TEST DE: FLEX FUEL (FF) SENSOR

NOTE: After each service or repair procedure has been completed, reconnect all components. Clear DTCs and repeat QUICK TEST procedures to ensure all EEC-V systems are working properly and DTCs are no longer present.

Diagnostic Aids

Perform this test only when directed by QUICK TEST. This system test is intended to diagnose the following components and circuits:

- Flex Fuel (FF) sensor.
- Wiring harness circuits (FFS SIG, VPWR and PWR GND).
- Powertrain Control Module (PCM).

NOTE: Type of fuel vehicle uses can be identified by checking calibration sticker on left door jam. See FUEL TYPE IDENTIFICATION table. Fuel type can also be identified by checking label on fuel filler door.

FUEL TYPE IDENTIFICATION (1)

Calibration	Fuel Type
610C	Ethanol
610G	Methanol
(1) Calibration sticker is located on left door jam. Fuel type is also identified on fuel filler door.	

1) DTC P0176: Check FF Sensor VPWR Circuit

This DTC indicates failure in the FF sensor and/or circuit. Possible causes for this fault are:

- Faulty FF sensor.
- Open or shorted wiring harness circuits.
- Fuel separation or contamination.
- Faulty Powertrain Control Module (PCM).

Turn ignition off. Disconnect FF sensor connector. Turn ignition on. Measure voltage between negative battery terminal and VPWR terminal at FF sensor wiring harness connector. See **Fig. 71** . If voltage is more than 10.5 volts, go to next step. If voltage is 10.5 volts or less, repair VPWR circuit.

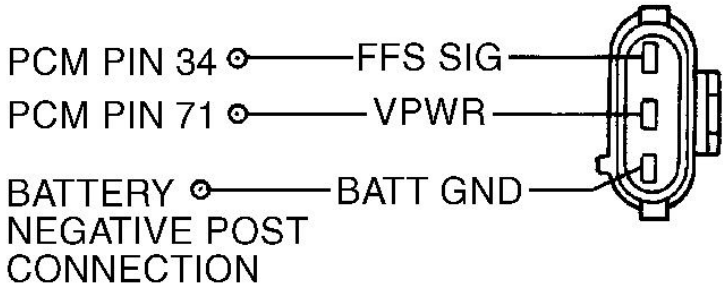

Fig. 71: Identifying Flex Fuel Sensor Circuits & Connector Terminals
Courtesy of FORD MOTOR CO.

2) Check FF Sensor Ground Circuit Resistance

Turn ignition off. Measure resistance between BATT GND terminal at FF sensor wiring harness connector and negative battery terminal. If resistance is more than 10,000 ohms, repair open circuit. If resistance is 10,000 ohms or less, go to next step.

3) Check FFS SIG Circuit Resistance

Disconnect PCM 104-pin connector. Inspect connector for loose, damaged or corroded terminals. Repair as necessary. Measure resistance between FFS SIG terminal of FF sensor wiring harness connector and PCM connector pin No. 34. If resistance is 5 ohms or more, repair open circuit. If resistance is less than 5 ohms, go to next step.

4) Check FFS SIG Circuit Short To Power

Disconnect scan tool Data Link Connector (DLC). Measure resistance between PCM connector pins No. 34 and 71 (VPWR). If resistance is 10,000 ohms or less, repair short circuit. If resistance is more than 10,000 ohms, go to next step.

5) Check FFS SIG Circuit Short To Ground

Measure resistance between PCM connector pin No. 34 and pins No. 51, 77 and 103 (PWR GND). If any resistance reading is 10,000 ohms or less, repair short circuit. If all resistance readings are more than 10,000 ohms, go to next step.

6) Check FF Sensor Dedicated Failure Mode PID

Reconnect all components. Start engine and allow to idle. Connect scan tool to DLC. Using scan tool,

select FFFM PID from PID/DATA monitor menu. If PID value indicates ON condition, go to next step and check FF sensor. If PID value does not indicate ON condition, proceed as follows:

- On ethanol vehicles, if percentage of ethanol in fuel is known, go to step 10) .
- On methanol vehicles, if percentage of methanol in fuel is known, go to step 11) .
- If percentage of ethanol or methanol in fuel is not known, go to next step.

