HC: Fuel Delivery System

WARNING: Crown Victoria Police Interceptor vehicles equipped with fire suppression system, refer to Section 419-03 for Important Safety Warnings. Failure to follow these instructions may result in personal injury.

WARNING: The fuel system remains under pressure after the engine is off. Relieve pressure before repairing. Highly flammable mixtures are present. To release pressure from the fuel system, carry out the following:

- **Connect Rotunda fuel pressure gauge 134-R0087 or equivalent.**
- **Gradually open the testing kit valve to relieve the fuel pressure in the vehicle fuel system and drain the fuel into a suitable container or return it to the fuel tank.**
- **To avoid unnecessary fuel spillage and fire hazard, any time fuel lines are disconnected, the ignition switch must be in the OFF position unless fuel pump operation is required for test purposes.**

Failure to follow these instructions may result in personal injury.

WARNING: Before working on or disconnecting any of the fuel tubes or fuel system components, relieve the fuel system pressure to prevent accidental spraying of fuel. Fuel in the fuel system remains under high pressure, even when the engine is not running. Failure to follow this instruction may result in serious personal injury.

WARNING: Do not smoke, carry lighted tobacco or have an open flame of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: Do not carry personal electronic devices such as cell phones, pagers or audio equipment of any type when working on or near any fuel-related component. Highly flammable mixtures are always present and may be ignited. Failure to follow these instructions may result in serious personal injury.

WARNING: When handling fuel, always observe fuel handling precautions and be prepared in the event of fuel spillage. Spilled fuel may be ignited by hot vehicle components or other ignition sources. Failure to follow these instructions may result in serious personal injury.

WARNING: Clean all fuel residue from the engine compartment. If not removed, fuel residue may ignite when the engine is returned to operation. Failure to follow this instruction may result in serious personal injury.

Note: *Replacement fuel injectors may not be the same color as the original injectors in the vehicle. Verify the replacement injector is correct for the application by part number.*

This pinpoint test is intended to diagnose the following:

- chassis components
- engine vacuum
- fuel pressure
- fuel supply line
- fuel supply
- fuel filter (9155)
- fuel injector(s) (9F593)
- fuel pump (9H307)

Note: *With the engine running, the FRP PID value may be 48-70 kPa (7-10 psi) higher than a fuel pressure reading taken with a mechanical gauge.*

Fuel System Specification Chart (Ignition ON, Engine OFF Values)

Application	Fuel System Type	FRP PID Fuel Pressure (kPa)	FRP PID Fuel Pressure (psi)	External Pressure Gauge (kPa)	External Pressure Gauge (psi)
Crown Victoria/Grand Marquis/Town Car	ERFS (1)	240-485	35-70	240-485	35-70
Edge/MKX	MRFS (2)	-	-	331-485	48-70
Escape/Mariner	ERFS (1)	240-485	35-70	240-485	35-70
E-Series	ERFS (1)	240-485	35-70	240-485	35-70
Expedition/Navigator	MRFS (2)	-	-	331-485	48-70
Explorer/Explorer Sport Trac/Mountaineer	ERFS (1)	240-485	35-70	240-485	35-70
F-150, Mark LT	ERFS (1)	240-485	35-70	240-485	35-70
F-Super Duty	ERFS (1)	240-485	35-70	240-485	35-70
Taurus/Taurus X/Sable	MRFS (2)	-	-	331-485	48-70
Focus	MRFS (2)	-	-	331-485	48-70
Fusion/Milan/MKZ	MRFS (2)	-	-	331-485	48-70

Application	Fuel System Type	FRP PID Fuel Pressure (kPa)	FRP PID Fuel Pressure (psi)	External Pressure Gauge (kPa)	External Pressure Gauge (psi)
Mustang	ERFS (1)	240-485	35-70	240-485	35-70
Ranger	MRFS (2)	-	-	331-485	48-70

Fuel System Type Definitions:

(1) Electronic Returnless Fuel System (ERFS):

This type of fuel delivery system does not return fuel to the fuel tank by means of a return line. This system does not incorporate a mechanical pressure regulator. Pressure is controlled by continuously varying the fuel pump speed through the fuel pump driver module (FPDM). All vehicles equipped with ERFS use a fuel rail pressure temperature (FRPT) sensor.

