a scan tool, actuate the Fuel Lift Pump control to ON (100%).

NOTE: **The voltage should read the same as battery voltage if there is no resistance in the circuit.**

Is the voltage reading the same as battery voltage +/- 0.2 volt?

Yes

- Check the supply line between the Fuel Lift Pump and the Fuel Filter inlet for a restriction. If the line is not restricted, replace the Fuel Lift Pump in accordance with the service information.
- Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

No

- Go To 7

7. **CHECK THE VOLTAGE DROP IN THE FUEL PUMP MOTOR FEED CIRCUIT**
   1. Turn the engine off.
   2. Remove the negative lead of the meter from the Fuel Lift Pump harness connector and connect the lead to a good battery ground.

NOTE: **The Fuel Lift Pump Module harness connector should remain connected.**

   3. Turn the ignition on.
   4. Using the scan tool, actuate the Fuel Lift Pump control to ON (100%).
   5. Measure the voltage of the Fuel Pump Motor Feed circuit at the Fuel Lift Pump harness connector.

   Is the voltage reading the same as battery voltage +/- 0.2 volt?

   Yes

   - Repair the Fuel Lift Pump Ground circuit for an open circuit or high resistance.
   - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

   No

   - Repair the Fuel Pump Motor Feed circuit for an open circuit or high resistance.
   - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

8. **CHECK FUEL QUALITY/CONTAMINATION**
    1. Collect the fuel in the collection bottle in a clear container.
    2. Check the fuel sample for hard particle debris, cloudiness, color, and off odor. Then let the sample sit in a dust free environment for at least 2 hours to look for any separation.

    Were any problems found?

    Yes

    - Repair as needed according to the Diesel Fuel Cleanup portion of the Contamination test procedure. Refer to the appropriate service information .
    - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

    No

    - Go To 9

9. **COMPARE THE FUEL PRESSURE ACTUAL READING AGAINST FUEL PRESSURE SET POINT (TARGET)**

    NOTE: **If the engine will not start skip this step and continue to Refer to 10.**

    1. Verify all fuel lines are connected.
    2. With the scan tool, select and add the fuel rail pressure actual to a graph.
    3. With the scan tool, select and add the fuel rail pressure set point (target) to a graph.
    4. Select merge graphs.

    NOTE: **For best results when viewing the graphs, set the time increment on the graph to 2.0 seconds and the pressure range to 400 bar (5800 psi) for cranking and idle checks. Change the pressure range to 1600 bar (23, 200 psi) before performing the snap acceleration. The Fuel Pressure reading should closely mirror the Fuel Pressure Set point reading.**

    5. While observing the Fuel Pressure Actual reading and the Fuel Pressure Set point on the graph, start the engine and then allow it to idle. After the idle RPM steadies, perform a snap acceleration.
        - **The minimum fuel rail pressure needed to start the engine is 120 bar (1740 psi) However, on a normally operating system, the fuel pressure will typically spike up instantly and peak at approximately 310 bar (4496 psi) during cranking.**
        - **After starting the engine will typically settle to about 280 bar (4061 psi) at idle. The spec. for minimum fuel rail pressure at idle is 230 bar (3336 psi).**
        - **During snap acceleration the pressure reading will typically spike up to between approximately 1500 bar - 1550 bar (21, 756 psi - 22, 481 psi).**

    Was the Fuel Pressure actual reading oscillating excessively above and below the Fuel Pressure Set point reading?

    Yes

    - Install a clear tube in-line in the fuel supply side, as close to the High Pressure Delivery Pump as possible. Check for signs of air bubbles in the fuel supply system. If air bubbles are present, repair the leak causing the air bubbles getting into the supply side system. If no air bubbles are present, Go To
    - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

    No

- Go To 10

10. **FUEL INJECTOR LEAK BACK CHECK**

NOTE: **The fuel injector leak back can be performed as a static test (engine cranking) or dynamic test (engine running). The procedure and specification for both tests are described below. There should be some leak back return flow for each Fuel Injector during the tests below. If any of the containers is empty after performing the procedure, the Fuel Injector is faulty.**

1.
2. Turn the ignition off.
3. Pull up on the center locking tab and disconnect the fuel return hoses at the Fuel Injectors.
4. Connect the Bosch Injector Return Flow Meter to all of the Fuel Injectors. (special tool #10493, Tester, Diesel Return Fuel Quantity)
5. **STATIC PROCEDURE**

NOTE: **For an accurate test result, all of the injectors must be measured at the same time for comparison. The maximum allowable injector return fuel for any injector is 15.0 ml or the 1st graduation of the larger vial in 30 seconds while cranking. Return fuel in excess of this amount would indicate a worn injector in need of replacement.**

1. Crank the engine for 30 seconds.
2. Turn the ignition off.
3. Evaluate the individual return quantities.

- The fuel injector return flow quantity should not exceed 15.0 ml for any Fuel Injector however there should be some fuel in each of the containers.

6. **DYNAMIC PROCEDURE**

NOTE: **For an accurate test result, all of the injectors must be measured at the same time for comparison. The maximum allowable injector return fuel for any injector is 15.0 ml or the 1st graduation of the larger vial in 30 seconds while cranking. Return fuel in excess of this amount would indicate a worn injector in need of replacement.**

1. Start the engine and allow it to idle for 120 seconds or until one of the measuring containers is full.

NOTE: **If the fuel gets to the point of overflowing the larger graduated vial before the end of the test time, abort the test and evaluate the results.**

2. Turn the ignition off.
3. Evaluate the individual return quantities.

- The fuel injector return flow quantity should not exceed 40.0 ml for any Fuel Injector however there should be some fuel in each of the containers.

Is the return fuel quantity collected for any of the Fuel Injectors above specification or empty?

Yes

- Replace the Fuel Injector or Fuel Injectors that were over specification or empty in accordance with the Service Information.

- Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

No

- Go To 11

11. **PRESSURE REGULATOR LEAK BACK CHECK**
    1. Turn the ignition off.
    2. Disconnect the fuel return line at the Fuel Pressure Regulator.
    3. Cap the end of the fuel return line to keep debris from entering the system and fuel from leaking out.
    4. Connect a hose to the end of the Fuel Rail return fitting (next to the Fuel Pressure Regulator).
    5. Place the hose into a measurement bottle.
    6. **STATIC PROCEDURE**
        1. Crank the engine for 10 seconds.
        2. Turn the ignition off.
        3. Measure the quantity of fuel collected in the bottle.
        - The Fuel Pressure Regulator should be closed during cranking and very little or no fuel should be present (below 10 ml).
    7. **DYNAMIC PROCEDURE**
        1. Start the engine and allow it to idle for 10 seconds.
        2. Turn the ignition off.
        3. Measure the quantity of fuel collected in the bottle.
        - The quantity collected should be between 0 ml and 60 ml.

    Select the conclusion that best matches the result of the test:

    Static test result was BELOW 10.0 ml

    - Replace the High Pressure Delivery Pump in accordance with the service information.
    - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

    Static test result was ABOVE 10.0 ml

    - Using the wiring diagram as a guide, check the resistance of the Fuel Pressure Regulator circuits. If the resistance is above 2.0 Ohms, repair the high resistance in the wiring. If the resistance is below 2.0 Ohms, replace the Fuel Rail Assembly in accordance with the service information.
    - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

    Dynamic test result was BELOW 30.0 ml

    - Replace the High Pressure Delivery Pump in accordance with the service information.
    - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

    Dynamic test result was ABOVE 60 ml

    - Using the wiring diagram as a guide, check the resistance of the Fuel Pressure Regulator circuits. If the resistance is above 2.0 Ohms, repair the high resistance in the wiring. If the resistance is below 2.0 Ohms, replace the Fuel Rail Assembly in accordance with the service information.
    - Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

    Dynamic test result was BETWEEN 30 ml and 60 ml

- At this time, the fuel system appears to be operating normally. Check for any Service Bulletins that may apply. It may be necessary to test drive the vehicle under various load conditions while monitoring the fuel pressure actual and target graphs.
- Perform the PCM VERIFICATION TEST. Refer to the appropriate service information .

DIAGNOSIS AND TESTING

CHECKING FOR PROPER ETHANOL LEVEL IN THE GASOLINE

THEORY OF OPERATION

A 100 ml or larger graduated cylinder is recommended for this test because it makes it easier to determine the percentage of ethanol without having to do the math to figure out the percentage. If this is not available, another measuring device can be used or you could use a ruler in a straight-sided glass cup or jar.

The idea is that when you mix water with gas, any ethanol in the gas combines with and joins the water, separating from the fuel. If you know how much water you initially added to the gas, subtract that out of the clear layer at the bottom of your graduated cylinder at the end of the experiment, and the rest of the clear substance is ethanol.

If you are not using the same volumes of fuel and water called out in the test procedure the formula to determine the percentage of ethanol in the fuel is as follows:

- (Clear fluid - Water added = ethanol) divided by (Gas) multiplied by (100) = ethanol percentage
- Example given for a vehicle that has 20% ethanol, Put 5" of gas plus 1" of water in a glass jar and shake well > (2" clear fluid - 1" of water = 1" ethanol), divided by (5" of gas) multiplied by 100) = 20% ethanol

DIAGNOSTIC TEST

1. **PREPARE THE GRADUATED CYLINDER FOR TESTING**

   NOTE: You will be putting a total volume of 110 ml in the graduated cylinder in this test.

   1. Measure the distance between the 90 ml mark and 100 ml mark on the graduated cylinder.
   2. Measure that distance just taken above the 100 ml line and make a mark on the graduated cylinder.

      NOTE: This will be your 110 ml line for the test.

      - Go To 2
2. **FILL THE GRADUATED CYLINDER WITH WATER AND GASOLINE**

   NOTE: It is important to put an accurate amount in during this step in order for the results to be accurate.

   1. Put gasoline into the cylinder up to the 100 ml line.
   2. Add water to the graduated cylinder until the 110 ml line is reached.
      - Go To 3
3. **MIX THE WATER AND GASOLINE**

   NOTE: Securely block the top of the graduated cylinder to prevent spilling during this step.

   1. Thoroughly shake and mix the water and gasoline in the graduated cylinder.
   2. Set the graduated cylinder down and allow the clear water/ethanol mixture to settle to the bottom.

NOTE: **The clear fluid that settles to the bottom will be a water/ethanol mixture. Subtract the 10 ml of water that was added from total volume of the clear fluid and the difference is the ethanol level.**

NOTE: **The maximum ethanol level for an E85 vehicle is 85% alcohol. The maximum ethanol level for a non - E85 vehicle is 10%.**

Is the ethanol level correct for the vehicle?

Yes

- Test complete.

No

- Replace with the proper fuel.

CHECKING THE EXHAUST SYSTEM FOR LEAKS

CHECKING THE EXHAUST SYSTEM FOR LEAKS

DIAGNOSTIC TEST

CHECK THE EXHAUST SYSTEM FOR LEAKS

1. Turn the ignition off.
2. Raise and support the vehicle in accordance with the service information. Refer to **HOISTING, STANDARD PROCEDURE** .

   WARNING: **The normal operating temperature of the exhaust system is very high. Never work around or attempt to service any part of the exhaust system until it has cooled. Special care should be taken when working near the catalytic converter. The temperature of the converter rises to a high level after a short period of engine operating time.**

3. Connect Exhaust Cone (special tool #8404-ECT, Exhaust Cone, Truck) to Air Pressure Regulator (with hose) W-18-MIL-1146AS.

   CAUTION: **The air pressure must not exceed 27.6 kPa (4 psi), otherwise engine damage can occur.**

4. Attach shop air to the air pressure regulator.
5. Adjust the Air Pressure Regulator to 27.6 kPa (4 psi)
6. Insert the exhaust cone into the vehicle tail pipe.
7. If the vehicle is equipped with dual exhaust, use a second Exhaust Cone (special tool #8404-ECT, Exhaust Cone, Truck) equipped with the attached plug and plug one side of the dual exhaust pipe. Pressurize the other as described above.
8. Apply MoparB® Air Leak Detector PN 05191804AA (or an equivalent leak finder liquid) to the following areas:
   - All welded joints from the exhaust manifold to 45.72 cm (18 inches) behind the downstream O2 Sensor
   - O2 Sensor seal points
   - O2 Sensor boss welds
   - Flange/joint connection(s)
   - Exhaust manifold to cylinder head connection(s)
   - EGR solenoid gasket base and tube seal points (if equipped)

9. Watch for the MoparB® Air Leak Detector PN 05191804AA (or the equivalent leak finder liquid) to bubble.
10. Use the following definitions to help determine if system or component repair/replacement is necessary:
    - **Type 1 Leak** is defined as a leak where very small foam like bubbles 1 mm (0.04 of an inch) or less appear. Any Type 1 or greater leaks found in welded joints, O2 sensor seal points or O2 sensor boss welds must be repaired or the component must be replaced.
    - **Type 2 Leak** is defined as a leak where larger bubbles pea size, 8 mm (0.3 of an inch) or greater appear. Any Type 2 or greater leaks found in flange or joint connections, exhaust manifold to cylinder head connections, or EGR gasket and tube seal points must be repaired or the components must be replaced.

Leak Location	Repair required if results at 27.6 kPa (4 psi) reveal bubble size:
Welded joints	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor seal points	Type 1, 1 mm (0.04 of an inch) or greater
O2 Sensor boss welds	Type 1, 1 mm (0.04 of an inch) or greater
Flange / joint connections	Type 2, 8 mm (0.3 of an inch) or greater
Exhaust Manifold to cylinder head connections	Type 2, 8 mm (0.3 of an inch) or greater
EGR gasket and tube seal points	Type 2, 8 mm (0.3 of an inch) or greater

11. If a leak is found that matches the above definition, repair or replace the component as necessary.
12. Once the repair is complete, repeat the procedure to verify that all leaks have been repaired.

Were any exhaust leaks found?

Yes

- Repair or replace the leaking exhaust parts as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

No

- Test complete.

CHECKING THE FUEL DELIVERY SYSTEM (HARD START)

Possible Causes
FUEL DELIVERY SYSTEM LEAKING OR DAMAGED
RESTRICTED FUEL SUPPLY LINE
FUEL PUMP INLET STRAINER PLUGGED
FUEL PUMP CONTROL OUTPUT CIRCUIT OPEN
FUEL INJECTOR(S)
FUEL PUMP MODULE

WARNING: **Follow these safety precautions to reduce the risk of fire and possible serious or fatal injury when performing this test procedure.**

- **Fuel or fuel vapors are highly flammable. A fire could occur if an ignition source is present. Do not expose the fuel or the test equipment used in this procedure to open flames or sparks.**
- **Inhalation of fuel vapors could lead to disorientation and personal injury. Keep the service area well ventilated, or perform this test procedure in an area where there is a building exhaust removal system.**

- **Relieve fuel system pressure before servicing fuel system components.**
- **Use extreme caution when connecting and disconnecting fuel lines.**
- **Considerable fuel leakage may occur when servicing the fuel system. Wear protective eye wear and clothing to protect from fuel splash, and take suitable fuel containment measures.**
- **Wrap a shop towel around the fuel pressure gauge connection to absorb fuel leakage that occurs when connecting the test equipment. Place the towel in an approved container when complete.**
- **Never store fuel in an open container due to the possibility of fire or explosion. Have a dry chemical (Class B) fire extinguisher nearby.**

DIAGNOSTIC TEST

1. **CHECK THE FUEL DELIVERY SYSTEM FOR LEAKS AND DAMAGE**
    1. Visually inspect the fuel delivery system lines and connections for external leaks and damage.

       Is the system leaking or damaged?

       Yes

       - Repair or replace as necessary.
       - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

       No

       - Go To 2
2. **CHECK FUEL PUMP OPERATION**

    NOTE: **Diagnose any Fuel Pump Relay or Fuel Pump Control Module DTCs before continuing with this procedure.**

    1. Turn the ignition on, engine not running.
    2. Start the engine or crank the engine to allow the Fuel Pump to be commanded on.

       NOTE: **It may be necessary to use a mechanics stethoscope in the next step.**

    3. Listen for fuel pump operation at the Fuel Tank.

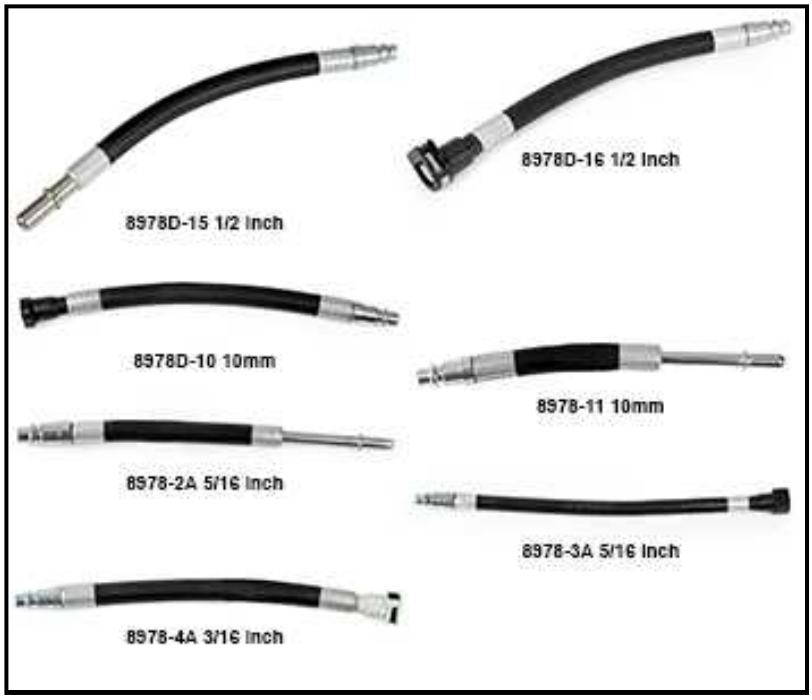
       Does the Fuel Pump operate?

