Computers and Control Systems: Pinpoint Tests
Test HB: Natural Gas Fuel Delivery System

PINPOINT TEST HB: NATURAL GAS FUEL DELIVERY SYSTEM

HB1 CHECK THE SYSTEM INTEGRITY

WARNING: BEFORE SERVICING OR REPLACING ANY COMPONENTS IN THE FUEL SYSTEM, REDUCE THE POSSIBILITY OF INJURY OR FIRE BY FOLLOWING THE DIRECTIONS IN THE FUEL SYSTEM WARNING, CAUTION AND NOTE AT THE BEGINNING OF THIS PINPOINT TEST.

- Key in ON position.
- Wait 5 seconds.
- Key in OFF position.
- Visually inspect the complete fuel delivery system including fuel lines, connections, fuel rail, pressure regulator and fuel injector areas for leaks (hissing noise), looseness, cracks, kinks, pinching or abrasion caused by a collision or mishandling.
- Visually inspect the electrical harness and connectors for loose pins, corrosion, abrasion or other damage from collision or mishandling.
- INSPECT the vehicle maintenance schedule and fuel filter.
- VERIFY the Inertia Fuel Shutoff (IFS) switch is set (button pushed in).
- Verify the battery is fully charged.
- Verify the fuse integrity.

Are any of the above concerns present?

Yes	No
REPAIR as necessary. VERIFY the symptom no longer exists.	For a poor fuel range symptom GO to the NG fuel tank venting procedures. For Fuel smell symptom GO to HB28 . For all other symptoms: GO to HB2 .

HB2 CHECK FUEL TANK PRESSURE

- Verify there is a minimum of 1/8 tank of fuel.
- Key in ON position.
- Access the AFCM and monitor the TANKPR PID.
- Record the fuel tank pressure reading and fuel gauge reading.

Is the fuel pressure reading greater than 3,448 kPa (500 psi)?

Yes	No
Key in OFF position. For No Start symptom GO to HB13 . For all other symptoms: GO to HB6 .	GO to HB3 .

HB3 CHECK PWR AND GND CIRCUITS TO THE FUEL TANK FUEL SOLENOID VALVE (FSV)

- Key in ON position.
- Command the outputs ON.

Note: The measurement must be made within 7 seconds of activating test mode.

- Measure the voltage between:

(+) FSV Solenoid Connector, Harness Side	(-) FSV Solenoid Connector, Harness Side
FSVPWR - Pin 1	GND - Pin 3

Is the voltage greater than 10.5 V?

Yes	No
GO to the NG fuel tank venting procedures. Follow the Fuel Tank Solenoid Shut-off valve diagnostic procedures.	GO to HB4 .

HB4 CHECK FOR OPEN GND CIRCUIT TO FUEL TANK FSV

- Key in OFF position.
- Measure the resistance between:

(+) FSV Solenoid Connector, Harness Side	(-) Vehicle Battery
GND - Pin 3	Negative terminal

Is the resistance less than 5 ohms?

Yes	No
REPAIR the open circuit and retest the vehicle. FSVPWR circuit concern.	GO to HB5 .

Test HB3 - HB4

HB5 CHECK FOR OPEN GND CIRCUIT TO THE NGV MODULE

- Key in OFF position.
- NG Module connector disconnected.
- Measure the resistance between:

(+) NG Module Connector, Component Side	(-) Vehicle Battery
PWRGND	Negative terminal

Is the resistance less than 5 ohms?

Yes	No
REPAIR the open circuit.	INSTALL a new NG module.

HB6 CHECK THE FUEL PRESSURE

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- Key in ON position.
- Access the PCM and monitor the FRP PID.

Is the pressure between 552 - 827 kPa (80.1 - 119.9 psi)?

Yes	No
Verify voltage was steady. If voltage is not steady verify that no injector is stuck open. If an injector is stuck open, verify the NGV module circuit is not the cause. If OK, For E-Series Dedicated NGV, and F-150 Heritage Bi-Fuel, GO to HB7 . For all others, GO to HB12 .	GO to HB17 .