(2) Mechanical Returnless Fuel System (MRFS):

This type of fuel delivery system does not return fuel to the fuel tank by means of a return line. Fuel pressure is controlled by a mechanical pressure regulator located on the fuel pump module in the fuel tank. Vehicles equipped with MRFS do not use a fuel rail pressure temperature (FRPT) sensor.

Inertia Fuel Shutoff (IFS) Switch - Reset Instructions

WARNING: If you see or smell gasoline at any time other than during fueling, do not reset the inertia fuel shutoff (IFS) switch. Failure to follow these instructions may result in personal injury.

- Key in OFF position.
- Check for fuel leaks in the engine compartment.
- If no leak is present, reset the IFS switch by pushing the reset button on the top of the switch. Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch.
- In the closed position, the button can be pressed an additional 1.57 mm (1/16 in) against a spring.
- Key ON, engine OFF.
- Key in OFF position.
- Key ON, engine OFF.
- Key in OFF position.
- Check for leaking fuel.

HC1 DTC P0148 OR SYMPTOMS WITHOUT DTCS: CHECK THE SYSTEM INTEGRITY

- Visually inspect the complete fuel delivery system for damage and leakage.

  Check the following:
  - fuel lines and connections
  - relays
  - fuel tank
  - fuel pump
  - fuel pressure regulator
  - fuel pulse damper
  - fuel rail at injectors
  - damaged connector pins
  - electrical connectors not fully engaged
- Verify the vehicle has followed the maintenance schedule. A new fuel filter should have been installed within the last 48,280 km (30,000 miles).
- Verify the inertia fuel shutoff (IFS) switch is set (button pushed in). Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch.
- Verify the fuse integrity.
- Verify the battery is fully charged.
- Verify clean sufficient fuel.

Is a concern present?

Yes	REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.
No	GO to HC2.

HC2 CHECK ALL SYSTEM RELATED DEVICES (SENSOR, DAMPER OR REGULATOR) FOR LEAKAGE

- Ignition OFF.
- FP connector connected.
- Remove the vacuum hose on each system device connected to the fuel rail.
- Inspect for the presence of fuel in the vacuum line of each device connected to the fuel rail.
- Ignition ON, engine running.
- Check for manifold vacuum at each system related component with a vacuum line.
- Ignition OFF.

Are all vacuum lines for system related devices indicating no fuel present?

Yes	GO to HC3.
No	If the vacuum line connected to a component indicates that a fuel leak is present, INSTALL a new component.

	CLEAR the DTCs. REPEAT the self-test.

HC3 CHECK THE FUEL PRESSURE

- Ignition OFF.
- Relieve the fuel pressure. Refer to the Workshop Manual Section 310-00, Fuel System for the Fuel System Pressure Release procedure.
- Mechanical fuel pressure gauge connected.
- Ignition ON, engine OFF.
- Pressurize the fuel system. Refer to the Workshop Manual Section 310-00, Fuel System for the Fuel System Pressure Release procedure to pressurize the fuel system.
- FP connector connected.
- Cycle the key several times to charge the fuel system.
- Compare the fuel pressure reading to the Fuel System Specification Chart.

Is the fuel pressure within range?

Yes	GO to HC6.
No	GO to HC4.

HC4 CHECK THE FUEL PUMP GROUND CIRCUIT FOR AN OPEN CIRCUIT IN THE HARNESS

Note: *Refer to the Wiring Diagrams Manual for schematic and connector information.*

- FP connector disconnected.
- Measure the voltage between:

(+) Vehicle Battery	(-) FP Connector, Harness Side
Positive terminal	FPGND

Is the voltage greater than 10 V?