       Yes

       - Go To 3

       No

       - Check the power and ground circuits to the Fuel Pump Assembly. If the circuits test good, replace the Fuel Pump Assembly in accordance with the Service Information.
       - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .
3. **INSTALL APPROPRIATE FUEL LINE ADAPTERS/FITTING FROM THE GAS AND DIESEL FUEL PRESSURE/DECAY TESTER 8978A**



1. Turn the ignition off.

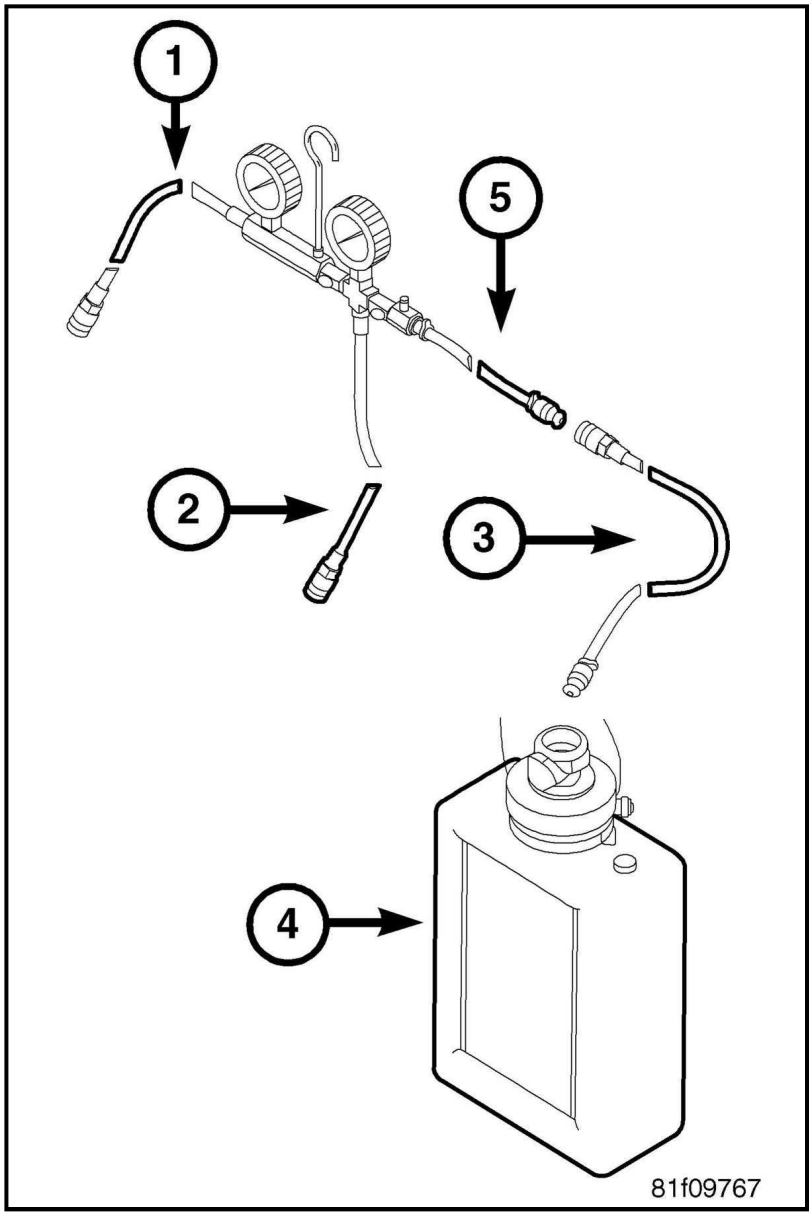
WARNING: **The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting, or line, the fuel system pressure must be released. Failure to follow these instructions can result in possible serious or fatal injury.**

2. Release the fuel system pressure. Refer to the appropriate service information .
3. Disconnect the fuel rail supply line connector between the fuel supply line and the fuel rail.
4. Install the appropriate Fuel Line Adapters/Fitting from the Gas and Diesel Fuel Pressure/Decay Tester (special tool #8978A, Decay Tool, Fuel).

Proceed

- Go To 4

4. **INSTALL THE FUEL PRESSURE GAUGE ASSEMBLY**



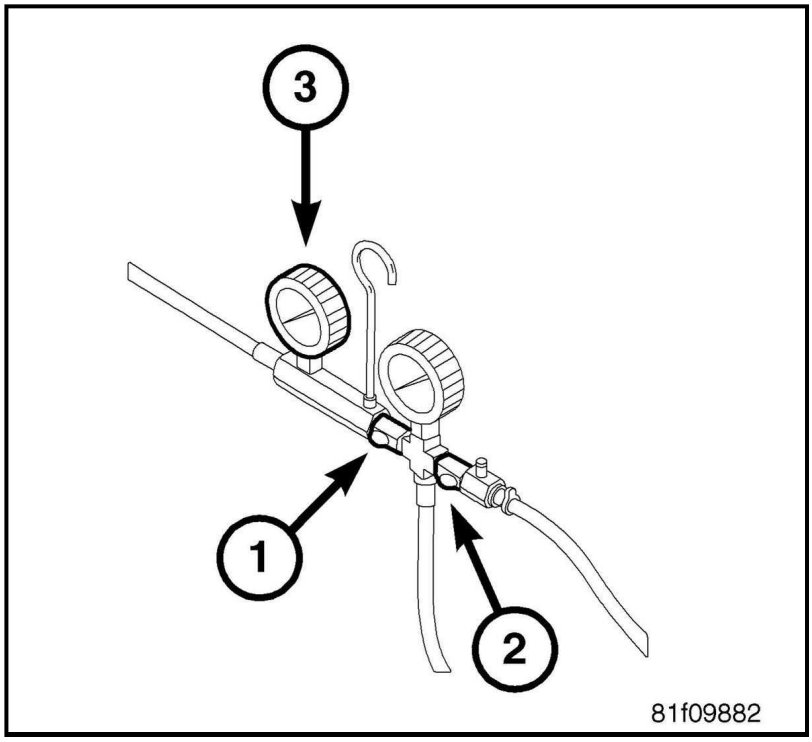
1. Connect the (special tool #8978A, Decay Tool, Fuel), with the Fuel Inlet Hose (1) toward the Fuel tank side and the Fuel Outlet Hose (2) toward the fuel rail side of the system using the Fuel Line Adapters/Fitting as needed.
2. Connect special tool Drain Extension Hose 535680 (3) to the Fuel Pressure Gauge Assembly Drain Hose (5).
3. Connect Reservoir Assembly 534960 (4) to Drain Extension Hose 535680 (3).

WARNING: **To reduce the risk of fire and possible serious or fatal injury, place Reservoir Assembly 534960 (4) on the floor and out of the way so that it is not a trip hazard.**

Proceed

- Go To 5

5. **CHECK THE FUEL PRESSURE**



1. Perform the following procedure to purge air from the system:
   - Open the Fuel System Isolation Valve (1).
   - Close the Flow Test Valve (2).
   - Ignition on, engine not running.
   - With the scan tool, actuate the Fuel Pump.
   - Open the Flow Test Valve (2) for 10 seconds, then close the Valve.
   - **CAUTION: Stop All Actuations.**
   - Turn the ignition off.
   - Disconnect, empty and then reconnect the Reservoir Assembly.
2. Turn the ignition on.
3. With the scan tool, actuate the Fuel Pump.

NOTE: **On vehicles equipped with a Fuel Pump Control Module and PWM Fuel Pump, actuate the Fuel Pump at 80%.**

4. Read the Fuel Pressure Gauge (3) and record the reading.

NOTE: **The fuel pressure specification for all engines, not including an SRT-4, is 407 kPa +/- 34 kPa (58.0 psi +/- 3.0 psi). An SRT-4 engine fuel pressure specification is 552 kPa +/- 34 kPa (80.0 psi +/- 3.0 psi).**

Choose a conclusion that best matches your fuel pressure reading.

Below Specification

- Go To 10

Within Specification

- Go To 6

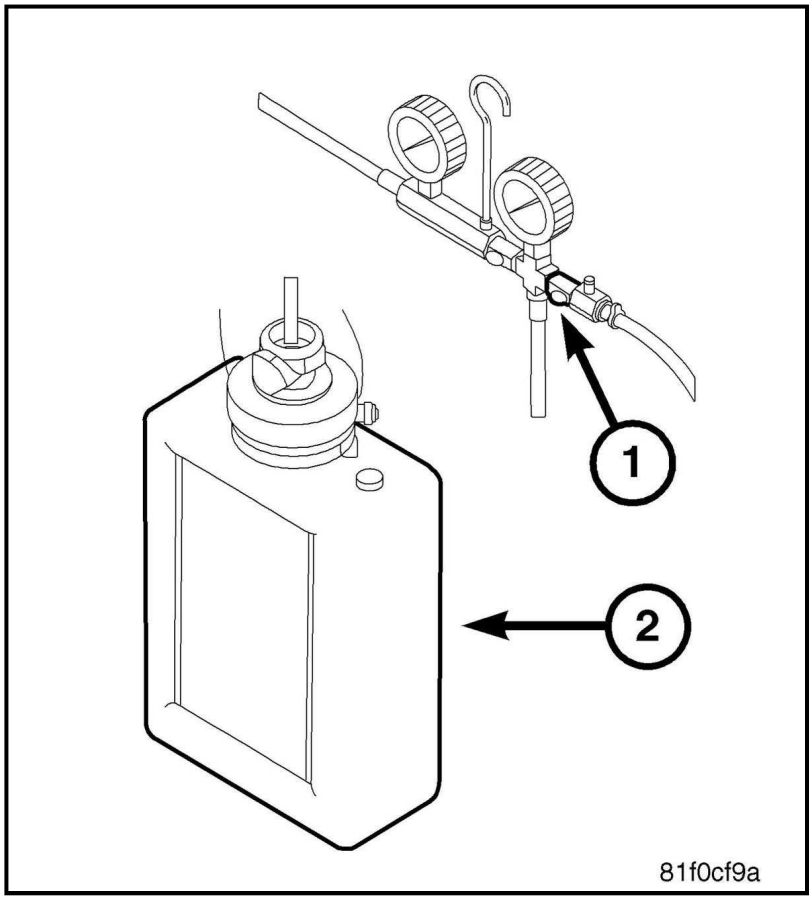
Above Specification

- Replace the fuel filter/fuel pressure regulator.

- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

CAUTION: **Stop all actuation tests before proceeding.**

6. **CHECK THE FUEL DELIVERY SYSTEM OUTPUT**



WARNING: **The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting, or line, the fuel system pressure must be released. Failure to follow these instructions can result in possible serious or fatal injury.**

1. With the scan tool, continue to actuate the fuel pump.
2. Open the Flow Test Valve (1) for 20 seconds, then close the Valve.

CAUTION: **Stop all actuation tests before proceeding.**

3. Turn the ignition off.
4. Measure the amount of fuel in the Reservoir Assembly (2). The fuel output specification is ml/s X 20 seconds = fuel flow in ml.

FUEL FLOW		
ENGINE	**ml/s**	**ml per 20 Seconds**
4 Cylinder and 6 Cylinder	20.8333	417
8 Cylinder	38.88889	778
SRT-4	50	1000
10 cylinder	55.5	1110

Does the amount of fuel in the reservoir meet or exceed the specification?

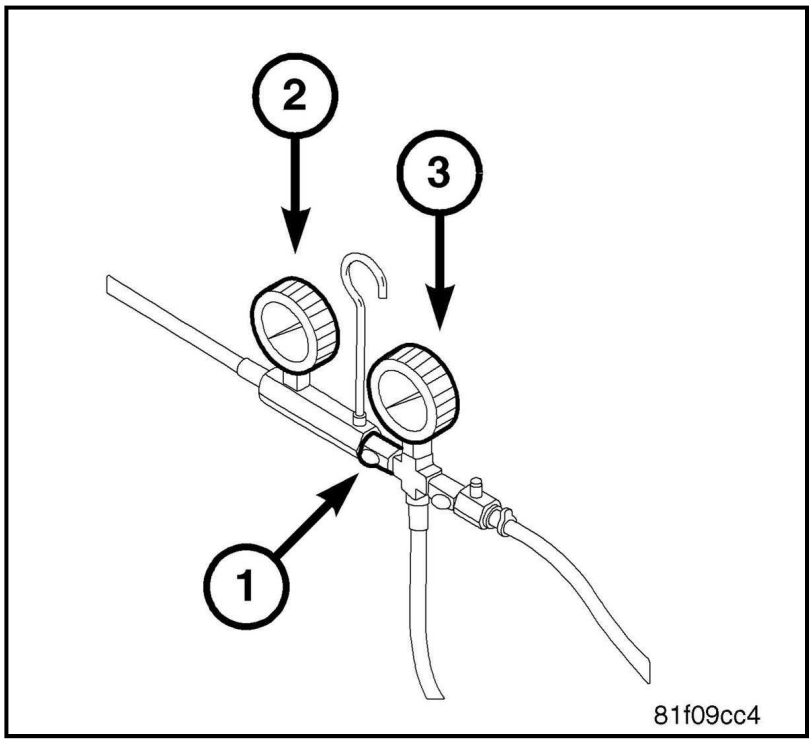
Yes

- Go To 7

No

- Go To 8

7. **CHECK THE FUEL DELIVERY SYSTEM FOR LEAK DOWN**



WARNING: **The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting, or line, the fuel system pressure must be released. Failure to follow these instructions can result in possible serious or fatal injury.**

NOTE: **If the engine is hot and heat soaking, the fuel pressure in the system could actually increase when the engine is off. This could lead to incorrect results and hide an issue. Using a fan to cool the fuel rail can help keep the pressure stabilized and make the testing more accurate.**

1. Ignition on, engine not running.
2. With the scan tool, actuate the fuel pump.
3. Close the Fuel System Isolation Valve (1).

CAUTION: **Stop all actuation tests before proceeding.**

4. Turn the ignition off and then wait five minutes before proceeding.
5. Read the Fuel Inlet (2) and Fuel Outlet (3) Pressure Gauges. The pressure should not drop more than 10 psi on either gauge.

Does the fuel pressure drop more than 10 psi?

Yes - On Fuel Inlet Gauge (2)

NOTE: **If equipped with Saddle tank, refer to Service information for verification of fuel pressure regulator location.**

- Replace the Fuel Pump Assembly.

- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

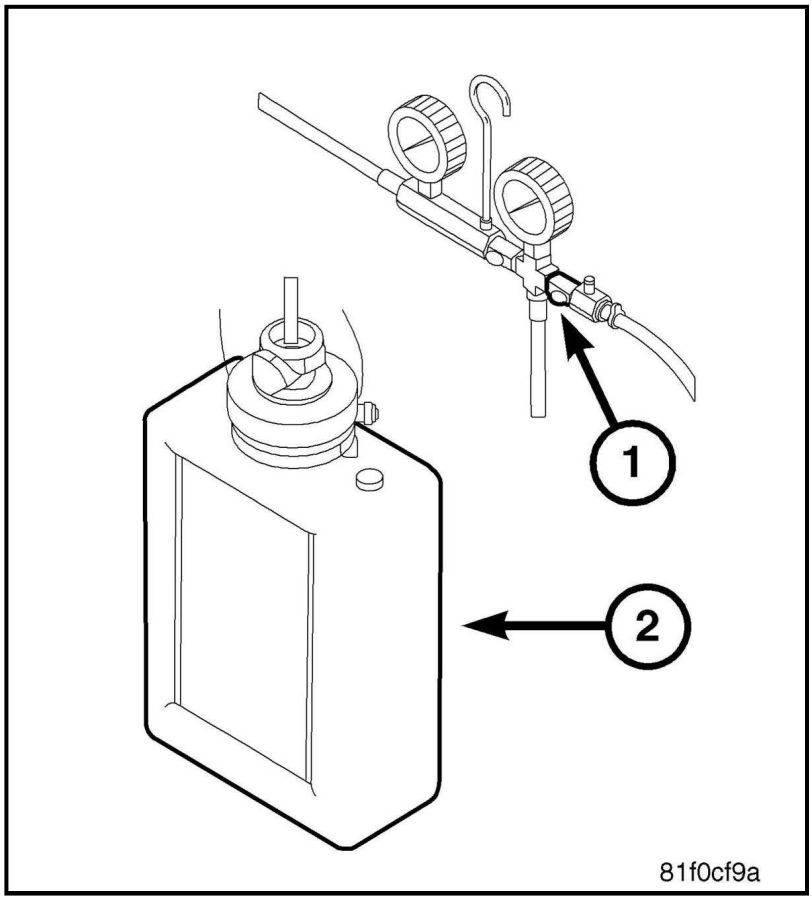
Yes - On Fuel Outlet Gauge (3)

- Replace the leaking Fuel Injector(s).
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

No

- If directed here by another test, return to that test. Otherwise, test complete.

8. **CHECK FOR RESTRICTED FUEL SUPPLY LINE**



WARNING: **The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.**

1. Turn the ignition off.
2. Disconnect the Fuel Pressure Decay Tester.
3. Raise the vehicle on a hoist, and disconnect the fuel pressure line at the Fuel Pump Assembly.
4. Install the Fuel Pressure Decay Tester between the fuel supply line and the Fuel Pump Assembly.
5. Again, purge air from the system.
6. Ignition on, engine not running.
7. With the scan tool, actuate the Fuel Pump.
8. Open the Flow Test Valve (1) for 20 seconds, then close the Valve.

CAUTION: **Stop all actuation tests before proceeding.**

9. Turn the ignition off.

10. Measure the amount of fuel in the Reservoir Assembly (2). The fuel output specification is ml/s X 20 seconds = fuel flow in ml.