7) Check FF Sensor Frequency

Leave engine idling. Using scan tool, select FF PID from PID/DATA monitor menu. If PID value indicates 40-160 Hz, turn ignition off and go to next step. If PID value does not indicate 40-160 Hz, turn ignition off and go to step 12) .

8) Determine Water Ethanol/Methanol & Gasoline Separation Point

Rotunda FFV Fuel Test Kit (014-00770), is required for this test. Turn ignition off. Ensure FF sensor is disconnected. Place hose end of fuel drain hose assembly in clean gas can. Connect fuel drain hose to fuel pressure relief valve. Fill beaker with 5 ml of clean water. Turn connector clockwise to tighten. Turn ON/OFF valve clockwise to open. Turn ignition on and leave on until at least 22 ml of fuel is pumped into gas can. Pour 20 ml of fuel into 25 ml graduated cylinder. Pour 4 ml of water into cylinder. Plug cylinder and shake cylinder. Let cylinder stand for 3 minutes, allowing fluids to separate. Water and methanol (or ethanol and water) will blend and settle on the bottom of cylinder. Gasoline will rise to the top. Record fluid levels and go to next step.

9) Determine Ethanol/Methanol Percentage

To determine the percentage of ethanol/methanol in fuel, perform the following equation:

- Percent of methanol (or ethanol) = (A - 4) x 5.

The letter "A" in the above equation equals the level on the graduated cylinder recorded from step **8)** where the methanol/water (or ethanol/water) mixture and gasoline meet. See **Fig. 72** . Example, if reading from step **8)** is 14 ml, then the percentage of methanol (or ethanol) in the fuel mixture is (14 - 4) x 5, which equals 50. Therefore the percentage of methanol (or ethanol) in the fuel mixture is 50 percent.

The accuracy of this equation is plus or minus 10 percent. Dispose of fuel properly. Go to step 11) for methanol powered vehicles or go to next step for ethanol powered vehicles.