Yes	GO to HC5.
No	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HC5 CHECK THE FUEL PUMP POWER CIRCUIT FOR AN OPEN IN THE HARNESS

Note: *During output state control, the fuel pump stays commanded on for only about 5 seconds.*

- Verify the inertia fuel shutoff (IFS) switch is set (button pushed in). Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch.
- FP connector disconnected.
- Ignition ON, engine OFF.
- Access the PCM and control the FP (MODE) PID.
- Be aware that output state control turns off the FP after a calibrated time. If this happens, command the outputs on again to continue testing.
- Measure the voltage between:

(+) FP Connector, Harness Side	(-) Vehicle Battery
FPPWR	Negative terminal

Is the voltage greater than 10 V?

Yes	For Vehicles that do not start, GO to HC16. For all others, GO to HC12.
No	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

HC6 CHECK THE SEPARATION LEVEL OF THE ETHANOL/WATER MIXTURE AND GASOLINE IN THE FUEL

Note: *This step requires the use of a locally obtained 200 ml beaker and a 25 ml graduated cylinder.*

Note: *After approximately 3 minutes of standing, the ethanol and water mixes together and settles to the bottom of the 25 ml graduated cylinder. The gasoline rises to the top.*

- Fill the 200 ml beaker with 5 ml of clean water.
- Use the pressure relief valve on the mechanical fuel gauge to drain 22 ml of fuel into an approved clean container.
- Pour 20 ml of fuel from the approved clean container into the 25 ml graduated cylinder.
- Add enough water from the 200 ml beaker to the 25 ml graduated cylinder to bring the total volume of liquid to 24 ml.
- Insert a stopper plug in the opening of the 25 ml graduated cylinder.
- Firmly hold the stopper in place and shake the 25 ml graduated cylinder to mix the water and fuel.
- Allow the liquid to stand and separate for approximately 3 minutes.

- Record the separation level from the 25 ml graduated cylinder where the ethanol/water mixture and gasoline meet.

Did the ethanol/water mixture and gasoline separate?

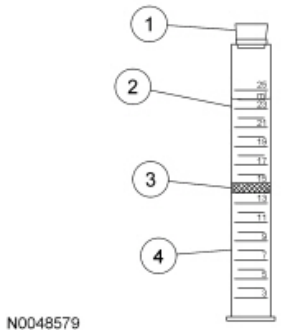
Yes	GO to HC7.
No	COMPLETE all steps before continuing. The ethanol/water mixture will separate from the gasoline. If the fuel does not appear to separate, then the fuel is either 100% ethanol or a mixture of ethanol and water.

HC7 CALCULATE THE PERCENTAGE OF ETHANOL IN THE FUEL

Note: *Use the illustration as an example for calculating the percentage of ethanol in the following steps. If the separation level is at 14 ml the calculation becomes; 14 minus 4, then multiply by 5 to equal 50. The percentage of ethanol in the fuel is 50%.*

- Ignition OFF.
- Take the recorded separation level from the previous step and subtract the amount of water added.
- Multiply the new value by 5. This new value is the percentage of ethanol in the fuel.
-

Item Number	Description
1	Stopper
2	Gasoline
3	Separation Point at 14 ml
4	Ethanol/Water Mixture



- Record the calculated percentage of ethanol in the fuel.

Is any ethanol present in the fuel?

Yes	For flex fuel vehicles, GO to HC8. For all others, GO to HC11.
No	GO to HC12.

HC8 COMPARE THE FF_INF PID TO THE CALCULATED PERCENTAGE OF ETHANOL

Note: *When determining if the FF_INF PID value is within 50% of the calculated percentage of ethanol, if the calculated percentage of ethanol value is 40% then the PID value should be between 0 - 90%. The PID value cannot be less than zero.*

- Ignition ON, engine OFF.
- Access the PCM and monitor the FF_INF (PER) PID.
- Compare the FF_INF PID to the calculated percentage of ethanol.