FUEL FLOW		
ENGINE	**ml/s**	**ml per 20 Seconds**
4 Cylinder and 6 Cylinder	20.8333	417
8 Cylinder	38.88889	778
SRT-4	50	1000
10 cylinder	55.5	1110

Does the amount of fuel in the reservoir meet or exceed the specification?

Yes

- Repair/replace fuel supply line as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

No

- Go To 9

CAUTION: **Stop all actuation tests before proceeding.**

9. **CHECKING THE FUEL INLET STRAINER**

WARNING: **The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in possible serious or fatal injury.**

1. Turn the ignition off.
2. Remove the Fuel Pump Assembly and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

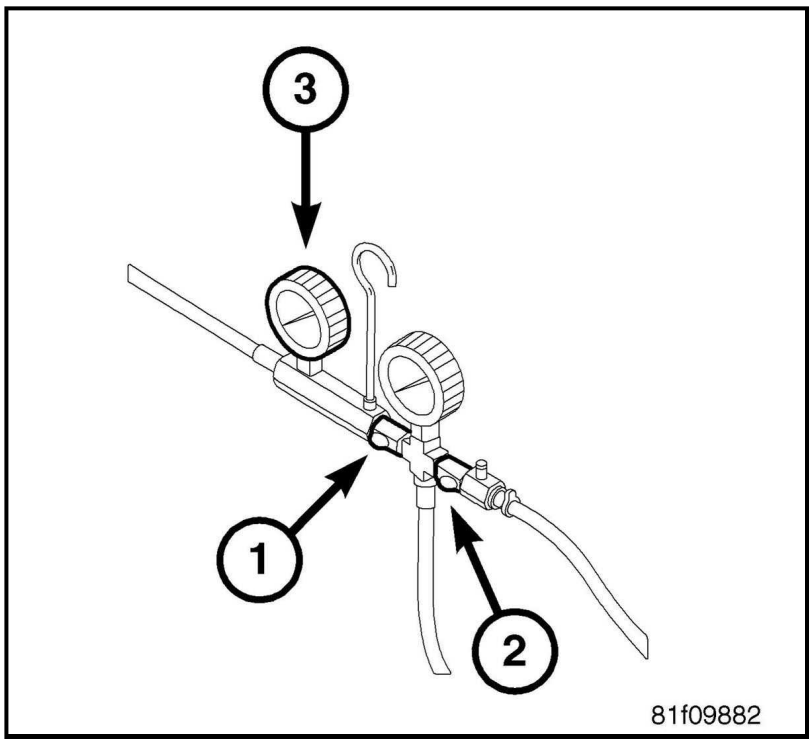
Yes

- Replace the Fuel Pump Inlet Strainer.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

No

- Replace the Fuel Pump Assembly.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

10. **CHECK FOR RESTRICTED FUEL SUPPLY LINE**



WARNING: **The fuel system is under a constant pressure even with the engine off. Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released.**

1. Turn the ignition off.
2. Disconnect the Fuel Pressure Decay Tool.
3. Raise the vehicle on a hoist, and disconnect the fuel pressure line at the Fuel Pump Assembly.
4. Install the Fuel Pressure Decay Tool between the fuel supply line and the Fuel Pump Assembly.
5. Again, purge air from the system.
6. Turn the ignition on.
7. With the scan tool, actuate the Fuel Pump.

NOTE: **On vehicles equipped with a PWM Fuel Pump, actuate the Fuel Pump at or above 80%.**

8. Read the Fuel Pressure Gauge (3) and record the reading.

NOTE: **The fuel pressure specification for all engines, including a Non SRT-4 is 407 kPa +/- 34 kPa (59 psi +/- 5 psi). SRT-4 fuel pressure specification is 552 kPa +/- 34 kPa (80 psi +/- 5 psi).**

Is the fuel pressure now within specification?

Yes

- Repair/replace fuel supply line as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to the appropriate service information .

No

- Go To 11

CAUTION: **Stop all actuation tests before proceeding.**

11. **CHECKING FUEL INLET STRAINER**

WARNING: **The fuel system is under a constant pressure (even with the engine off). Before testing or servicing any fuel system hose, fitting or line, the fuel system pressure must be released. Failure to follow these instructions can result in possible serious or fatal injury.**

1. Turn the ignition off.
2. Remove the Fuel Pump Assembly and inspect the Fuel Inlet Strainer.

Is the Fuel Inlet Strainer plugged?

Yes

- Replace the Fuel Pump Inlet Strainer.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to the appropriate service information .

No

- Replace the Fuel Pump Assembly.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to the appropriate service information .

CHECKING THE IGNITION COIL OPERATION

DIAGNOSTIC TEST

1. **IGNITION COIL WIRING OR CONNECTORS**

NOTE: **Diagnose and repair any ignition coil, Camshaft Position (CMP) Sensor, or Crankshaft Position (CKP) Sensor DTCs before proceeding with this test.**

1. Turn the ignition off.
2. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Ignition Coil for the cylinder being tested and the PCM.
3. Look for any chafed, pierced, pinched, or partially broken wires.
4. Look for broken, bent, pushed out or corroded terminals.

NOTE: **If the vehicle is not equipped with the coil on plug ignition system, check the resistance of the ignition wire(s) before checking the cylinder with a spark tester. The resistance should be below 10k ohms.**

Were any problems found?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the Powertrain Verification Test. Refer to the appropriate service information .

No

- Go To 2

2. **VERIFY ENGINE SPEED INPUT FROM THE CKP SENSOR**
   1. Turn the ignition on.

2. With a scan tool, navigate to Data Display and monitor the engine speed.
3. Crank the engine for up to 10.0 seconds.

Was there any engine speed input detected on the scan tool during cranking?

Yes

- Go To 3

No

- Verify that the CKP Sensor is properly mounted. Replace the CKP Sensor if no mounting issues are found.
- Perform the Powertrain Verification Test. Refer to the appropriate service information .

3. **IGNITION COIL OPERATION**

NOTE: **Inspect the ignition coil for damage, carbon tracking on the coil or a damaged spark plug insulator boot. If a problem is found, replace the ignition coil.**

NOTE: **Some coils must have a spark tester installed on both sides of the coil during the following test. During the test, each side of the coil should output a crisp blue spark that is able to jump the gap of the spark tester.**

NOTE: **On some engines, it may be necessary to remove the upper intake manifold to access the ignition coils. Once the ignition coil has been removed, the intake must be installed in order to crank the engine. Move the ignition coil harness connector through the slots in the upper intake and then connect the coil to the harness connector. Secure the upper intake to the lower intake in accordance with the Service Information.**

1. Turn the ignition off.
2. If the vehicle is equipped with coil on plug ignition system, remove the ignition coil for the cylinder being tested.
3. Disconnect the fuel injector harness connector for the cylinder being tested.
4. For coil on plug ignition systems, install a spark tester(s) on the ignition coil, otherwise install the spark tester to the ignition wire.
5. While cranking the engine observe the spark coming from the spark tester.

NOTE: **A crisp blue spark that jumps the gap of the spark tester should be generated.**

Is good spark present?

Yes

- Go To 8

No

- Go To 4

4. **CHECK THE ASD RELAY OUTPUT CIRCUIT FOR AN OPEN/HIGH RESISTANCE**

1. Turn the ignition off.
2. Disconnect the Ignition Coil harness connector.
3. Turn the ignition on.

4. With the scan tool, actuate the ASD Relay to on.
5. Using a 12 volt test light connected to ground, check the ASD Relay output circuit at the ignition coil harness connector.

NOTE: **The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

Is the test light illuminated and bright during the actuation?

Yes

- Go To 5

No

- Repair the ASD Relay output circuit for an open or high resistance.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

5. **IGNITION COIL**

WARNING: **When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in possible serious or fatal injury.**

1. Using a 12 volt test light connected to 12 volts, check the Ignition Coil Control circuit for the cylinder being tested in the Ignition Coil harness connector.
2. Crank the engine for five seconds.

NOTE: **The test light should blink each time the circuit is activated by the PCM.**

Does the test light blink each time the circuit is activated by the PCM?

Yes

- Replace the Ignition Coil in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

No

- Go To 6

6. **CHECK THE IGNITION COIL CONTROL CIRCUIT FOR AN OPEN/HIGH RESISTANCE**
1. Measure the resistance of the Ignition Coil control circuit for the cylinder being tested between the Ignition Coil harness connector and the PCM harness connector.

Is the resistance below 3.0 Ohms?

Yes

- Go To 7

No

- Repair the Ignition Coil Control circuit for an open or high resistance.

- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

7. **POWERTRAIN CONTROL MODULE (PCM)**
    1. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Ignition Coil for the cylinder being tested and the PCM.
    2. Look for any chafed, pierced, pinched, or partially broken wires.
    3. Look for broken, bent, pushed out or corroded terminals.
    4. Perform any Service Bulletins that may apply.

    Were any problems found?

    Yes

    - Repair as necessary.
    - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

    No

    - Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION** .
    - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

8. **SPARK PLUG(S)**
    1. Turn the ignition off.
    2. Remove the spark plug.
    3. Inspect the spark plug for any of the following conditions:
        - Cracks or damage
        - Carbon tracking
        - Foreign material
        - Gap not within specification
        - Loose or broken electrode
        - Fuel fouled

    NOTE: **Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.**

    Were any problems found?

    Yes

    - Replace the spark plug.
    - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

    No

    - Test Complete.

CHECKING THE OXYGEN SENSOR OPERATION

DIAGNOSTIC TEST

1. **TEST FOR A RICH O2 SENSOR CONDITION**
    1. Start the engine.
    2. Allow the engine to reach normal operating temperature.
    3. Disconnect engine vacuum lines to create a lean running condition.
    4. With the engine vacuum lines disconnected monitor the O2 Sensor graph on the scan tool.

    Did the O2 Sensor graph show a change from rich to lean?

    Yes

    - Check for any of the following conditions/mechanical problems that can cause a O2 Sensor stuck rich condition:
    - AFTERMARKET equipment or software effecting emissions.
    - AIR INDUCTION SYSTEM - must be free from blockage.
    - ENGINE VALVE TIMING - must be within specifications.
    - ENGINE COMPRESSION - must be within specifications.
    - ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
    - ENGINE PCV SYSTEM - must flow freely.
    - FUEL - must be free of contamination.
    - FUEL INJECTOR - plugged, stuck open or restricted injector.

    No

    - Replace the Oxygen Sensor in accordance with the Service Information.
    - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .
2. **TEST FOR A LEAN O2 SENSOR CONDITION**
    1. Start the engine.
    2. Allow the engine to reach normal operating temperature.
    3. Create a rich running condition.
    4. With the rich running condition, monitor the O2 Sensor graph on the scan tool.

    Did the O2 Sensor graph show a change from lean to rich?

    Yes

    - AFTERMARKET equipment or software effecting emissions.
    - AIR INDUCTION SYSTEM - must be free from leaks.
    - ENGINE VACUUM - must be at least 13 inches in neutral.
    - ENGINE VALVE TIMING - must be within specifications.
    - ENGINE COMPRESSION - must be within specifications.
    - ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
    - ENGINE PCV SYSTEM - must be free of leaks and flow freely.
    - POWER BRAKE BOOSTER - no internal vacuum leaks.
    - FUEL - must be free of contamination.
    - FUEL INJECTOR - plugged or restricted injector; control wire not connected to correct injector.

    No

    - Replace the Oxygen Sensor in accordance with the Service Information.

- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

CHECKING THE MAP SENSOR OPERATION

DIAGNOSTIC TEST

1. **MAP SENSOR WIRING OR CONNECTORS**

NOTE: **Diagnose and repair any MAP Sensor circuit DTCs before proceeding with this test.**

NOTE: **Diagnose and repair any sensor supply or system voltage DTCs before proceeding with this test.**

1. Turn the ignition off.
2. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the MAP Sensor and the PCM.
3. Look for any chafed, pierced, pinched, or partially broken wires.
4. Look for broken, bent, pushed out or corroded terminals.
5. Turn the ignition on.
6. Monitor the scan tool data relative to the sensor and wiggle test the wiring and connectors.
7. Look for the data to change or for a DTC to set during the wiggle test. If necessary, check each sensor circuit for high resistance or a shorted condition.

Were any problems found?

Yes

- Repair as necessary in accordance with the Service Information.
- Perform the Powertrain Verification Test. Refer to **POWERTRAIN VERIFICATION TEST** .

No

- Go To 2

2. **MAP VACUUM/BAROMETRIC PRESSURE**
   1. With a scan tool, read the Barometric Pressure.

NOTE: **The Barometric Pressure should be approximately equal to the actual barometric pressure. If necessary, compare the Barometric Pressure value of the tested vehicle to the value of a known good vehicle of a similar make and model.**

   2. Connect a vacuum gauge to a manifold vacuum source.
   3. Start the engine.

NOTE: **If the engine will not idle, maintain a constant rpm above idle.**

WARNING: **When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in possible serious or fatal injury.**

   4. With the scan tool, read the MAP Sensor value.

NOTE: **The scan tool reading for MAP vacuum should be within 1" of the vacuum gauge reading.**

Were any problems found?

Yes

- Go To 4

No

- Go To 3

3. **CHECK THE MAP SENSOR VOLTAGE**
    1. With the scan tool, monitor the MAP Sensor signal voltage.
    2. With the engine idling in neutral or park, snap the throttle.

NOTE: **The MAP Sensor signal voltage should change from below 2.0 volts at idle to above 3.5 volts at wide open throttle.**

Were any problems found?

Yes

- Go To 4

No

- Test complete.

4. **CHECK THE 5-VOLT SUPPLY CIRCUIT FOR HIGH RESISTANCE**
    1. Turn the ignition off.
    2. Using a voltmeter, perform a voltage drop test on the MAP Sensor 5-Volt Supply circuit between the MAP Sensor harness connector and the PCM harness connector. Make sure the voltmeter leads are connected so that positive polarity is displayed on the voltmeter.

WARNING: **When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in possible serious or fatal injury.**

    3. Start the engine.

Is the voltage reading below 0.1 volt?

Yes

- Go To 5

No

- Repair the 5-Volt Supply circuit for excessive resistance.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

5. **CHECK THE MAP SENSOR SIGNAL CIRCUIT FOR HIGH RESISTANCE**
    1. Turn the ignition off.
    2. Using a voltmeter, perform a voltage drop test on the MAP Sensor Signal circuit between the MAP Sensor harness connector and the PCM harness connector. Make sure the voltmeter leads are

connected so that positive polarity is displayed on the voltmeter.

WARNING: **When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in possible serious or fatal injury.**

3. Start the engine.

   Is the voltage reading below 0.1 volt?

   Yes

   - Go To 6

   No

   - Repair the MAP Sensor Signal circuit for excessive resistance.
   - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

6. **CHECK THE MAP SENSOR GROUND CIRCUIT FOR HIGH RESISTANCE**
   1. Turn the ignition off.
   2. Using a voltmeter, perform a voltage drop test on the MAP Sensor Ground circuit between the MAP Sensor harness connector and the PCM harness connector. Make sure the voltmeter leads are connected so that positive polarity is displayed on the voltmeter.

      WARNING: **When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts, or fan. Do not wear loose clothing. Failure to follow these instructions can result in possible serious or fatal injury.**

   3. Start the engine.

      Is the voltage below 0.1 volt?

      Yes

      - Go To 7

      No

      - Repair the MAP Sensor Ground circuit for excessive resistance.
      - Perform the Powertrain Verification Test. Refer to **POWERTRAIN VERIFICATION TEST** .

7. **MAP SENSOR**
   1. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the MAP Sensor and the Powertrain Control Module (PCM).
   2. Look for any chafed, pierced, pinched, or partially broken wires.
   3. Look for broken, bent, pushed out or corroded terminals.
   4. Perform any Service Bulletins that may apply.

      Were any problems found?

      Yes

      - Repair as necessary.

- Perform the Powertrain Verification Test. Refer to **POWERTRAIN VERIFICATION TEST** .

No

- Replace the MAP Sensor in accordance with the Service Information.
- Perform the Powertrain Verification Test. Refer to **POWERTRAIN VERIFICATION TEST** .

CHECKING THE PCM POWER AND GROUND CIRCUITS - 3.6L

PCM POWERS AND GROUNDS TABLE

PCM POWERS AND GROUNDS			
FUSED B (+)	**GROUND**	**FUSED ASD CONTROL OUTPUT**	**FUSED IGNITION SWITCH OUTPUT**
CONNECTOR PCM C1 PIN: 96 CIRCUIT ID: A106	CONNECTOR PCM C1 PIN: 52 CIRCUIT ID: Z909	CONNECTOR PCM C1 PIN: 74 CIRCUIT ID: F342	CONNECTOR PCM C1 PIN: 23 CIRCUIT ID: F942
B	CONNECTOR PCM C1 PIN: 53 CIRCUIT ID: Z909	CONNECTOR PCM C1 PIN: 75 CIRCUIT ID: F342	B
B	CONNECTOR PCM C1 PIN: 72 CIRCUIT ID: Z909	CONNECTOR PCM C1 PIN: 76 CIRCUIT ID: F342	B

DIAGNOSTIC TEST

1. **INSPECT THE PCM WIRING OR CONNECTORS**
    1. Turn the ignition off.
    2. Using the wiring diagram/schematic as a guide, inspect the wiring and each connector at the PCM.
    3. Look for any chafed, pierced, pinched, or partially broken wires.
    4. Look for broken, bent, pushed out or corroded terminals.

    Were any problems found?

    Yes

    - Repair as necessary.
    - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

    No

    - Go To 2
2. **CHECK THE (A106) FUSED B (+) CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
    1. Disconnect the component harness connector to isolate the 12.0 volt supply circuit.
    2. Connect the positive lead of the load test tool to the 12.0 volt supply circuit at the component harness connector (A). **Note:** refer to the diagram below.
    3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.