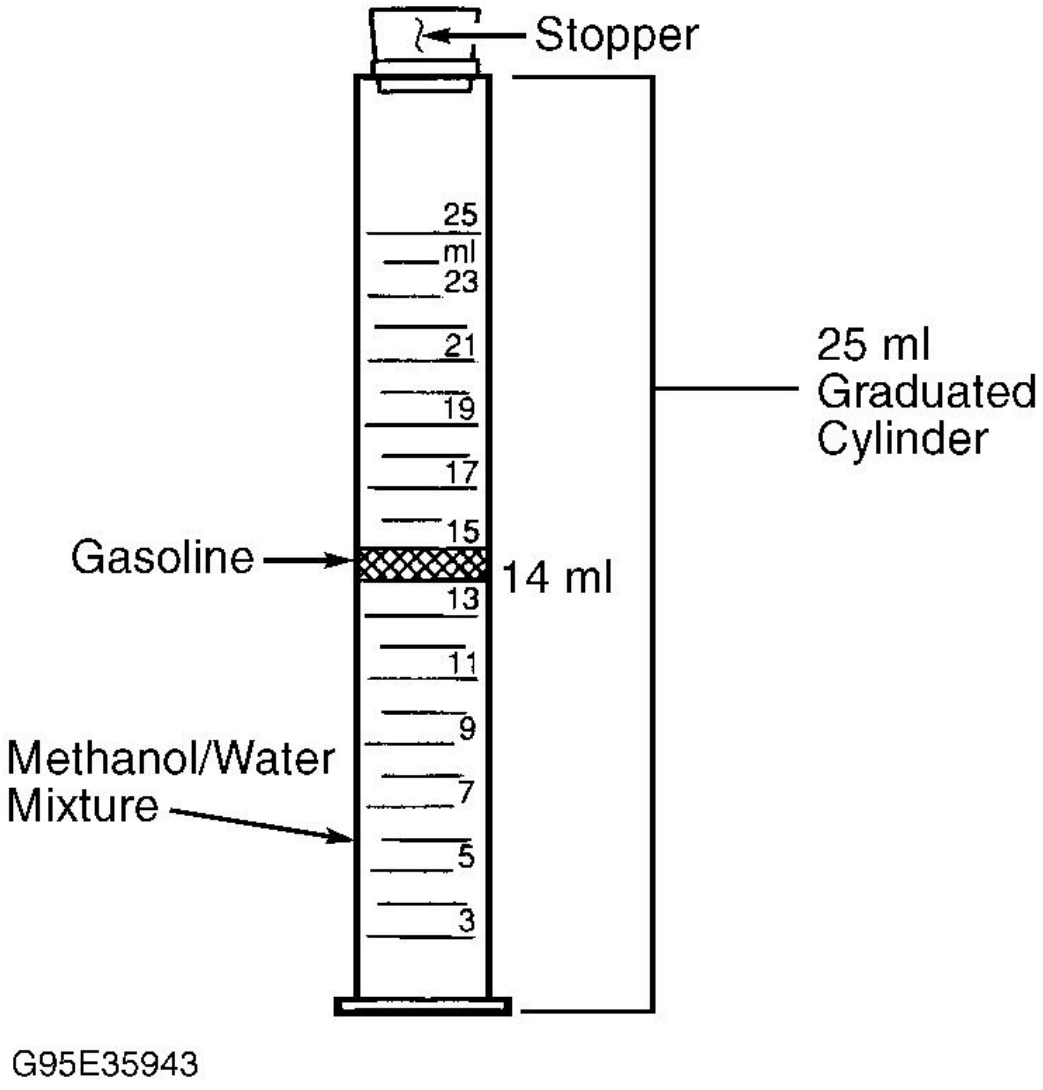

Fig. 72: Testing Flex Fuel Sample
Courtesy of FORD MOTOR CO.

10) Check FF Sensor (Ethanol Vehicles)

Start engine and allow to idle. Using scan tool, select FF PID from PID/DATA monitor menu. Record frequency reading. Use FF PID to determine blend (percentage) of ethanol. See **FF PID ETHANOL RATING** table. If FF PID value falls within the frequency range, replace PCM. If FF PID value does not fall within the frequency range, check fuel for contamination. If fuel is not contaminated, replace FF sensor. If fuel is contaminated, drain and refill fuel tank. Start engine and allow to idle until old fuel is purged from fuel rails. Repeat this step. If FF PID value still does not fall within the frequency range,

replace FF sensor.

FF PID ETHANOL RATING (1)

Ethanol Blend (FF PID%)	Frequency
Zero	40-60
15	50-70
25	60-80
35	65-85
45	75-100
55	80-105
65	90-110
75	95-120
85	105-125

(1) Ratings may vary between listed values.

11) Check FF Sensor (Methanol Vehicles)

Start engine and allow to idle. Using scan tool, select FF PID from PID/DATA monitor menu. Record frequency reading. Use FF PID to determine blend (percentage) of methanol. See **FF PID METHANOL RATING** table. If FF PID value falls within the frequency range, replace PCM. If FF PID value does not fall within the frequency range, check fuel for contamination. If fuel is not contaminated, replace FF sensor. If fuel is contaminated, drain and refill fuel tank. Start engine and allow to idle until old fuel is purged from fuel rails. Repeat this step. If FF PID value still does not fall within the frequency range, replace FF sensor.

FF PID METHANOL RATING (1)

Methanol Blend (FF PID%)	Frequency
Zero	40-60
15	55-75
25	65-85
35	75-95
45	85-105
55	95-115
65	105-125
75	115-135
85	125-145

(1) Ratings may vary between listed values.

12) Check PCM Function

Disconnect FF sensor. Using scan tool, select FF PID from PID/DATA monitor menu. Using NGS scan tool signal simulator or equivalent, feed a 100Hz signal into FFS SIG circuit terminal at FF sensor wiring

harness connector. Turn ignition on. If FF PID value reflects frequency input signal, replace FF sensor. If FF PID value does not reflect frequency input signal, replace PCM.

NOTE: A break in step numbering sequence occurs at this point. Procedure skips from step 12) to step 20). No test procedures have been omitted.

20) Continuous DTC P0176

Continuous DTC P0176 indicates failure in the FF sensor and/or circuit. Possible causes for this fault are:

- Faulty FF sensor.
- Open or shorted wiring harness circuits.
- Faulty Powertrain Control Module (PCM).

Perform **KOER ON-DEMAND SELF-TEST** . If KOER DTC P0176 is present, hard fault is present. Go to step 1) . If KOER DTC P0176 is not present, check for intermittent fault. See **TEST Z** .