Is the FF_INF PID value within 50% of the calculated percentage of ethanol?

Yes	GO to HC12.
No	GO to HC9.

HC9 RESET THE PERCENT ETHANOL PARAMETER IN THE PCM

Note: *Certain customer fueling practices such as only fueling with small amounts of fuel or repeatedly switching between gasoline and an ethanol blend greater than E15 may prevent the PCM from learning the correct ethanol content in the fuel.*

- Reset the keep alive memory (KAM). Refer to Section 2, Resetting The Keep Alive Memory (KAM).
- Ignition ON, engine running.
- Access the PCM and monitor the FF_LRND (MODE) PID.
- Drive the vehicle approximately 11.3 km (7 miles) or until the FF_LRND PID indicates yes.

Is the PID state YES?

Yes	GO to HC10.
No	GO to HC18.

HC10 COMPARE THE UPDATED FF_INF PID TO THE CALCULATED PERCENTAGE OF ETHANOL

- Ignition OFF.
- Ignition ON, engine OFF.
- Access the PCM and monitor the FF_INF (PER) PID.

Is the FF_INF PID value within 50% of the calculated percentage of ethanol?

Yes	Return the vehicle to the customer. ADVISE the customer of the correct fueling practices when using flex fuel. REFER to the Owner's Literature for additional information. ADVISE the customer to continue to use the same fuel for the next 2-3 refuels. This practice helps to verify the PCM is learning the correct percentage of ethanol in the fuel.
No	A fuel system concern may be present, which prevents the PCM from learning the correct percentage of ethanol in the fuel, GO to HC12.

HC11 DETERMINE IF THE PERCENTAGE OF ETHANOL IN THE FUEL IS LESS THAN 25%

- Check the recorded calculated percentage of ethanol in the fuel.

Is the calculated percentage of ethanol in the fuel less than 25%?

Yes	GO to HC12.
No	REPAIR as necessary. ADVISE the customer of the correct fuel type required for this vehicle. REFER to the Owner's Literature for additional information. CLEAR the DTCs. REPEAT the self-test.

HC12 CHECK THE FUEL PRESSURE LEAKDOWN

Note: *When the fuel pump is commanded off, the fuel pressure may substantially decrease and then stabilize.*

Note: *During output state control, the fuel pump stays commanded on for only about 5 seconds.*

- Mechanical fuel pressure gauge connected.
- Ignition ON, engine OFF.
- Access the PCM and control the FP (MODE) PID.
- Run the fuel pump to obtain maximum fuel pressure.
- Command the fuel pump off.
- Allow the fuel pressure to stabilize.
- Record the stabilized reading.
- Monitor the fuel pressure for 1 minute.

Does the fuel pressure remain within 34 kPa (5 psi) of the recorded reading (MRFS) or greater than 275 kPa (40 psi) (ERFS) after 1 minute?

Yes	For ERFS, GO to HC14. For MRFS, GO to HC15.
No	GO to HC13.

HC13 CHECK THE FUEL INJECTOR FLOW AND LEAKAGE

Note: *Observe the Warnings, Cautions, and Notes.*

- Check the fuel injectors for leakage and flow rate using the injector flow tester or other method such as inspecting the intake manifold for fuel.

Are the test results satisfactory?

Yes	For ERFS, GO to HC14. For MRFS, GO to HC15.
No	INSTALL a new fuel injector as necessary. REFER to the Workshop Manual Section 303-04, Fuel Charging and Controls. RESET the keep alive memory (KAM). REFER to Section 2, Resetting The Keep Alive Memory (KAM). REPEAT the self-test.

HC14 COMPARE THE FRP PID TO THE MECHANICAL GAUGE

Note: *Most mechanical gauges are referenced to atmospheric pressure. The FRPT sensor is referenced to manifold pressure. In order to make a valid comparison, the engine must be off.*

Note: *The vehicle may exhibit a long crank until the fuel system is pressurized.*

- Ignition OFF.