4. Ensure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.

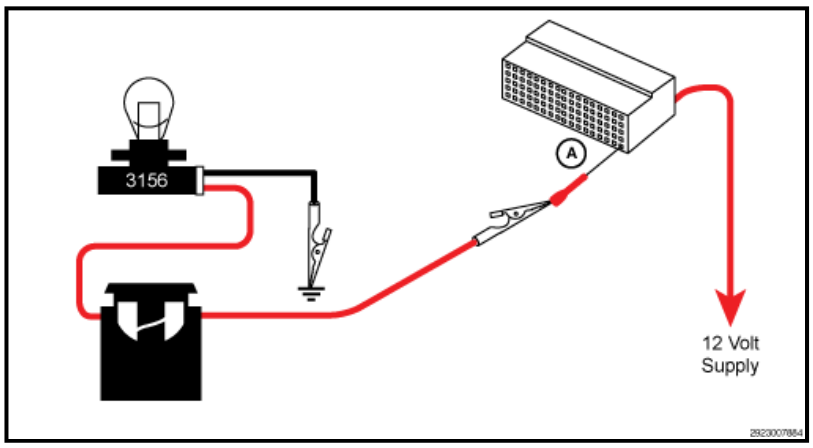
NOTE: **Note: Why load test a circuit? A load test is used to determine if a circuit is capable of carrying the amperage needed to perform properly. The 3156 bulb in the load tool illustrated, is a simple but effective method of testing circuit functionality. A 3156 Bulb has approximately 6.0 Ohms of resistance when the bulb is powered and draws approximately 2.0 amps of current. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .**

NOTE: **Note: A 12-volt test light can be substituted for the load test tool, but only if the test light draws enough current to effectively load test the circuit. Many high impedance test lights draw very little amperage (less than 0.1 amps) and are not reliable to load test a circuit. To perform a proper load test of a circuit, the tool being used should draw more than approximately 0.75 amps.**

NOTE: **Note: Why perform a Voltage Drop Test? To verify with certainty there is not any resistance in the circuit being tested, perform a simple voltage drop test across the 3156 bulb of the load test tool. To do so perform the following:**

1. **Connect the leads of a DVOM to the alligator clips on the load test tool while the load test tool is connected in series with the circuit.**
2. **Compare the voltage drop across the bulb to the voltage reading across the Battery terminals.**
3. **The voltage dropped across the bulb should be equal to the voltage reading across the Battery terminals if there is no resistance in the circuit being tested.**

Example: 2.0 Ohms of resistance in the circuit being tested will cause the voltage measurement across the bulb to be 25% less than when compared to Battery voltage. The reason for this is that the 2.0 Ohms in the circuit makes up 25% of the total circuit resistance of 8.0 Ohms. Read the CIRCUIT LOAD TESTING PROCEDURE for information on building a simple load test tool and for additional load testing information and alternative methods of load testing or voltage drop testing a circuit. Refer to CIRCUIT LOAD TESTING PROCEDURES .



CAUTION: **Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.**

6. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adapter, GPEC Diagnostic) to the appropriate PCM harness connector.

NOTE: **Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.**

Is the load test bulb illuminated and bright?

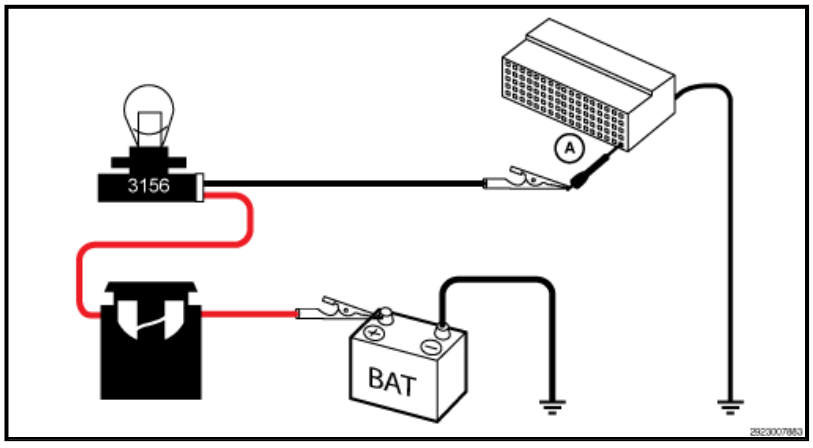
Yes

- Go To 3

No

- Repair the (A106) Fused B (+) circuit for an open or high resistance. If the fuse is found to be open, check the circuit for a short to ground.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

3. **CHECK THE (Z909) GROUND CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
   1. Disconnect the component harness connector to isolate the ground circuit.
   2. Connect the positive lead of the load test tool to the positive side of the Battery.
   3. Connect the negative lead of the load test tool to the ground circuit at the component harness connector (A). **Note:** refer to the diagram below.
   4. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.



CAUTION: **Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.**

5. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adapter, GPEC Diagnostic) to the appropriate PCM harness connector.

NOTE: **Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.**

Is the load test bulb illuminated and bright?

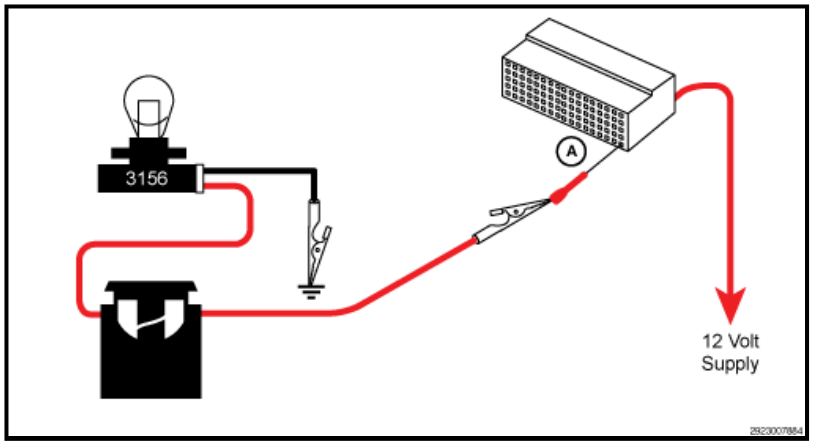
Yes

- Go To 4

No

- Repair the (Z909) Ground circuit for an open or high resistance.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

4. **CHECK THE (F942) FUSED IGNITION SWITCH OUTPUT CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
   1. Disconnect the component harness connector to isolate the 12.0 volt supply circuit.
   2. Connect the positive lead of the load test tool to the 12.0 volt supply circuit at the component harness connector (A). **Note:** refer to the diagram below.
   3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
   4. Ensure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
   5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.



CAUTION: **Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.**

6. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adapter, GPEC Diagnostic) to the appropriate PCM harness connector.

NOTE: **Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.**

Is the load test bulb illuminated and bright?

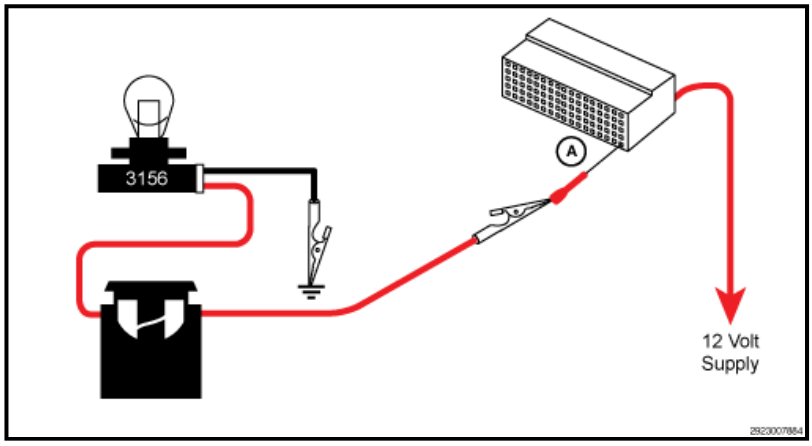
Yes

- Go To 5

No

- Repair the (F942) Fused Ignition Switch Output circuit for an open or high resistance. If the fuse is found to be open, check the circuit for a short to ground.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

5. **CHECK THE (F342) FUSED AUTO-SHUTDOWN CONTROL OUTPUT CIRCUIT FOR HIGH RESISTANCE BY LOAD TESTING THE CIRCUIT**
   1. Disconnect the component harness connector to isolate the 12.0 volt supply circuit.
   2. Connect the positive lead of the load test tool to the 12.0 volt supply circuit at the component harness connector (A). **Note:** refer to the diagram below.
   3. Connect the negative lead of the load test tool to the ground circuit of the Battery or a good chassis ground.
   4. Ensure that the circuit being tested is being powered on. If the 12.0 volt circuit being tested is an ignition feed for example, the ignition must be on. If testing an output from a relay, verify that the relay is energized and on.
   5. The bulb on the load test tool should be illuminated and bright if there is no resistance in the circuitry.



CAUTION: **Do not probe the PCM harness connectors. Probing the PCM harness connectors will damage the PCM terminals resulting in poor terminal to pin connection. Install the GPEC Diagnostic Adaptor to perform the diagnosis.**

   6. If it is necessary to probe a terminal at a PCM harness connector, connect the (special tool #10436, Adapter, GPEC Diagnostic) to the appropriate PCM harness connector.

NOTE: **Compare the brightness of the bulb in the load test tool to that of a direct connection to Battery.**

Is the load test bulb illuminated and bright?

Yes

- Test complete.

No

- Repair the (F342) Fused Auto-Shutdown Control Output circuit for an open or high resistance. If the fuse is found to be open, check the circuit for a short to ground.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

ENGINE CRANKS BUT DOES NOT START

POSSIBLE CAUSES

Possible Causes
SYSTEM DTCS PRESENT
POWERTRAIN FUSES OPEN
FUEL DELIVERY SYSTEM
FUEL CONTAMINATION
FAULTY CRANKSHAFT POSITION SENSOR
INADEQUATE SPARK
POWERTRAIN POWER AND GROUND CIRCUIT(S) OPEN OR HIGH RESISTANCE
ENGINE MECHANICAL PROBLEM

Always perform the PRE-DIAGNOSTIC TROUBLESHOOTING PROCEDURE before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. **NO START PRE-TEST**

NOTE: **Verify no faults are set in the Occupant Restraint Controller. If codes are present, they may be the cause of a No Start condition.**

NOTE: **The following list of items must be checked before continuing with any no start tests.**

1. The Battery must be fully charged and in good condition. A low charged Battery may produce invalid test results. If the Battery is low, charge the Battery and then attempt to start the vehicle by cranking the engine for 15.0 seconds, three consecutive times. This will allow any DTCs to set that may have been erased due to a dead Battery.
2. Try to communicate with the PCM using a scan tool. If communication between the scan tool and PCM is not allowed, inspect fuses. If the fuses appear OK, for the No Response from PCM diagnostic procedure. Refer to **DIAGNOSIS AND TESTING** .
3. Read the PCM DTCs with the scan tool. If any DTCs are present, they must be repaired before continuing with any other No Start diagnostic tests. for the related P-code that is reported by the PCM. Refer to .
4. Make sure that the Communication Bus is functional. Attempt to communicate with other modules on the CAN C bus. If you are unable to establish communication with any modules, for the Diagnostic CAN C diagnostic procedures. Refer to **DIAGNOSIS AND TESTING** .
5. The vehicles security module must be operating properly. Check for DTCs that may be stored in the vehicles security module. Repair the DTCs before continuing.
6. If no DTCs are found, using the scan tool, select Clear PCM (BATT Disconnect).
7. Crank the engine several times. Using the scan tool, read DTCs. If a DTC is present go to and perform the appropriate diagnostic procedure before continuing.

Were any problems found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

No

- Go To 2

2. **OPEN FUSE**
    1. Check for any open fuses that may be related to the No Start condition.

    Are any of the fuses open?

    Yes

    - Check the related circuit(s) for a short to ground and replace the open fuse.
    - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

    No

    - Go To 3

3. **IGNITION SYSTEM**
    1. Perform the CHECKING THE IGNITION COIL OPERATION test procedure. Refer to **DIAGNOSIS AND TESTING**.

    Was the No Start condition solved after following the CHECKING THE IGNITION COIL OPERATION diagnostic procedure?

    Yes

    - Test Complete.

    No

    - Go To 4

4. **FUEL DELIVERY**
    1. Verify that the Fuel tank is not empty before continuing.
    2. Perform the CHECKING THE FUEL DELIVERY SYSTEM test procedure. Refer to **DIAGNOSIS AND TESTING**.

    Was the No Start condition solved after following the CHECKING THE FUEL DELIVERY SYSTEM diagnostic procedure?

    Yes

    - Test Complete.

    No

    - Go To 5

5. **CHECK THE PCM POWERS AND GROUNDS**
    1. Perform the CHECKING THE POWERS AND GROUNDS test procedure. Refer to **DIAGNOSIS AND TESTING**.

Were any issues found?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

No

- Go To 6

6. **ENGINE MECHANICAL**
    1. Check for any of the following conditions/mechanical problems:
        - ENGINE COMPRESSION - must be within specifications.
        - ENGINE EXHAUST SYSTEM - must be free of any restrictions or leaks.
        - ENGINE VALVE TIMING - must be within specifications, check for broken timing components

    Are there any engine mechanical problems?

    Yes

    - Repair as necessary.
    - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

    No

    - Go To 7

7. **POWERTRAIN CONTROL MODULE (PCM)**
    1. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the related Sensors and the Powertrain Control Module (PCM).
    2. Look for any chafed, pierced, pinched or partially broken wires.
    3. Look for broken, bent, pushed out or corroded terminals. Verify that there is good pin to terminal contact in the related Sensors and the Powertrain Control Module connectors.
    4. Refer to any Technical Service Bulletins (TSBs) that may apply.

    Were there any problems found?

    Yes

    - Repair as necessary.
    - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

    No

    - Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information. Refer to **MODULE, POWERTRAIN CONTROL (PCM), REMOVAL AND INSTALLATION** .
    - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

START AND STALL CONDITION

Possible Causes
CURRENT PCM DTCS
CURRENT VEHICLE SECURITY MODULE DTCS
RESTRICTED EXHAUST
ENGINE MECHANICAL
VACUUM LEAKS
CRACKED SPARK PLUG(S), CARBON TRACKING SPARK PLUG AND COIL
CARBON BUILDUP ON THROTTLE BODY
FUEL CONTAMINATION
FUEL DELIVERY
VALVE TIME OUT OF SPECIFICATION
5-VOLT SUPPLY CIRCUIT
SENSOR GROUND CIRCUIT
CMP SIGNAL CIRCUIT
CAMSHAFT POSITION SENSOR (CMP)
CKP SIGNAL CIRCUIT
CRANKSHAFT POSITION SENSOR (CKP)
FLEX PLATE (TARGET WHEEL)
CMP AIRGAP
CKP AIRGAP
POWERTRAIN CONTROL MODULE (PCM)

Always perform the Pre-Diagnostic Troubleshooting procedure before proceeding. Refer to the appropriate service information .

DIAGNOSTIC TEST

1. **CHECKING DIAGNOSTIC TROUBLE CODES (DTCS)**

NOTE: **Before continuing with this procedure, review the Technical Service Bulletins (TSBs) that may be related to a start and stall condition.**

NOTE: **It may be helpful to review Secondary Indicators, if a two trip DTC is present, drive the vehicle to try and mature the DTC to Active.**

1. Ignition on, engine not running.
2. Using a scan tool, read DTCs.

Are there any DTCs present in any other module?

Yes

- Perform the appropriate diagnostic procedure for the active DTC.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

No

- Go To the appropriate service information

2. **SPARK PLUG(S)**

NOTE: **Inspect the ignition coil for damage, carbon tracking on the coil or a damaged spark plug insulator boot. If a problem is found, replace the ignition coil.**

1. Turn the ignition off.
2. Remove the spark plug.
3. Inspect the spark plug for any of the following conditions:
    - Cracks or damage
    - Carbon tracking
    - Foreign material
    - Gap not within specification
    - Loose or broken electrode

    NOTE: **Lightly tap the bottom of the spark plug on a solid surface. The electrode in the spark plug should not move.**

    Were any problems found?

    Yes

    - Replace the spark plug.
    - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

    No

    - Go To 3

3. **POSSIBLE CAUSES OF START AND STALL CONDITION**
    1. The following items should be checked as a possible cause for a start and stall condition:
        - Perform any Technical Service Bulletins (TSBs) that may apply to the symptom.
        - The exhaust system must be free of any restrictions.
        - The engine compression must be within specifications.
        - The engine valve timing must be within specifications.
        - The engine must be free from vacuum leaks.
        - The throttle body must be free of carbon buildup and dirt.
        - Cracked spark plugs, carbon track on spark plugs, spark plug wires if applicable, coil and coil boot.

        Do any of the above conditions exist?

        Yes

        - Repair as necessary.
        - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

        No

        - Go To 4

4. **FUEL PUMP DELIVERY**
    1. Verify that the Fuel tank is not empty before continuing.
    2. Refer to **DIAGNOSIS AND TESTING** and perform the Checking the Fuel Delivery System diagnostic procedure.

        Was the No Start condition solved after following the above diagnostic test?

        Yes

- Test Complete.

No

- Check for contamination/water in the fuel. Make sure the fuel being used in this vehicle meets OEM Fuel Requirement, perform the appropriate service procedure.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

5. **5 VOLT SUPPLY CIRCUIT VOLTAGE (CMP)**
   1. Turn the ignition off.
   2. Disconnect the Camshaft Position Sensor connector.
   3. Turn the ignition on.
   4. Measure the voltage of the 5 Volt Supply circuit in the Camshaft Position Sensor harness connector.

      Is the voltage 5.0 Volts?

      Yes

      - Go To 6

      No

      - Repair the 5 Volt Supply.

        NOTE: **A battery disconnect must be performed to clear the Cam Crank Synchronization Events.**

      - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .
6. **SENSOR GROUND CIRCUIT TEST**
   1. Turn the ignition off.
   2. Using a 12-volt test light connected to 12 Volts, probe the Sensor Ground circuit in the Camshaft Position Sensor harness connector.