HB7 GENERATE THE OPPOSITE SIGNAL

- FRP Sensor connector disconnected.
- Key in ON position.
- Access the PCM and monitor the FRP V PID.
- Connect a 5 amp fused jumper wire between the following:

Point A FRP Sensor Connector, Harness Side	Point B FRP Sensor Connector, Harness Side
FRP	VREF

Does a diagnostic tool communication concern exist?

Yes	No
Key in OFF position. REMOVE the jumper. GO to HB11 .	GO to HB8 .

HB8 CHECK THE FRP V PID

- Access the PCM and monitor the FRP V PID.

Is the voltage greater than 4.75 V?

Yes	No
Key in OFF position. REMOVE the jumper. For other than no start symptoms, INSTALL a new FRP. Otherwise: GO to HB10 .	REMOVE the jumper. GO to HB9 .

HB9 CHECK THE VREF VOLTAGE TO FRP SENSOR

- Measure the voltage between:

(+) FRP Sensor Connector, Harness Side	(-) FRP Sensor Connector, Harness Side
SRef	SRtn

Is the voltage between 4 V - 5.5 V?

Yes	No
Key in OFF position. GO to HB10 .	Key in OFF position. GO to C25 .

HB10 CHECK THE FRP CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) NG Module Connector, Harness Side	(-) FRP Sensor Connector, Harness Side
FRP	FRP

Is the resistance less than 5 ohms?

Yes	No
GO to HB11 .	REPAIR the open circuit.

HB11 CHECK THE FRP CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- Diagnostic tool connector disconnected.
- Measure the resistance between:

(+) NG Module Connector, Harness Side	(-) NG Module Connector, Harness Side
FRP	SRtn

- Measure the resistance between:

(+) NG Module Connector, Harness Side	(-) Vehicle Battery
FRP	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
For other than no start symptoms, INSTALL a new NG Module. Otherwise: GO to HB20 .	REPAIR the short circuit.

Test HB10 - HB11

HB12 GENERATE THE OPPOSITE SIGNAL

- FRP Sensor connector disconnected.
- Key in ON position.
- Access the PCM and monitor the FRP V PID.
- Connect a 5 amp fused jumper wire between the following:

Point A FRP Sensor Connector, Harness Side	Point B FRP Sensor Connector, Harness Side
FRP	VREF

Does a diagnostic tool communication concern exist?

Yes	No
Key in OFF position. REMOVE the jumper. GO to HB16 .	GO to HB13 .

HB13 CHECK THE FRP V PID

- Access the PCM and monitor the FRP V PID.

Is the voltage greater than 4.75 V?

Yes	No
Key in OFF position. REMOVE the jumper. For other than no start symptoms, INSTALL a new FRP. Otherwise: GO to HB15 .	REMOVE the jumper. GO to HB14 .

HB14 CHECK THE VREF VOLTAGE TO FRP SENSOR

- Measure the voltage between:

(+) FRP Sensor Connector, Harness Side	(-) FRP Sensor Connector, Harness Side
VREF	SIGRTN

Is the voltage between 4 V - 5.5 V?

Yes	No
Key in OFF position. GO to HB15 .	Key in OFF position. GO to C1 .

HB15 CHECK THE FRP CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FRP Sensor Connector, Harness Side
FRP	FRP

Is the resistance less than 5 ohms?

Yes	No
GO to HB16 .	REPAIR the open circuit.

HB16 CHECK THE FRP CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- Diagnostic tool connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRP	SIGRTN

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
FRP	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
For other than no start symptoms, INSTALL a new PCM. Otherwise: GO to HB20 .	REPAIR the short circuit.

HB17 VERIFY THE FUEL RAIL FSV OPENS

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- Key in ON position.
- Command the outputs ON.

- Start and stop several times by toggling the START and STOP button on the diagnostic tool and listening or feeling for a click at the FSV.
- Key in OFF position.

Was a click of the FSV felt or heard?

Yes	No
For E-Series Dedicated NGV, and F-150 Heritage Bi-Fuel, GO to HB7 . For all others, GO to HB12 .	GO to HB18 .

HB18 CHECK PWR AND GND CIRCUITS TO THE FUEL RAIL FUEL SOLENOID VALVE (FSV)

- Key in ON position.
- Command the outputs ON.
- Key on engine running.
- Measure the voltage between:

(+) FSV Solenoid Connector, Harness Side	(-) FSV Solenoid Connector, Harness Side
FSVPWR - Pin 1	GND - Pin 3

Is the voltage greater than 10.5 V?