- Relieve the fuel pressure. Refer to the Workshop Manual Section 310-00, Fuel System for the Fuel System Pressure Release procedure.
- Disable the fuel pump.
- Ignition ON, engine OFF.
- Monitor the mechanical gauge.
- Access the PCM and monitor the FRP (PRESS) PID.
- Compare the FRP PID value to the mechanical gauge.
- Ignition OFF.
- Pressurize the fuel system. Refer to the Workshop Manual Section 310-00, Fuel System for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Ignition ON, engine running.
- Allow the fuel pressure to stabilize.
- Ignition OFF.
- Ignition ON, engine OFF.
- Compare the FRP PID value to the mechanical gauge.

Are the FRP PID values within 34 kPa (5 psi) of the mechanical gauge readings?

Yes	GO to HC15.
No	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of this pinpoint test. REFER to the Workshop Manual Section 303-14, Electronic Engine Controls. CLEAR the DTCs. REPEAT the self-test.

HC15 MONITOR THE FUEL PRESSURE WHILE ROAD TESTING THE VEHICLE

WARNING: Strict observance of posted speed limits and attention to driving conditions are mandatory when carrying out the road test. Failure to follow these instructions may result in personal injury.

Note: *Some concerns may only be present during certain fuel level conditions. Determine the fuel level at the time of the concern. Access the information from the customer information worksheet and the customer.*

- Ignition OFF.
- Securely route the mechanical gauge so that the gauge is viewable while road testing the vehicle.
- Ignition ON, engine running.
- Engine at normal operating temperature.
- Monitor the mechanical gauge.
- From a stop, accelerate to 89 km/h (55 mph) at full throttle. Repeat this 3 times.

Is the fuel pressure always greater than 240 kPa (35 psi)?

Yes	For misfire DTC diagnosis, GO to HD8. For symptoms without DTCs, the concern is elsewhere. RETURN to Section 3, No Diagnostic Trouble Codes (DTCs) Present Symptom Chart Index for further direction. For all others, unable to duplicate or identify the concern at this time.
No	GO to HC16.

HC16 CHECK THE FUEL SUPPLY LINE FOR RESTRICTION

Note: *Observe the Warnings, Cautions, and Notes.*

- Ignition OFF.
- Disconnect the fuel supply line at the fuel rail.
- Disconnect the fuel supply line at the fuel pump.
- Check the fuel supply line for restriction.
- Apply 21 to 34 kPa (3 to 5 psi) air pressure to the fuel supply line.

Does air flow freely through the line?

Yes	For Crown Victoria, E-Series, Escape / Mariner, Expedition, Explorer, Explorer SportTrac, F-150, F-Series Super Duty, Focus, Grand Marquis, Mark LT, Mountaineer, Mustang, Navigator, Ranger, and Town Car, INSTALL a new Fuel Filter assembly. REFER to the Workshop Manual Section 310-01, Fuel Tank and Lines. GO to HC17. For all others, GO to HC17.
No	REPAIR the cause of the restriction. CLEAR the DTCs. REPEAT the self-test.

HC17 VERIFY THE REPAIR

WARNING: Strict observance of posted speed limits and attention to driving conditions are mandatory when carrying out the road test. Failure to follow these instructions may result in personal injury.

- Ignition ON, engine running.
- Engine at normal operating temperature.
- Monitor the mechanical gauge.
- From a stop, accelerate to 89 km/h (55 mph) at full throttle. Repeat this 3 times.

Is the fuel pressure always greater than 240 kPa (35 psi)?

Yes	The test is complete and no concerns are present.
No	INSTALL a new FP module. REFER to the Workshop Manual Section 310-01, Fuel Tank and Lines. CLEAR the DTCs. REPEAT the self-test.

HC18 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test and verify the concern is still present.

Is the concern still present?

Yes	INSTALL a new PCM. REFER to Section 2, Flash Electrically Erasable Programmable Read Only Memory (EEPROM).
No	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

© Copyright 2025, Ford Motor Company.