      NOTE: **The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

      Is the test light illuminated and bright?

      Yes

      - Go To 7

      No

      - Repair the Ground Circuit.

        NOTE: **A battery disconnect must be performed to clear the Cam Crank Synchronization Events.**

      - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .
7. **CMP SIGNAL**
   1. Turn the ignition on.

2. Measure the voltage of the CMP Signal circuit in the Camshaft Position Sensor harness connector.

   Is the voltage between 4.7 and 5.0 Volts?

   Yes

   - Go To 11

   No

   - Go To 8

8. **CMP SIGNAL CIRCUIT SHORTED TO VOLTAGE**
   1. Turn the ignition off.
   2. Disconnect the Powertrain Control Module harness connector.
   3. Turn the ignition on.
   4. Measure the voltage of the CMP Signal circuit in the Camshaft Position Sensor harness connector.

      Is there any voltage present?

      Yes

      - Repair the CMP Signal circuit for a short to voltage.

        NOTE: **A battery disconnect must be performed to clear the Cam Crank Synchronization Events.**

      - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

      No

      - Go To 9

9. **CMP SIGNAL CIRCUIT SHORTED TO GROUND**
   1. Turn the ignition off.
   2. Measure the resistance between ground and the CMP Signal circuit in the Camshaft Position Sensor harness connector.

      Is the resistance above 100 Ohms?

      Yes

      - Go To 10

      No

      - Repair the CMP Signal circuit for a short to ground.

        NOTE: **A battery disconnect must be performed to clear the Cam Crank Synchronization Events.**

      - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

10. **CMP SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE**
    1. Measure the resistance of the CMP Signal circuit between the Camshaft Position Sensor harness connector and the PCM harness connector.

Is the resistance below 5.0 Ohms?

Yes

- Go To 22

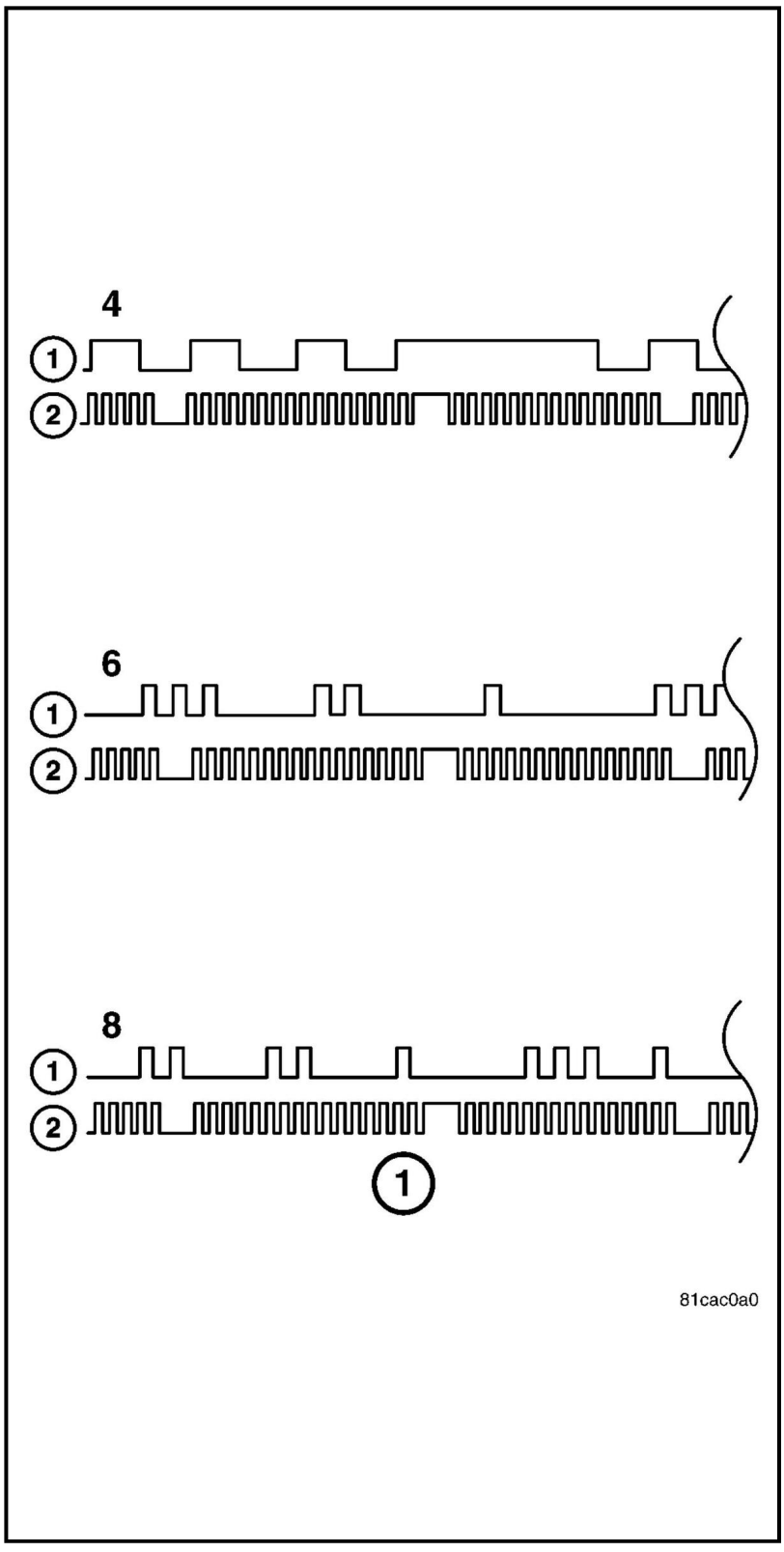
No

- Repair the CMP Signal circuit for an open circuit or excessive resistance.

  NOTE: **A battery disconnect must be performed to clear the Cam Crank Synchronization Events.**

- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

11. **CAMSHAFT POSITION SENSOR SIGNAL**

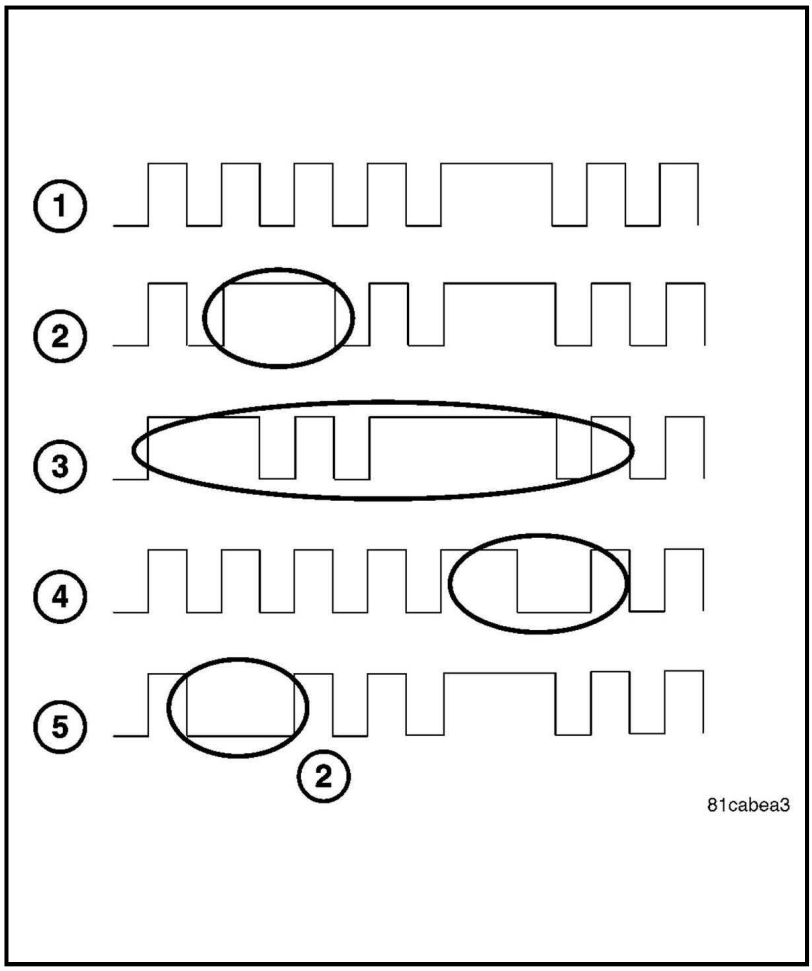


1. Turn the ignition off.
2. **Figure 1 is a depiction of typical scope patterns of the Cam (1) and Crank (2) sensors for 4, 6 and 8 cylinder engines. The square wave patterns are uniform and are identical to one another. The patterns must be evenly spread apart and at the same height. The larger gap pattern (signature) after the shorter wave forms are used for cylinder identification (Crank signal) and the distance between the series of slots (trigger) on the camshaft pulley (cam signal). Any variation of the pattern will indicate an issue with the sensor, wiring or trigger (target) wheel.**
3. With a lab scope, probe the CMP Signal circuit at the PCM harness connector.

WARNING: **When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear**

loose clothing. Failure to follow these instructions may result in possible serious or fatal injury.

4. Start and allow the engine to run.
5. Observe the lab scope screen.



6. Compare the scope pattern with the ones in Figure 2.
7. 1. Pattern indicates a clean (good) square wave form that is identical to what the cam and crank should be. The square wave patterns are uniformed and are identical to one another.
8. 2. Two pulses joined together in the same spot on target. Indicates damage to the target (trigger) on the flexplate or broke tooth, runout in the target or large airgap between the sensor and the target wheel.
9. 3. Wide airgap or intermittent connection.
10. 4. Early signature, predominately at high speed. Large airgap between the sensor and the target wheel.
11. 5. Missed pulse. Possible burr or light damage to target or incorrect lateral position of the crank sensor to target (trigger).

NOTE: **If any of the above (except pattern 1) is displayed on the lab scope repair as necessary.**

Was the square wave found to match any of the above except pattern 1?

Yes

- Repair as necessary.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

No

- Replace the Camshaft Position Sensor in accordance with the Service Information.

NOTE: **A battery disconnect must be performed to clear the Cam Crank Synchronization Events.**

- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

12. **5 VOLT SUPPLY CIRCUIT VOLTAGE (CKP)**
    1. Turn the ignition off.
    2. Disconnect the Crankshaft Position Sensor connector.
    3. Turn the ignition on.
    4. Measure the voltage of the 5 Volt Supply circuit in the Crankshaft Position Sensor harness connector.

    Is the voltage 5.0 Volts?

    Yes

    - Go To 13

    No

    - Repair the 5 Volt Supply for an open circuit or excessive resistance.

    NOTE: **A battery disconnect must be performed to clear the Cam Crank Synchronization Events.**

    - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

13. **SENSOR GROUND CIRCUIT TEST**
    1. Turn the ignition off.
    2. Using a 12-volt test light connected to 12 Volts, check the Sensor Ground circuit in the Crankshaft Position Sensor harness connector.

    NOTE: **The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

    Is the test light illuminated and bright?

    Yes

    - Go To 14

    No

    - Repair the Ground Circuit for an open circuit or excessive resistance.

    NOTE: **A battery disconnect must be performed to clear the Cam Crank Synchronization Events.**

    - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

14. **CKP SIGNAL**
    1. Turn the ignition on.

2. Measure the voltage of the CKP Signal circuit in the Crankshaft Position Sensor harness connector.

   Is the voltage between 4.7 and 5.0 Volts?

   Yes

   - Go To 18

   No

   - Go To 15

15. **CKP SIGNAL CIRCUIT SHORTED TO VOLTAGE**
    1. Turn the ignition off.
    2. Disconnect the Powertrain Control Module (PCM) harness connector.
    3. Turn the ignition on.
    4. Measure the voltage of the CKP Signal circuit in the Crankshaft Position Sensor harness connector.

       Is there any voltage present?

       Yes

       - Repair the CKP Signal circuit for a short to voltage.

         NOTE: A battery disconnect must be performed to clear the Cam Crank Synchronization Events.

       - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

       No

       - Go To 16

16. **CKP SIGNAL CIRCUIT SHORTED TO GROUND**
    1. Turn the ignition off.
    2. Measure the resistance between ground and the CKP Signal circuit in the Crankshaft Position Sensor harness connector.

       Is the resistance above 100 Ohms?

       Yes

       - Go To 17

       No

       - Repair the CKP Signal circuit for a short to ground.

         NOTE: A battery disconnect must be performed to clear the Cam Crank Synchronization Events.

       - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

17. **CKP SIGNAL CIRCUIT OPEN OR HIGH RESISTANCE**
    1. Measure the resistance of the CKP Signal circuit between the Camshaft Position Sensor harness connector and the PCM harness connector.

Is the resistance below 5.0 Ohms?

Yes

- Go To 22

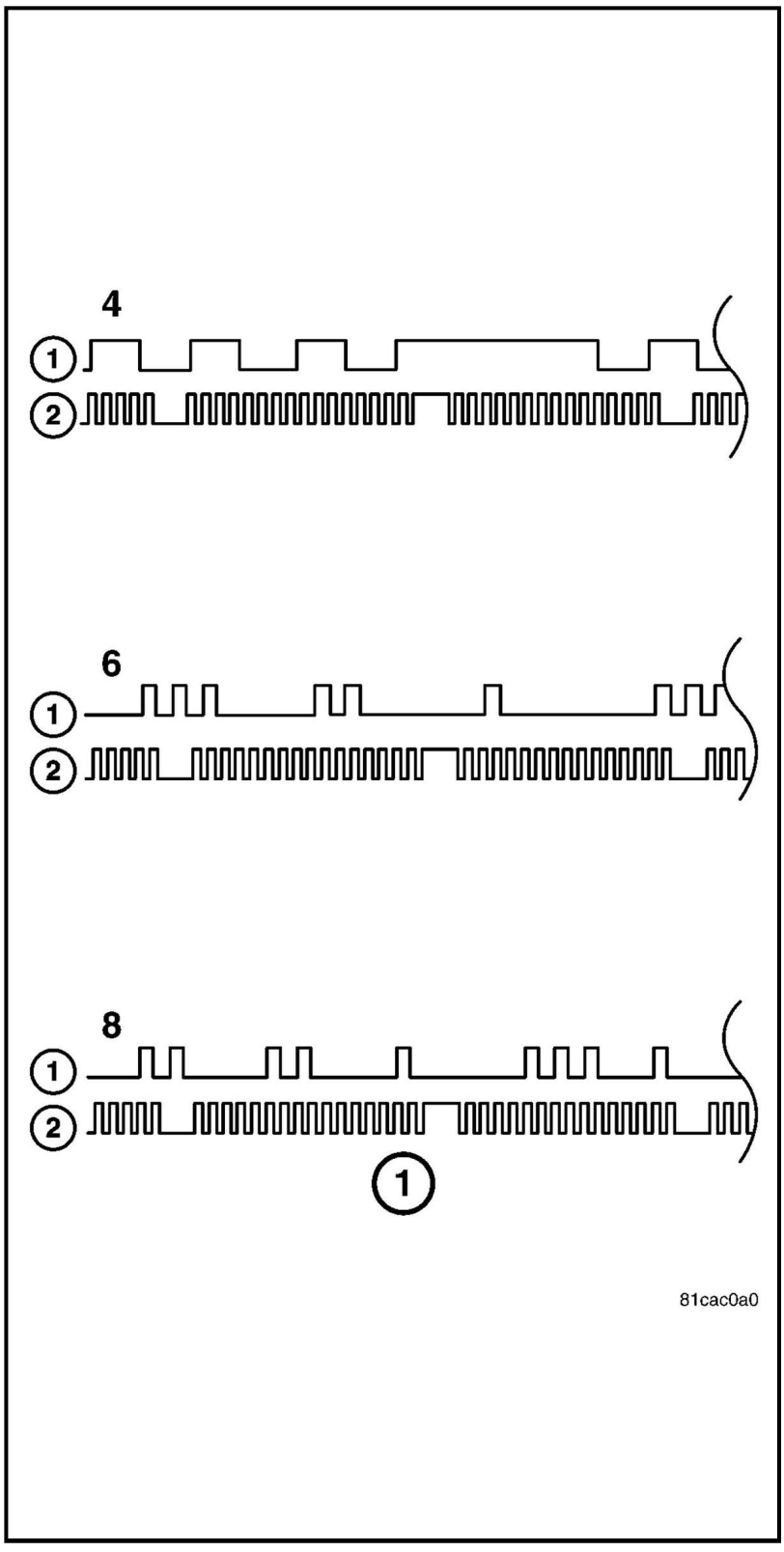
No

- Repair the CKP Signal circuit for an open circuit or high resistance.