Note: The measurement must be made within 7 seconds of activating test mode.

Yes	No
INSTALL a new FSV solenoid and retest vehicle.	GO to HB19 .

HB19 CHECK FOR OPEN GND CIRCUIT TO FUEL RAIL FSV

- Measure the resistance between:

(+) FSV Solenoid Connector, Harness Side	(-) Vehicle Battery
GND - Pin 3	Negative terminal

Is the resistance less than 5 ohms?

Yes	No
REPAIR the open circuit and retest the vehicle. FSVPWR circuit concern.	REPAIR the open circuit and retest the vehicle. GND circuit concern.

HB20 VERIFY FSV SEALS

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- Relieve the fuel pressure. Follow the Fuel Line Pressure Relief procedure in the beginning of this pinpoint test.
- FSV Solenoid connector disconnected. (Located at the fuel injection supply manifold.)
- Re-open the manual lockdown valve jackscrews that were closed while performing the fuel line pressure relief procedure.
- Wait 2 minutes.
- Key in ON position.
- Access the PCM and monitor the FRP PID.

Is the pressure less than 70 kPa (10.2 psi)?

Yes	No
GO to HB21 .	INSTALL a new FSV solenoid and retest vehicle.

HB21 VERIFY FSV PARTIALLY OPENS

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- Key in OFF position.
- FSV Solenoid connector connected. (Located at the fuel injection supply manifold.)
- Key in ON position.
- Access the PCM and monitor the FRP PID.

Is the pressure between 552 - 827 kPa (80.1 - 119.9 psi)?

Yes	No
Key in OFF position. GO to HB22 .	INSTALL a new FSV plunger and housing assembly and retest vehicle.

Test HB20 - HB21

HB22 VERIFY FSV FULLY OPENS

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- Relieve the fuel pressure. Follow the Fuel Line Pressure Relief procedure in the beginning of this pinpoint test.
- Re-open the manual lockdown valve jackscrews that were closed while performing the fuel line pressure relief procedure.
- Key OFF then SNAP START (key quickly turned from OFF to START without pausing at the RUN position.).
- Immediately increase engine speed to 2,500 RPM.
- Access the PCM and monitor the FRP PID.

Is the pressure between 552 - 827 kPa (80.1 - 119.9 psi)?

Yes	No
Key in OFF position. GO to HB23 .	INSTALL a new FSV plunger and housing assembly and retest vehicle.

HB23 VISUALLY CHECK FSV PLUNGER AND HOUSING

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- Visually check FSV plunger and housing. The FSV plunger may be sticking in the FSV plunger housing due to fuel contamination. Verify FSV plunger and housing is clean.

Are all checks OK?

Yes	No
GO to HB24 .	Service as necessary (plunger and housing assembly are replaced separately)

HB24 CHECK THE FUEL PRESSURE

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- Key on engine running.
- Access the PCM and monitor the FRP PID.
- Note the FRP PID pressure at idle and at 2,500 RPM.

Is the pressure between 552 - 827 kPa (80.1 - 119.9 psi)?

Note: Pressure must be greater than 552 kPa (80.1 psi) at 2,500 RPM.

Yes	No
Key in OFF position. GO to HB25 .	INSTALL a new Fuel Pressure Regulator and retest vehicle. Verify a blockage does not exist in the fuel lines.

HB25 VERIFY FPR THERMOSTAT OPERATION

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- Key on engine running.
- Bring the engine to normal operating temperature.
- Measure the temperature of the fuel pressure regulator coolant bowl or coolant outlet with a thermometer or temperature probe.

Is the temperature between 15°C (59°F) - 60°C (140°F)?

Yes	No
Key in OFF position. GO to HB26 .	INSTALL a new Fuel Pressure Regulator and retest vehicle. CHECK the coolant lines and coolant system for proper operation.