  NOTE: **A battery disconnect must be performed to clear the Cam Crank Synchronization Events.**

- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

18. **CRANKSHAFT POSITION SENSOR SIGNAL**

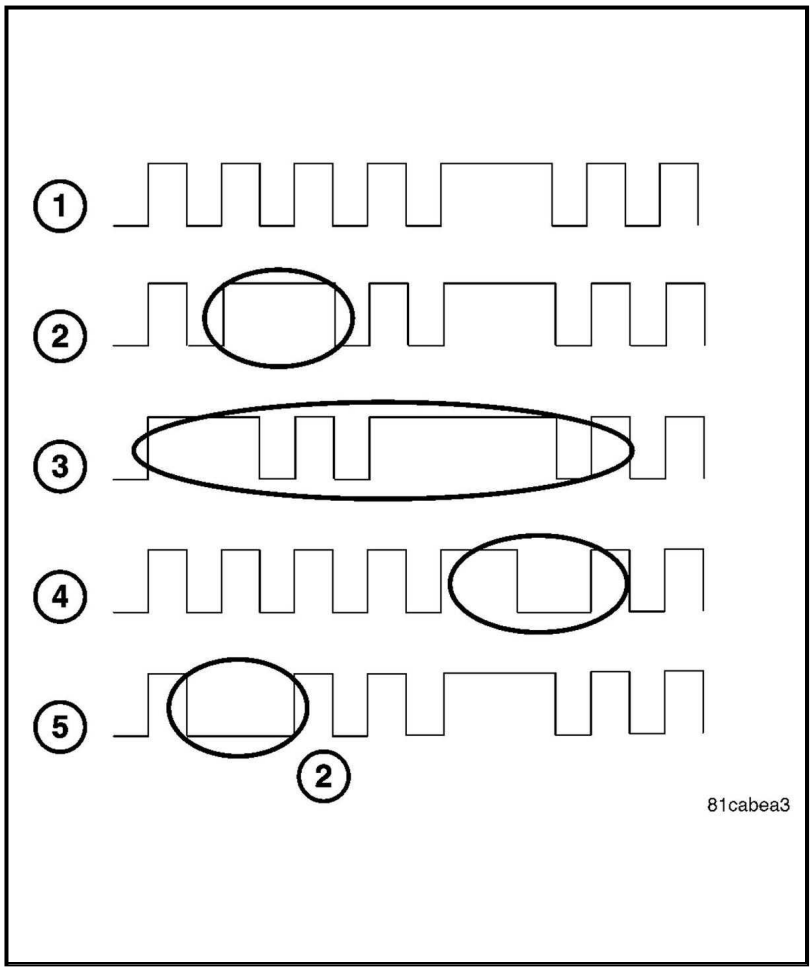


1. Turn the ignition off.
2. **Figure 1 is a depiction of typical scope patterns of the Cam (1) and Crank (2) sensors for 4, 6 and 8 cylinder engines. The square wave patterns are uniform and are identical to one another. The patterns must be evenly spread apart and at the same height. The larger gap pattern (signature) after the shorter wave forms are used for cylinder identification (Crank signal) and the distance between the series of slots (trigger) on the camshaft pulley (cam signal). Any variation of the pattern will indicate an issue with the sensor, wiring and trigger (target) wheel.**
3. With a lab scope, probe the CKP Signal circuit at the PCM harness connector.

WARNING: **When the engine is operating, do not stand in direct line with the fan. Do not put your hands near the pulleys, belts or fan. Do not wear**

loose clothing. Failure to follow these instructions may result in possible serious or fatal injury.

4. Start and allow the engine to run.
5. Observe the lab scope screen.



6. Compare the scope pattern with the ones in Figure 2.
7. 1. Pattern indicates a clean (good) square wave form that is identical to what the cam and crank should be. The square wave patterns are uniformed and are identical to one another.
8. 2. Two pulses joined together in the same spot on target. Indicates damage to the target (trigger) on the flexplate or broke tooth, runout in the target or large airgap between the sensor and the target wheel.
9. 3. Wide airgap or intermittent connection.
10. 4. Early signature, predominately at high speed. Large airgap between the sensor and the target wheel.
11. 5. Missed pulse. Possible burr or light damage to target or incorrect lateral position of the crank sensor to target (trigger).

NOTE: **If any of the above (except pattern 1) is displayed on the lab scope repair as necessary.**

Was the square wave found to match any of the above except pattern 1?

Yes

- Repair as necessary.

NOTE: **A battery disconnect must be performed to clear the Cam Crank Synchronization Events.**

-
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

No

- Replace the Crankshaft Position Sensor.

NOTE: **A battery disconnect must be performed to clear the Cam Crank Synchronization Events.**

- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

19. **VALVE TIMING**
    1. Make sure the valve timing is within specification. Go to section of the appropriate engine being diagnosed.

       Was the valve timing within specification?

       Yes

       - Go To 20

       No

       - Repair as necessary.
       - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

20. **5 VOLT SUPPLY CIRCUIT VOLTAGE (CMP/CKP)**

NOTE: **The 5 Volt Supply circuit must be present at both CMP and CKP Sensors.**

1. Turn the ignition off.
2. Disconnect the Camshaft Position Sensor connector.
3. Turn the ignition on.
4. Measure the voltage of the 5 Volt Supply circuit in the Camshaft Position Sensor harness connector.
5. **Repeat the above test at the Crankshaft Position Sensor (Crankshaft Position Sensor harness connector measure).**

   Is the voltage 5.0 Volts at each sensor?

   Yes

   - Go To 21

   No

   - Repair the 5 Volt Supply circuit(s) as necessary.

NOTE: **A battery disconnect must be performed to clear the Cam Crank Synchronization Events.**

- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

21. **SENSOR GROUND CIRCUIT**

NOTE: **The Ground circuit must be present at both CMP and CKP Sensors.**

1. Turn the ignition off.
2. Using a 12-volt test light connected to 12 Volts, probe the Sensor Ground circuit in the Camshaft Position Sensor harness connector.
3. **Repeat the above test at the Crankshaft Position Sensor (Crankshaft Position Sensor harness connector measure).**

   NOTE: **The test light should be illuminated and bright. Compare the brightness to that of a direct connection to the battery.**

   Is the test light illuminated and bright?

   Yes

   - Replace both the Camshaft Position Sensor and Crankshaft Position Sensor in accordance with the Service Information.

     NOTE: **A battery disconnect must be performed to clear the Cam Crank Synchronization Events.**

   - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

   No

   - Repair the Ground Circuit(s) as necessary.

     NOTE: **A battery disconnect must be performed to clear the Cam Crank Synchronization Events.**

   - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

22. **POWERTRAIN CONTROL MODULE (PCM)**
    1. Using the wiring diagram/schematic as a guide, inspect the wiring and connectors between the Camshaft Position Sensor and the Powertrain Control Module (PCM).
    2. Look for any chafed, pierced, pinched or partially broken wires.
    3. Look for broken, bent, pushed out or corroded terminals.
    4. Monitor the scan tool data relative to this circuit and wiggle test the wiring and connectors.
    5. Look for the data to change or for the DTC to reset during the wiggle test.
    6. Perform any Technical Service Bulletins (TSBs) that may apply.

       Were any problems found?

       Yes

       - Repair as necessary.

         NOTE: **A battery disconnect must be performed to clear the Cam Crank Synchronization Events.**

       - Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

       No

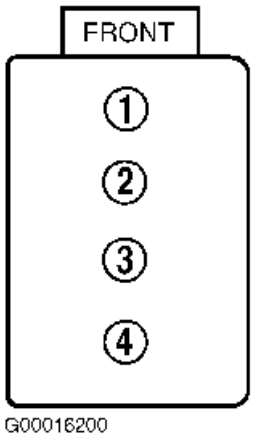
- Replace and program the Powertrain Control Module (PCM) in accordance with the Service Information.
- Perform the POWERTRAIN VERIFICATION TEST. Refer to **POWERTRAIN VERIFICATION TEST** .

Firing Order & Cylinder Identification - Chrysler - All Models

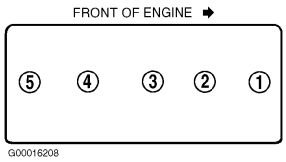
FIRING ORDER & CYLINDER IDENTIFICATION

NOTE: **This information is intended as a quick reference for firing order and cylinder identification only. The information provided covers many vehicles and may include some information that does not apply to the vehicle you have currently selected.**

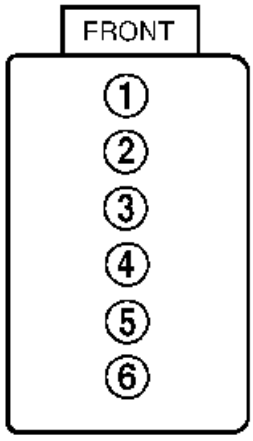
4 CYLINDER ENGINE

Engine Configuration	Firing Order	Cylinder Identification
In-Line 4	1-3-4-2	 G00016200

5 CYLINDER ENGINE

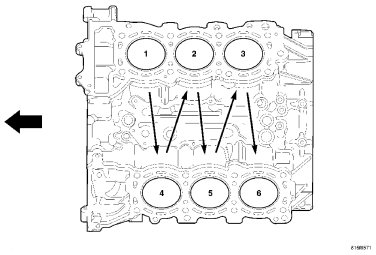
Engine Configuration	Firing Order	Cylinder Identification
In-Line 5	1-2-4-5-3	 G00016208

IN-LINE 6 ENGINE

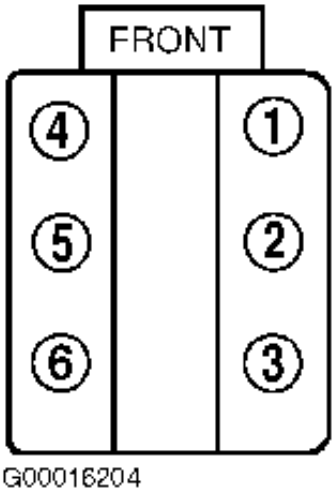
Engine Configuration	Firing Order	Cylinder Identification
In-Line 6	1-5-3-6-2-4	 G00016201

V6 ENGINE

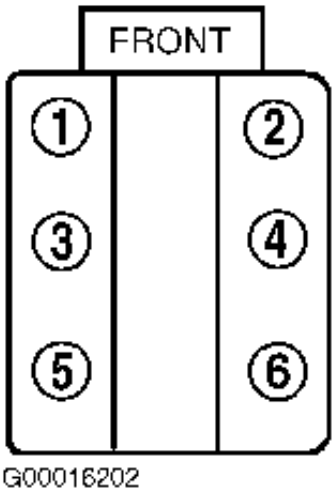
3.0L Turbo Diesel V6 Engine

Engine Configuration	Firing Order	Cylinder Identification
3.0L Turbo Diesel	1-4-2-5-3-6	

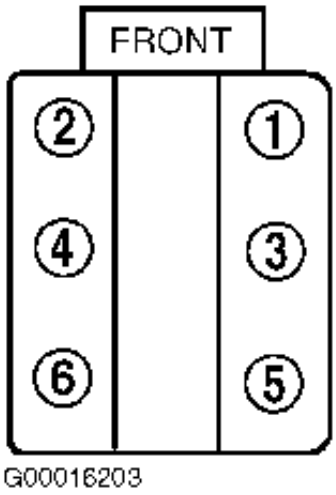
3.2L (VIN L & N) V6 Engines

Engine Configuration	Firing Order	Cylinder Identification
3.2L (VIN L & N)	1-4-3-6-2-5	 G00016204

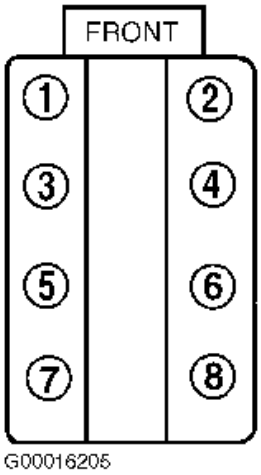
3.7L & 3.9L V6 Engines

Engine Configuration	Firing Order	Cylinder Identification
3.7L & 3.9L	1-6-5-4-3-2	 G00016202

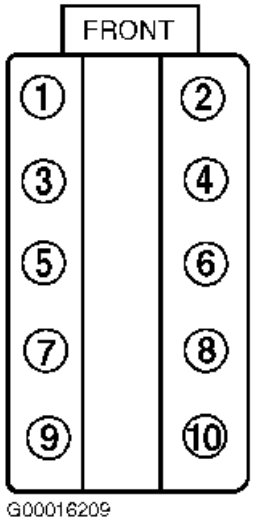
All Other V6 Engines Except 3.0L Turbo Diesel, 3.2L (VIN L & N), 3.7L & 3.9L

Engine Configuration	Firing Order	Cylinder Identification
All Others	1-2-3-4-5-6	 G00016203

V8 ENGINE

Engine Configuration	Firing Order	Cylinder Identification
V8	1-8-4-3-6-5-7-2	 G00016205

V10 ENGINE

Engine Configuration	Firing Order	Cylinder Identification
V10	1-10-9-4-3-6-5-8-7-2	 G00016209

DIAGNOSIS AND TESTING

NO CRANK (BCM EQUIPPED)

THEORY OF OPERATION

This vehicle is equipped with a KIN (Keyless Ignition Node) and Radio Frequency Hub (RF Hub). The KIN uses a Keyless Go Start/Stop push button for cycling the ignition on/off.

When the operator presses the Start/Stop Button on a KIN, the FOBIK is validated wirelessly by the RF Hub (Radio Frequency Hub Module). If the FOBIK is recognized as belonging to the vehicle and is inside the vehicle, the system allows the ignition state of the vehicle to be changed by the operator between the LOCK, ACCESSORY, RUN, and START ignition states.

LED Operation

The LEDs in the IGNM and Start/Stop Button provide visual indication of the ignition system and button use to aid the driver. The Logic for LED control is implemented in the RF HUB. The Start/Stop Button contain four LEDs:

- OFF Indication
- ACC Indication (Accessory)
- ON Indication (On or Run)
- Ignition Switch Indicator (button backlight)

The LEDs indicate the vehicle ignition position and are driven by the CAN bus signals related to the ignition position. The Center LED (Ignition Switch Indicator) will blink if there is a related concern.

The RF HUB will log a DTC indicating an incorrect Ignition status value is present; in this state the ignition status is unknown. This will continue until the correct signal is received by the RF Hub.

EVIC Operation

The Keyless Go feature requires the vehicle to be equipped with an EVIC display for prompts and status information. The display messages are:

- Service Keyless System
- FOB Not Detected
- FOB Left Vehicle
- Not in Park
- Push Brake Pedal and Push Button to Start
- Push Clutch Pedal and Push Button to Start
- Vehicle not in Park Warning

BCM/RF Hub Module Interaction

There are a few things that must take place before the starter relay can apply voltage to the starter. Below are some key points to check when diagnosing a no crank condition.

The BCM requires two signals from the RF HUB to verify the ignition is in the run or start position. The voltage on the F20 circuit is one of these signals. It can be monitored in both the RF HUB and BCM data display screens as the Ignition Run/Start under the "Sensor" value. The run or start position voltage on this circuit should be at or close to battery voltage.

Simultaneously the RF HUB busses the Ignition Run/Start status to the BCM. The BCM monitors the bussed input information as the secondary verification on the Ignition Run/Start status. The bussed messages can be monitored with the scan tool in both the RF HUB and BCM data display screens.

The F20 circuit voltage and the bussed ignition run/start status message received by the BCM must agree to enable starting. Once the vehicle is started, the loss of only one ignition signal will not cause the vehicle to cycle off as long as the other feed still indicates a "run status".

The RF HUB also requires an input from the Gated Park Switch (Automatic Transmission) or a Clutch Switch input (Manual Transmission).

Diagnostic Aids

NOTE: **The No Crank Diagnostic serves as an aid in diagnosing the concern and is intended to be used as a general guide, since each no crank condition can be unique.**

The No Crank Diagnostic Test assumes all of the following to be true:

- Communication to all configured modules in the vehicle is possible with the scan tool.
- The condition is currently present.
- The HCP, BPCM, IDCM TCM, PCM, RF HUB, and BCM are at the latest calibration (part number) levels.
- There are no active DTCs.
- There are no applicable Recalls.
- There are no applicable TSBs.
- There are no PCM inhibits (i.e. RPM, Trans Range, Clutch).
- The Key Fobs complete function and operation is correct.
- All battery cables and connections are clean and tight.
- There are no open fuses.
- The battery is fully charged and can pass a load test from the GR8 tester.
- HV battery is charged.
- The engine rotates freely.
- Any aftermarket equipment/wiring that has been installed is operating correctly.

Starter Relay Operation

In a no crank condition the Starter Relay can be missing power at pin 85, feed at pin 30, controlled ground at pin 86 or output at pin 87. Further explanation of how a relay operates is listed below:

- Pin 85 receives power from the BCM once the parameters for the Ignition Switch position and status, and all inhibit monitors (i.e. clutch switch, RPM, etc.) are satisfied.
- Pin 30 is a constant B+ feed.
- Pin 86 is a controlled ground by a module (i.e. PCM or BCM). Once power is sent from the BCM to the pin 85 of the relay it passes through a coil and leaves the relay through pin 86 to the control module.
- Pin 87 is an output circuit to the Starter solenoid. Once the circuit on pin 86 is grounded by the control module, the coil winding in the relay magnetically pulls the internal switch closed. When the internal switch is closed the power at pin 30 is sent to pin 87 of the relay.

DIAGNOSTIC TEST

1. **STARTER RELAY CHECK**
    1. When attempting to start the vehicle, listen and if needed feel for a click at the starter relay in the PDC.

NOTE: **Some starter relays are internal to a module and may not be accessible, making it more difficult to hear, or feel the clicking response. It is possible for a poor ground or the Trans Range Sensor position to be lost causing the starter to click once.**

Did you hear an audible click at the relay or starter?

Yes

- Go To 9

No

- Go To 2

2. **STARTER RELAY INPUT CHECK**
    1. Use a 12 volt test light/DVOM to check for power at pin 85 of the starter relay.

       Is there Power/12 volts at pin 85?

       Yes

       - Go To 8

       No

       - Go To 3

3. **RF HUB OPERATION**
    1. Using the scan tool, confirm the ignition switch status changes in the RF HUB under the data display screen for the "Sensor" values.

       Does the ignition switch status on the data screen match the physical position of the KIN/IGNM?

       Yes

       - Go To 5

       No

       - Go To 4

4. **REMOTE START ANTENNA**

NOTE: **If the vehicle is not equipped with Remote Start, proceed to the next test step.**

1. Cycle the ignition off.
2. Disconnect the Remote Start Antenna from the RF HUB.
3. Using one FOBIK and sitting in the driver's seat, attempt to start the vehicle.

Did the vehicle start?

Yes

- Replace the Remote Start Antenna in accordance with the Service Information.
- Perform the BODY VERIFICATION TEST.

No

- Go To 5

5. **BCM IGNITION STATUS**
    1. Using the scan tool, confirm the ignition switch status changes in the BCM under the data display screen for the "Bussed Input" and "Sensor" values.

        NOTE: The change of status in the BCM for the "Sensor" value validates the voltage activity (with very low amperage) of the F20 circuit.

        In the BCM, do both values for the ignition switch status match; and do they match those in the RF HUB?

        Yes

        - Go To 6

        No

        - If the status of the Ignition Switch position is not changing under the "Sensor" value, check the F20 circuit at the BCM for battery voltage with a DVOM (not a test light).
        - If there is Battery voltage **at the BCM on the F20 circuit** verify all power, ground and bus circuits are ok for the BCM. If no problem found replace the BCM in accordance with Service Information.
        - If there is **NO** Battery voltage **at the BCM** on the F20 circuit, then check for voltage on the F20 circuit at the RF HUB.
        - If there is Battery voltage **coming out of the RF HUB on the F20 circuit** , check the F20 circuit between the RF HUB and BCM for a short, open condition or high resistance.
        - If there is **NO** Battery voltage **coming out of the RF HUB on the F20 circuit** verify all power, ground & communication circuits, & connections to the RF HUB prior to replacing.
        - In the data screen, if the status of the Ignition Switch was not changing under the "Bussed Input" value, further diagnosis is needed between the RF HUB, (bus circuits, connections) and the BCM.

6. **PCM IGNITION, TRANS RANGE/CLUTCH SWITCH STATUS VERIFICATION**
    1. Using the scan tool confirm there are no inhibits that have been triggered in the PCM (i.e. Ignition Switch, Trans Range or Clutch Switch) and any switch inputs (filtered states) relating to the starting system function and operate correctly under the data display screen.

        Does the PCM show any inhibits (**not DTCs**) for starting (**not remote starting**)?

        Yes

        - Correct the inhibit reason listed.
        - If no problem can be found, then verify all power, ground and bus circuits to the PCM and replace the PCM in accordance with the Service Information.

        No

        - Go To 7

7. **BCM TO STARTER RELAY POWER INPUT CHECK**
    1. At this time if all the correct inputs for the ignition switch status are correct in the RF HUB, BCM and PCM, verify both power feeds are present (pin 30 and 85) to the Starter Relay while in the crank position.

        Are both power feeds present at the relay when the ignition is in the crank position?

        Yes

- Go To 8

No

- If, there is no power to pin 30 or 85, no DTCs, TSBs, Recalls, or Inhibits replace the BCM in accordance with Service Information.

8. **STARTER RELAY CONTROL CIRCUIT CHECK**
    1. Using a test light/DVOM determine if the Starter Control circuit at pin 86 of the relay is missing ground (at the relay if equipped with a removable relay or wiring to the internal relay) when the ignition is in the crank position.

       Was the Starter Control circuit for pin 86 being grounded when the ignition was in the crank position?

       Yes

       - Go To 10

       No

       - Verify the Starter Relay Control circuit from pin 86, has no shorts, opens or high resistance on the wiring going from the Starter Relay in the BCM (or PDC) to the PCM.
       - Verify the cables do not have excessive resistance by performing a voltage drop on the battery cables.
9. **STARTER RELAY OUTPUT CIRCUIT CHECK**

    NOTE: **At this point in the test, when the key is in the crank position power has been verified at Pin 30 & 85, along with the control circuit being grounded for pin 86.**

    1. Remove the Starter Relay Output circuit connector from the Starter solenoid.
    2. Using a test light/DVOM and ignition in the crank position check for power at pin 87 (If equipped with a removable relay or wiring to the internal relay) of the relay and at the connection to the starter.

       Was there power at pin 87 for the output circuit?

       Yes

       - Go To 10

       No

       - If power is missing to pin 30 of the starter relay the BCM is suspect. Verify all power, ground, communication circuits and connections to the BCM before replacing in accordance with service information.
       - If power is missing at pin 87 of the starter relay and the relay is replaceable, change out the relay and recheck the concern. If a known good relay causes no change, check the Starter Output circuit from pin 87 of the relay to the starter for an open, short, excessive resistance, or poor connections to the solenoid or starter.
       - Verify and Inspect the Starter to ensure it is free of corrosion, oil, and there is no damage, or binding conditions.
       - Verify that all wiring, cables and connections are clean and tight.
10. **STARTER RELAY OUTPUT CIRCUIT LOAD TEST**
    1. Load test the Starter Relay output circuit going from the BCM to the Starter.

Does the starter relay output circuit pass the load test?

Yes

- Verify that all connections and engine grounds are clean, tight and there is no damage to starter when fully inspected. If no problem found then replace the Starter in accordance with Service Information.

No

- Adjust the shift cable in accordance with the Service Information. Perform the POWERTRAIN VERIFICATION TEST.

FOB NOT DETECTED-POOR RKE OR REMOTE START RANGE

THEORY OF OPERATION

The Radio Frequency Hub (RF HUB) uses LF Antennas and the internal RKE antenna or the Remote Start Antenna (RSA) (if equipped) to locate the FOBIK either inside or outside of the vehicle for Keyless Go (KG) and Passive Entry (PE) functions. Once an input is activated to the RF HUB, (door handle, trunk or liftgate handle or Keyless Ignition node (KIN), the RF HUB looks for the FOBIK on the LF Antennas and then the FOBIK will send a signal to the RKE internal antenna or RSA with an encrypted message for the RF HUB. The encrypted message will validate that the programmed FOBIK is correct for the vehicle and then carry out the Keyless Go or Passive Entry requests. The RF HUB monitors the LF Antennas, Antenna circuits for shorts or opens. The RF HUB will also monitor the RSA for open circuit concerns.

DIAGNOSTIC TEST

1. **CHECK FOR AN ACTIVE DTC**

NOTE: **Before performing this diagnostic test, ensure that there are no Aftermarket cell phone chargers, Aftermarket GPS devices or any other aftermarket electronic equipment/devices that will cause LF interference miscommunication between the LF Antennas and the Key Fob at 125 kHz. This will display a "FOB NOT DETECTED" message displayed in the Cluster.**

NOTE: **To Press the ignition on the Passive Entry Keyless Go (PEKG)/Keyless Ignition Node (KIN) system, use the rounded end of the Key Fob to press the Stop/Start button to advance ignition positions.**

1. Press the ignition on.
2. With the scan tool, create a Vehicle Scan Report and attach it to the repair order.
3. With the scan tool, erase DTCs.
4. Press the ignition off.
5. Press the ignition on.
6. Wait 20 seconds.
7. With the scan tool, read the RF HUB DTCs.

Are there any DTCs present in the RF HUB?

Yes

- Perform the appropriate RF HUB diagnostic test and recheck operation.
- Perform the RADIO FREQUENCY HUB (RF-HUB) VERIFICATION TEST. Refer to **RADIO FREQUENCY (RF HUB) VERIFICATION TEST** .

No

- Go To 2

2. **VERIFY PROGRAMMED (LEARNED) KEY FOB FOR THE VEHICLE WITH THE SCAN TOOL**
    1. Ensure that the inoperative Key Fob is being used.
    2. With the scan tool, select RF HUB, Misc Functions, and perform the "Key Fob Identification" routine.

       Does the scan tool verify that the correct Key Fob is programmed (learned) to the vehicle?

       Yes

       - Go To 3

       No

       - Not Learned. The Key Fob being tested is already programmed to another vehicle.
       - Perform the RADIO FREQUENCY HUB (RF-HUB) VERIFICATION TEST. Refer to **RADIO FREQUENCY (RF HUB) VERIFICATION TEST** .
3. **CHECK THE KEY FOB BATTERY**
    1. Press any Key Fob button and see if the LED comes on with each button press.

       NOTE: **If there are Low Fob battery DTCs, repair those DTCs first. Non LED Key Fobs, replace the coin battery first.**

       Does the LED illuminate on the Key Fob?

       Yes

       - Go To 4

       No

       - Replace the Key Fob coin battery.
       - If the Key Fob LED does not Illuminate or the Key Fob is still inoperable after replacing the coin battery, replace the Key Fob in accordance with the Service Information.
       - Perform the RADIO FREQUENCY HUB (RF-HUB) VERIFICATION TEST. Refer to **RADIO FREQUENCY (RF HUB) VERIFICATION TEST** .
4. **CHECK THE REMOTE START ANTENNA (RSA) (IF EQUIPPED)**
    1. Check the sales code of the vehicle's VIN number and see if the vehicle is equipped with Remote Start.

       Is the vehicle equipped with Remote Start?

       Yes

       - Go To 5

       No

       - Go To 6
5. **CHECK THE REMOTE START ANTENNA (RSA)**

   NOTE: **You will need an assistant to perform the following resistance check of the RSA.**

1. Disconnect the RSA harness connector from the RF HUB module.
2. Remove the RSA from the vehicle.
3. Disconnect the RSA from the coax cable.
4. Carefully place the RSA harness connector (RF HUB END) in a vice to hold the connector carefully in place.

   NOTE: **DO NOT over tighten the vice. Harness connector damage or connector distortion may occur.**

5. Set the DVOM to Mega Ohms.
6. Connect one probe to the center terminal and the other to the outer shell of the coax cable.
7. With the help of an assistant, move the antenna cable up, down and side to side in order to stress the cable and rotate the cable in it's own axis.

   NOTE: **Verify that the coax cable measurements do not get out of the spec range of 1.6 to 2.0 Mega Ohms.**

   Did the resistance of the coax cable go below the specified range of 1.6 to 2.0 Mega Ohms?

   Yes

   - Replace the coax cable and the RSA and recheck operation.
   - Perform the RADIO FREQUENCY HUB (RF-HUB) VERIFICATION TEST. Refer to **RADIO FREQUENCY (RF HUB) VERIFICATION TEST** .

   No

   - Go To 6

6. **CHECK LF ANTENNAS**
   1. Verify that all LF Antennas are in the correct mounting locations on the vehicle.
   2. Verify that all the LF Antennas are not blocked by any aftermarket metal shields or metal brackets that would inhibit locating the Key Fob. (police vehicles and upfitted vehicles.)

      Were there any LF Antenna concerns?

      Yes

      - Repair the LF Antenna concern in accordance with the Service Information and recheck operation.
      - Perform the RADIO FREQUENCY HUB (RF-HUB) VERIFICATION TEST. Refer to **RADIO FREQUENCY (RF HUB) VERIFICATION TEST** .

      No

      - Replace the Radio Frequency Hub Module (RF HUB) in accordance with the Service Information and recheck operation.
      - Perform the RADIO FREQUENCY HUB (RF-HUB) VERIFICATION TEST. Refer to **RADIO FREQUENCY (RF HUB) VERIFICATION TEST** .

REMOTE START INHIBITORS

The following table below is a list of possible causes for the inoperative Remote Start System. If any of the following conditions exist, the Remote Start System will not work. Use this information as a guide to the diagnosis of the Remote Start System.

- ABORT
- BATTERY VOLTAGE HIGH
- BATTERY VOLTAGE LOW
- BRAKE PRESSED
- COOLANT TEMPERATURE HIGH
- CRANK NO START
- DRIVER DOOR AJAR
- PASSENGER DOOR AJAR
- LEFT REAR DOOR AJAR
- RIGHT REAR DOOR AJAR
- TRUNK/LIFTGATE AJAR
- HOOD AJAR
- NO HOOD SWITCH (INOPERATIVE)
- FUEL LEVEL LOW
- EXCESSIVE GLOW PLUG TIME (DIESEL ONLY)
- FAILED COUNTER REACHED (START)
- HAZARD LAMPS (SWITCH PRESSED)
- IGNITION IN RUN/START
- IGNITION NOT IN LOCK
- IGNITION SNA (SIGNAL NOT AVAILABLE FROM OTHER MODULE)
- INVALID KEY
- KEY IN IGNITION
- LOW RPM SHUTDOWN
- MIL ON
- NO AUTOMATIC TRANSMISSION
- NORMAL TIME OUT CUSTOMER ACCESS
- NORMAL TIME OUT RUN MODE (15 MINUTES)
- NOT CONFIGURED
- NOT ENABLED
- NOT IN PARK OR NEUTRAL
- NOT PROGRAMMED
- OIL PRESSURE LOW
- PANIC MODE (ACTIVATED)
- POWER LOSS
- RKE OFF MESSAGE
- RPM TOO HIGH (EXCEEDS 2500)
- START COUNTER REACHED
- VEHICLE SPEED HIGH
- VTA ALARMING

REMOTE START INOPERATIVE

DIAGNOSTIC TEST

1. **REMOTE START FUNCTION**

NOTE: **In some cases the vehicle will start then stall, indicating a fuel level concern (less than a quarter of a tank). Before proceeding verify there is enough fuel in the tank for the vehicle to start and run.**

1. Attempt to start the vehicle with the key fob.

   Does the vehicle start when using the key fob?

   Yes

   - At this time the Remote Start is functioning properly.
   - Using the scan tool, check for any related Starting, Communication, or Ignition related DTCs that may inhibit the Remote Starting feature. Check the BCM for any previous Remote Start Inhibits and mileage that were stored.

   No

   - Go To 2

2. **REMOTE START VISUAL CHECK**
   1. While pressing the remote start button on the key fob, observe the exterior lights and the horn operation.

      Does the horn sound and the exterior parking lights flash?

      Yes

      - Go To 3

      No

      - Go To 4

3. **CHECKING BCM INHIBITS**

NOTE: **Since the horn sounds and the parking lights flash, this verifies the BCM is receiving the CAN BUS message from the RF HUB. It also verifies the RF signal for Remote Start from the key fob to the RF HUB is operating correctly.**

1. Using the scan tool, check the Remote Start inhibits of the BCM or any ACTIVE DTCs listed in all modules.

   NOTE: **Inhibits may be found under the system tests or miscellaneous functions tab. The fuel level may not be a listed inhibit.**

   Are there any Remote Start inhibits or any ACTIVE DTCs listed in the entire vehicle?

   Yes

   - For any inhibits for a complete list of Remote Start inhibits. Refer to **DIAGNOSIS AND TESTING** , or **DIAGNOSIS AND TESTING** .
   - For any ACTIVE DTCs, perform the appropriate diagnostic procedure.

   No

   - Check for any related TSBs prior to replacing the BCM. If no related TSBs are found, then replace the BCM in accordance with the Service Information.

4. **RKE FUNCTION SHORT RANGE**

1. While standing next to the Driver door and using the key fob, attempt to lock and unlock the doors.

   Does the RKE function properly?

   Yes

   - Go To 5

   No

   - Go To 7

5. **RKE FUNCTION MID RANGE**
   1. While standing 20 feet from the vehicle and using the key fob, attempt to lock and unlock the doors.

      Does the RKE function properly at 20 feet?

      Yes

      - Go To 6

      No

      - Go To 7

6. **RKE FUNCTION LONG RANGE**
   1. While standing 100 feet from the vehicle and using the key fob, attempt to lock and unlock the doors.

      Does the RKE function properly at 100 feet?

      Yes

      - Go To 9

      No

      - Go To 7

7. **KEY FOB SIGNAL STRENGTH**
   1. Use the TPM/RKE Tester to check the signal strength of the key fob.

      Does the key fob pass?

      Yes

      - Go To 10

      No

      - Go To 8

8. **CHECKING THE KEY FOB**
   1. Replace the battery in the key fob with a known good battery and recheck the signal from the key fob with the TPM/RKE Tester.

      Does the key fob pass?

      Yes

      - Go To 9

No

- Check for any related TSBs prior to replacing the key fob. If no related TSBs are found, then replace the key fob in accordance with the Service Information.

9. **CHECKING FOR ACTIVE DTCs**

NOTE: **The RKE portion of the key fob is operational, this verifies that the RF HUB is capable of receiving signals and communicating to operate the locks.**

1. Use the scan tool to check for ACTIVE DTCs.

   Did the scan tool show any ACTIVE DTCs in the entire vehicle?

   Yes

   - Diagnose the DTCs in accordance with the Service Information before proceeding with the Remote Start Inoperative concern.

   No

   - Go To 10

10. **CHECKING THE RF HUB**

NOTE: **Even though the RKE function of the system may work with no concern, the BCM is either not receiving a message or is receiving a corrupt message from the RF HUB for remote start operation.**

1. While sitting in the driver seat and using the scan tool, monitor the RF HUB on the data display screen for changes when the Remote Start button of the key fob is pressed.

   Did the status change when the Remote Start button of the key fob was pressed?

   Yes

   - Go To 11

   No

   - Go To 12

11. **CHECKING BCM INHIBITS**

NOTE: **The parking lights flash and the horn are inoperative when using the key fob, this indicates a faulty BCM or "Inhibit" that may be preventing the start request from occurring.**

1. Use the scan tool to check for any Remote Start inhibits listed in the BCM.

   Were there any Remote Start inhibits listed in the BCM?

   Yes

   - Perform the REMOTE START SYSTEM Diagnosing and Testing. Refer to **DIAGNOSIS AND TESTING** , or **DIAGNOSIS AND TESTING** .

   No

- If this has had a Mopar Accessory kit installed verify the correct Sales Code for Remote Start has been added to Dealer Connect and a Restore Vehicle Configuration has been performed.
- Confirm the system is enabled; and the temporary Remote Start override is set to disabled in the BCM and contact the Mopar Accessories group (800-84-Mopar) for further details before proceeding.
- If this has a factory installed Remote Start, check for any related TSBs prior to replacing the BCM. If no related TSBs are found, then replace the BCM in accordance with the Service Information.

12. **CHECKING THE REMOTE START ANTENNA**
    1. Cycle the ignition off
    2. Disconnect the Remote Start antenna from the RF Hub.
    3. Using one key fob, and sitting in the driver's seat, attempt to start the vehicle.

    Did the vehicle start?

    Yes

    - Replace the Remote Start Antenna in accordance with the Service Information.
    - Perform the BODY VERIFICATION TEST.