HB26 VERIFY FUEL INJECTOR FLOW

- Key in OFF position.
- Key in ON position.
- Access the PCM and monitor the FRP PID.
- Electronic fuel injector tester connected to suspect injector.
- Select a pulse width of 200 msec.
- Activate the fuel injector tester.
- Subtract the final pressure from the initial pressure to determine the pressure drop.
- Repeat the test on all remaining fuel injectors.

Is the pressure drop within 241 kPa (35 psi) to 345 kPa (50 psi)?

Yes	No
Concern is elsewhere. RETURN to Symptom Charts for further direction.	GO to HB27 .

HB27 DETERMINE THE FUEL INJECTOR FLOW CONSISTENCY

Do all fuel injectors flow within 20 kPa (3 psi) of each other?

Yes	No
Concern is elsewhere. RETURN to Symptom Charts for further direction.	INSTALL a new Fuel Injector and retest vehicle. Note: More than 1 fuel injector may require replacement.

HB28 CHECK FOR LEAKING FUEL

- Possible causes:
  - Loose fitting connections.
  - Damaged or worn seals or fittings.
  - Damaged fuel lines or fuel system components.

Note: After the vehicle has not run for several hours, a slight natural gas smell may emanate from within the intake manifold and intake air system. This is normal as the fuel injectors leak down over several hours. If a fuel leak is present, it may be necessary to cycle the key to maintain adequate pressure when checking for leaks using the natural gas sniffer.

- Key in OFF position.
- Access the PCM and monitor the FRP PID.
- Key in ON position.
- CHECK for leaks with the natural gas sniffer provided in Rotunda tool kit (134-00254) or a soapy water-based solution such as Snoop. Cover the complete joint with this solution. Examine the components or joints for 60 seconds for signs of bubbles.

Are any fuel leaks present?

Yes	No
VERIFY the proper torque of the suspect fuel system component(s). REPAIR as necessary.	Concern is elsewhere. RETURN to Symptom Charts for further direction.

HB29 CONTINUOUS MEMORY DTCS P1180 AND P1181: CHECK THE FUEL PRESSURE

- Visually inspect the complete fuel delivery system including fuel lines, connections, fuel rail, pressure regulator and fuel injector areas for leaks (hissing noise), looseness, cracks, kinks, pinching or abrasion caused by a collision or mishandling.

Are any Fuel System concerns present?

Yes	No
REPAIR as necessary.	GO to HB30 .

HB30 CHECK FUEL TANK PRESSURE

- Key on engine running.
- Access the PCM and monitor the FRP and TANKPR PIDs.
- Record the PID values.
- Locate the approximate fuel tank pressure value on the chart below.
- Using this value, determine the approximate PCM inferred pressure.

Fuel Tank Pressure	PCM inferred pressure (PSI)
30000	94
28000	95.5
26000	96
24000	96
23000	96.31
22000	97.25
21000	97.5
20000	98.5
19000	99
18000	99.31
17000	99.75
16000	100.75
14000	101.75
13000	102.25
12000	102.5
11000	103
10000	103.38
9000	104.5
8000	105
7000	105.56
6000	106
5000	106.5
4000	106.88
3000	108.44
2000	109
0	0

Is the PCM inferred pressure +/- 152 kPa (+/- 22 psi) of the FRP value?

Yes	No
Diagnose other continuous memory DTCs. Concern is elsewhere. RETURN to Symptom Charts for further direction.	For other than P1180, REPLACE the fuel pressure regulator. Otherwise: GO to HB31 .

HB31 CHECK THE FUEL FILTER FOR WATER OR OTHER CONTAMINATION

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- Disassemble the fuel filter and check for water and other contamination.

Is there any evidence of contamination ?

Yes	No
INSTALL a new Fuel Filter assembly and retest vehicle. CLEAN contamination from the filter housing.	GO to HB32 .

HB32 CHECK THE FUEL SUPPLY LINE FOR RESTRICTION

- Visually inspect the complete fuel delivery system for damage.

Are any fuel delivery concerns present?

Yes	No
REPAIR as necessary.	GO to HB33 .

HB33 ENGINE NO START

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- FRP Sensor connector disconnected.
- Attempt to start engine.

Does the engine start?

Yes	No
INSTALL a new FRP sensor and retest vehicle.	INSTALL a new Fuel Pressure Regulator and retest vehicle.