    No

    - Verify all power, ground, communication circuits, & connections to the RF HUB prior to replacing.

ENGINE STOP/START (ESS) SYSTEM INOPERATIVE

THEORY OF OPERATION

General Operation: The Engine Stop/Start (ESS) system uses a **Power Control Relay (PCR)** and two Batteries to eliminate the voltage drop in the system voltage during an AutoStart event. The purpose of this is for the consumer electronics and vehicle modules subsystems to continue to function in a normal manner. The Power Control Relay is connected in-line between the Main (Cranking) Battery and the Auxiliary (Vehicle) Battery. The Power Control Relay is normally closed when de-energized, connecting the two Batteries. When the Power Control Relay is energized, the relay opens and breaks the connection between the Batteries. The **Power Control Relay (PCR)** is energized when 12.0 volts is supplied from the output of the **PCR Control Relay in the PDC** . The PCR Control Relay is controlled by the Powertrain Control Module (PCM) using a Low Side Driver (LSD).

Key Start and normal driving: The engine starting and charging systems are connected in parallel to the Main Battery and Auxiliary Battery and charges both Batteries simultaneously. The starting and charging systems are connected directly to the Main Battery. The starting and charging systems are connected to the Auxiliary Battery when the Power Control Relay is de-energized (closed). Therefore, if the Power Control Relay is stuck on (open), the Auxiliary Battery will not charge. The Power Control Relay remains closed **during all non-AutoStart crank events and while driving.** With the Power Control Relay closed during a **non-AutoStart** crank event, the Auxiliary Battery is connected to the starting system and will have a voltage drop during cranking. Before allowing a Key Start, the Power Control Relay is opened to diagnose a disconnected or depleted Auxiliary Battery.

AutoStart Event: When in ESS mode, and an **AutoStart crank event is initiated** , the Power Control Relay is temporarily energized which opens the relay, breaking the connection and allowing the Batteries to work independently. When this occurs, the Main Battery is used to crank and start the engine. The Auxiliary Battery, which is now solely connected to the Power Distribution Center (PDC) and is not affected by cranking, can maintain full Battery voltage to the rest of the vehicle modules and subsystems with the exception of the Electric Power Steering (EPS) Module.

Diagnostics: It is important for the Power Control Relay to operate properly for the Auxiliary Battery to charge correctly with the engine running and be disconnected during an AutoStart event, the PCM will run diagnostics to determine if the Power Control Relay is stuck in the On (open) or off (closed) positions.

- Disconnected Battery Detection: Before allowing a key crank event, the voltage supply from the Auxiliary Battery to the PCM is monitored. If the voltage drops low enough to cause a PCM reset, the Auxiliary Battery state of charge is determined to be too low.
- There are two checks before allowing the key crank: 1. If the PCM resets, the Auxiliary Battery is disconnected. 2: If the PCM doesn't reset and the voltage is below calibration, then deplete the Auxiliary Battery.
- After the engine is started and running the Auxiliary Battery system voltage is monitored and compared to the charging system feedback voltage. If the Auxiliary Battery voltage is below the charging system voltage by more than a calibrated threshold, the Power Control Relay is determined to be stuck open.
- The Power Control Relay is monitored for a stuck closed condition during an Auto Start Event. If the difference between the Auxiliary Battery voltage and the Main Battery voltage is not more than a calibrated threshold during an Auto Start cranking event, the Power Control Relay is determined to be stuck closed.

NOTE: **The terminology on the relays in this procedure can be confusing. For clarity, the Power Control Relay is the relay that makes and breaks the connection between the two Batteries. The PCR Control Relay is controlled by the PCM using a typical Low Side Driver (LSD) and is the relay that provides the power supply to operate the Power Control Relay.**

STOP/START SYSTEM DIAGNOSIS - ESS EQUIPPED

For diagnostics of the Stop Start system, the scan tool can be used to review the Stop Start Data to help root cause a potential Stop Start concern.

With the scan tool, under BCM, Data display, review any data that will inhibit the ESS.

For diagnostics of the basic starting system. Refer to **DIAGNOSIS AND TESTING** , or **DIAGNOSIS AND TESTING** .

For diagnostics of the Stop/Start system, the scan tool can be used to review the inputs/sensor values and DTCs to help root cause a potential Stop/Start concern.

With the scan tool, select OBDII monitors, OBDII, Engine Stop/Start Status, check for a "False" status to help root cause a potential Stop/Start concern.

Possible Reasons The Engine Does Not AUTOSTOP

Prior to engine shut down, the PCM will check many safety and comfort conditions to see if they are fulfilled.

A **Stop/Start Not Ready** message and the inhibit reason may display in the Electronic Vehicle Information Center (EVIC).

0001141736

EVIC Warning Messages for ESS	
ESS EVIC Message	**ESS EVIC Message Reason/Repair Action**
Stop/Start Not Available	During ECM wake-up and Stop/Start not ready at key On indicating engine off.
Stop/Start Active	Indicates engine is off during an Autostop.
Stop/Start Not Ready Driver Seatbelt Unbuckled	Driver's seatbelt is unbuckled prior to an Autostop.
Stop/Start Not Available Driver Not Detected	Driver Presence Detection Module indicates driver's seat is unoccupied for applications with removable doors only.
Stop/Start Not Ready Driver Door Open	Driver's door is open, prior or during an Autostop.
Stop/Start Press Clutch or Shift To Neutral	Shifting into gear during an Autostop without pressing the clutch. (For MTX vehicles only).
Stop/Start Restart Required Fault Detected	During an Autostop/Autostart, the ECM/PCM detects a DTC calibrated to be an Engine Start inhibit trigger. Repair DTCs and retest.
Stop/Start Not Available Service Battery Radio display and functions may be inoperative to the customer.	In order to allow the ESS Autostop, the Battery State of Charge (SOC) must be greater than the threshold reported in the table as following:

IBS SOC Temperature	Minimum SOC to allow ESS Autostop
(-20Â°C) -4Â°F	100
(-16Â°C) 3.2Â°F	100
(-15Â°C) 5Â°F	80
(-1Â°C) 30.2Â°F	80
(0Â°C) 32Â°F	70
(15Â°C) 59Â°F	70
(35Â°C) 95Â°F	70
(50Â°C) 122Â°F	70
(59Â°C) 138.2Â°F	70
(60Â°C) 140Â°F	100
(80Â°C) 176Â°F	100
Main 12 Volt Battery does not successfully pass a load test or Battery is sulfated. Auxiliary Battery does not successfully pass a load	In order to allow the ESS Autostop, the Battery State of Charge (SOC) must be greater than the threshold reported in the table as following:

test or Battery is sulfated. Stop/Start Not Ready Battery Charging Radio display and functions may be inoperative to the customer.	

IBS SOC Temperature	Minimum SOC to allow ESS Autostop
(-20Â°C) -4Â°F	100
(-16Â°C) 3.2Â°F	100
(-15Â°C) 5Â°F	80
(-1Â°C) 30.2Â°F	80
(0Â°C) 32Â°F	70
(15Â°C) 59Â°F	70
(35Â°C) 95Â°F	70
(50Â°C) 122Â°F	70
(59Â°C) 138.2Â°F	70
(60Â°C) 140Â°F	100
(80Â°C) 176Â°F	100
Main 12 Volt Battery does not successfully pass a load test or Battery is sulfated. Auxiliary Battery (if Equipped) does not successfully pass a load test or Battery is sulfated. Stop/Start Fail	During engine running, ECM/PCM detects a DTC calibrated to be an Engine Off inhibit trigger. Repair DTCs and retest.
Stop/Start Not Available	Message Indicates "not ready" during engine running and any of the Engine Off AND Engine Start conditions are **FALSE** .
Stop/Start Ready	ATX: while vehicle is moving and during engine running, ESS ready to allow an Autostop (all Engine Off AND Engine Start conditions are true) ESS will enter an Autostop once TransReadyForESS = True, Master Cylinder input threshold, and Vehicle speed is below threshold. MTX: While vehicle is moving and engine running, ESS ready to allow an Autostop (all Engine Off AND Engine Start conditions are true) once Vehicle speed is below threshold, Gear is in Neutral and Clutch pedal is released.
Stop/Start Off	Indicates ESS disable switch pressed, ESS is inhibited. No Autostop while engine running. Autostart if ESS disable switch pressed during Autostop. ESS disable switch status resets with every key cycle.
Stop/Start Not Ready Hood Open	Indicates hood is open. Inhibits Autostops while engine running.
Stop/Start Not Ready Accelerator Depressed	Vehicle speed below Autostopping threshold, brake pedal is pressed AND accelerator pedal is pressed. Inhibits Autostops while engine running. Initiates an Autostart during an Autostop.
Stop/Start Not Ready Battery Protection Mode Radio display and functions may be inoperative to the customer.	With the scan tool, verify that the Battery State Of Function (SOF) status is not "False." In order to allow the ESS Autostop, the Battery State of Function from the Intelligent Battery Sensor (IBS) must be greater than the threshold reported in the table below:

IBS SOF Temperature	Minimum SOF to allow the ESS Autostop
(-15Â°C) 5 Â°F	7
(-5Â°C) 23Â°F	7
(5Â°C) 41Â°F	7
(15Â°C) 59Â°F	7
(25Â°C) 77Â°F	7
(35Â°C) 95Â°F	7
(45Â°C) 113Â°F	7
(60Â°C) 140Â°F	7
Stop/Start Not Ready Tow Active	When Tow/Haul mode is active, ESS is inhibited. Autostart is triggered if Tow/Haul Switch (if Equipped) is pressed during an Autostop.
Stop/Start Not Ready 4Low Active	T-Case is in 4Wheel Low mode. Present on vehicles with T- Case (4Wheel Low).
Stop/Start Not Ready Too Steep	Indicates grade above calibrated threshold to allow Autostop. Triggers an Autostart during an Autostop if grade threshold is above +7% or below -10%.
Stop/Start Not Ready Cabin Cooling or Heating	Indicates HVAC demand via the CAN C Bus.
Stop/Start Not Ready Max Cooling or Heating	When HVAC max button is pressed by customer. Indicates HVAC demand via CAN C signal. Inhibits Autostops while pressed. Triggers an Autostart if pressed during an Autostop.
Stop/Start Not Ready Front Defrost Selected	Indicates Front Defrost active. Triggers an Autostart during an Autostop and inhibits Autostops if active during engine running.
Stop/Start Not Ready Turned Steering Wheel	Indicates steering wheel is being turned. Inhibits Autostops if present during engine running. Triggers Autostarts if active during and Autostop.
Stop/Start Not Ready Engine Temp Too Low	Indicates either coolant, or oil, or catalyst engine temperature is lower than calibrated threshold. Inhibits Autostops during engine running and triggers an Autostart during an Autostop event. For engine coolant temperature, see table below:
Minimum Engine Coolant Temperature To Allow Autostop Event	Ambient Temperature
(80Â°C) 176 Â°F	(-16Â°C) 3.2 Â°F
(70Â°C) 158Â°F	(0Â°C) 32Â°F
(60Â°C) 140Â°F	(10Â°C) 50Â°F
(55Â°C) 131Â°F	(15Â°C) 59Â°F
(45Â°C) 39.2Â°F	(20Â°C) 68Â°F
(40Â°C) 104Â°F	(25Â°C) 77Â°F
(40Â°C) 104Â°F	(30Â°C) 86Â°F
(40Â°C) 104Â°F	(35Â°C) 95Â°F
(40Â°C) 104Â°F	(40Â°C) 104Â°F
Minimum Engine Oil Temperature To Allow Autostop Event	Ambient Temperature
(50Â°C) 122 Â°F	(0Â°C) 32Â°F
(40Â°C) 104Â°F	(5Â°C) 41Â°F
(35Â°C) 95Â°F	(10Â°C) 50Â°F
(30Â°C) 86Â°F	(15Â°C) 59Â°F
(25Â°C) 77Â°F	(20Â°C) 68Â°F

(25Â°C) 77Â°F	(25Â°C) 77Â°F
(25Â°C) 77Â°F	(30Â°C) 86Â°F
(25Â°C) 77Â°F	(35Â°C) 95Â°F
(25Â°C) 77Â°F	(40Â°C) 104Â°F Minimum Catalyst Temperature to allow an ESS AutoStop event is (440Â°C) 824Â°F.
Stop/Start Not Ready DEF RGN (if Equipped)	During engine running, ECM inhibits Autostops when Regen is active.
Stop/Start Not Ready Service Battery Vehicle Shut Off	During a failure of the Power Control Relay (PCR). After an Autostop: If Power Control Relay between Cranking Battery and Auxiliary Battery is stuck open, vehicle shuts off within minutes.

The engine will **NOT** Autostop unless **ALL** conditions below are **TRUE** .

If **ANY** of the conditions below are **NOT TRUE** Autostop is **INHIBITED** .

ESS Allow Conditions for Autostop	
Condition	**Operating Range**
Outside Ambient temperature	Greater than 10Â°F (-12Â°C) or less than 110Â°F (43Â°C)
Driver seatbelt	Buckled
Driver door	Closed
Driver seat pad Driver Presence Detection Module (if equipped)	Occupied - when equipped (on vehicles with removable doors)
Hood	Fully closed (2 Hood Ajar Switch Inputs)
Accelerator pedal	Released
Grade -too steep of an incline/decline	Lesser than +7% OR greater than -10%
Engine operating temperature	Minimum acceptable range: Coolant temperature greater than a calibrated threshold (Function of ambient temp) Engine Oil temperature is greater than a calibrated threshold (Function of ambient temp) Catalyst temperature is greater than a calibrated threshold (Function of ambient temp) Maximum acceptable range: Coolant temperature below a calibrated threshold 239Â°F (115Â°C) Engine Oil temperature below a calibrated threshold 239Â°F (115Â°C) Catalyst temperature below a calibrated threshold 1742Â°F (950Â°C)
Transfer Case Selection	4WD LO = Off Neutral = Off
Manual Paddle shifter	Not selected/active/pressed
Shifter position	Drive (NAFTA ATX) Neutral (NAFTA MTX)
Brake Master Cylinder pressure	Above a calibrated threshold (ATX only)
Hill start assist	Hill start assist brake pressure above calibrated threshold
ESS related OBD faults	No Active OBD DTCs
Brake Booster Vacuum	29.9 kPa (4.34 PSI)
Steering Angle	Below 135 degrees
Tow Haul Mode	Off

ESS Allow Conditions for Autostop	
ESS Disable Button	Not pressed
PPPA (Parallel Perpendicular Park Assist)	Not active
Altitude	Barometric pressure above: 72 KPa (less than 9, 000 ft.)
Brake Pedal	Pressed (while maintaining steady Brake Pedal pressure applied by driver)
ABS Module	Anti-lock brake system is not active
Engine Speed	1100 RPM
ACC+	Stop/Start allowed
Engine run time	2 seconds
Vehicle speed	0 MPH\0 kph (ATX)
Threshold vehicle speed exceeded since last engine Autostart	5 MPH
12 volt Battery Parameters	Voltage more than 11.5 volts SOC above 65% Temperature below 140Â°F (60Â°C)

It may be possible for the vehicle to be driven several times without the Stop/Start system going into a Stop/Start ready state under more extreme conditions of the items listed above.

When it comes to Stop/Start, the PCM allows the engine Autostart during an Autostop event when any of the below conditions are **TRUE** .

ESS Allow Conditions for Autostart	
Condition	**Operating Range**
Ambient temperature	Less than 10Â°F (-12Â°C) or greater than 110Â°F (43Â°C)
Shifter Position	For NAFTA : Out of Drive or M-Gate For EMEA : Neutral / Reverse
Accelerator Pedal	Pressed
HVAC mode:	1. HVAC set to AUTO mode 2. Customer changes blower motor speed 3. Rear defrost = No impact to ESS 4. Front Defrost = ON 5. Cabin Hi= ON 6. Cabin Lo= ON 7. Max A/C=ON
HVAC blower speed	Max blower speed selected or blower speed incremented
Grade-too steep of an incline/decline	Greater than +7% OR lesser than -10%
Engine operating temperature	Minimum acceptable range: Coolant temperature less than a calibrated threshold (Function of ambient temp) Engine Oil temperature is less than a calibrated threshold (Function of ambient temp) Catalyst temperature is less than a calibrated threshold (Function of ambient temp) Maximum acceptable range: Coolant temperature above a calibrated threshold 239Â°F (115Â°C) Engine Oil temperature above a calibrated threshold

ESS Allow Conditions for Autostart	
	239Â°F (115Â°C) Catalyst temperature above a calibrated threshold 1742Â°F (950Â°C)
Stop/Start Autostop time active	Exceeded 5 minute timeout
Transfer Case Selection	4WD LO = ON Neutral = ON
Manual Paddle shifter	Active/Pressed during Autostop
Shifter position	Autostart when shifter moved out of Drive
Brake Master Cylinder pressure	Below a calibrated threshold (Below 3bar) Or below a calibrated pressure gradient threshold (ATX only)
Hill Start Assist	Hill Start Assist brake pressure below calibrated threshold
ESS related OBD Faults	Calibrated active to allow Autostart Example: U0131-00 active DTC
Brake Booster Vacuum	29.9 kPa (4.34 PSI)
Steering Angle	Above 135 degrees
Tow Haul Mode	On
ESS Disable Button	Pressed
PPPA (Parallel Perpendicular Park Assist)	Activated
Brake Pedal	Released
ACC+	Cancelled/disengaged
Vehicle speed	Above 0 MPH/0 kph (ATX) Above 1.5 MPH/3 kph (MTX)
12V Battery Parameters	Voltage Less than 11.5 V (trigger Autostart when below 11.5 V) SOC Below 65% Temperature Above 140Â°F (60Â°C) Main 12 Volt Battery does not successfully pass a load test or Battery is sulfated. Auxiliary Battery does not successfully pass a load test or Battery is sulfated.