2006 ENGINE PERFORMANCE

Pinpoint Tests - Escape Hybrid & Mariner Hybrid

PINPOINT TEST A: ENGINE NO START

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

WARNING: STOP THIS TEST AT THE FIRST SIGN OF A FUEL LEAK AND REPAIR AS REQUIRED.
NO OPEN FLAME. NO SMOKING DURING FUEL DELIVERY CHECKS.

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This pinpoint test is intended to diagnose the following:

- Spark (as related to electronic engine control).
- Powertrain control module (PCM) (12A650).

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Fig. 1: Identifying Electrical Throttle Body (ETB) Connector
Courtesy of FORD MOTOR CO.

Fig. 2: Identifying Data Link Connector (DLC)
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

A1 ATTEMPT TO CRANK THE ENGINE

- Crank the engine using the engine cranking diagnostic mode. Refer to **DIAGNOSTIC MODES** .

Does the engine crank?

Yes	No
Key in OFF position. GO to **A2**.	Key in OFF position. REFER to **ENGINE SYSTEM-GENERAL INFORMATION** to diagnose the difficult starting condition.

A2 IDENTIFY THE TYPE OF NO START

NOTE: The purpose of this test step is to identify intermittent no starts in order to determine the proper repair procedure.

- Start the engine using the engine running diagnostic mode. Refer to **DIAGNOSTIC MODES** .

Does the vehicle start?

Yes	No
Key in OFF position. Vehicle is an intermittent no start. GO to **Z2**.	Key in OFF position. GO to **A3**.

A3 CHECK THE VREF VOLTAGE TO THE TP SENSOR

- ETB connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ETB Connector, Harness Side	(-) ETB Connector, Harness Side
ETCREF - Pin 5	ETCRTN - Pin 4

Is the voltage between 4.5 V - 5.5 V?

Yes	No
Key in OFF position. GO to **A4**.	Key in OFF position. GO to Pinpoint Test **C**.

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A4 CHECK THE FLASH EEPROM POWER SUPPLY (FEPS) CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- ETB connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) DLC, Harness Side	(-) Vehicle Battery
FEPS - Pin 13	Negative terminal

Is the voltage greater than 9 V?

Yes	No
Key in OFF position. REPAIR the short circuit.	Key in OFF position. GO to **A5**.

A5 CHECK THE PCM DRIVER TO THE COILS

- Connect a test lamp between B+ and each coil driver circuit at the harness connector.
- Crank the engine using the engine cranking diagnostic mode. Refer to **DIAGNOSTIC MODES** .

Does the lamp blink consistently and brightly (one blink per engine revolution)?

Yes	No
Key in OFF position. GO to **A6**.	Key in OFF position. GO to Pinpoint Test **JD**.

A6 CHECK THE RPM IN THE PCM

NOTE: The diagnostic tool must be connected to a reliable power source that is powered with the key in the START position (such as directly to the vehicle battery). Also verify that the vehicle battery is fully charged.

- Access the PCM and monitor the RPM PID.
- Crank the engine using the engine cranking diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Monitor the RPM PID while cranking engine.

Is the RPM between 900 RPM - 1,200 RPM?

Yes	No
Key in OFF position. CHECK the secondary ignition system GO to Pinpoint Test **JB**.	Key in OFF position. GO to Pinpoint Test **JD**.

A7 CHECK THE FUEL PRESSURE

WARNING: BEFORE REPAIRING OR REPLACING ANY COMPONENTS IN THE

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FUEL SYSTEM, REDUCE THE POSSIBILITY OF INJURY OR FIRE BY FOLLOWING THE WARNING, CAUTION, AND HANDLING DIRECTIONS IN PINPOINT TEST HC.

- Relieve the fuel pressure.
- Connect the fuel pressure test gauge to the vehicle.
- Key ON, engine OFF.
- Enter output test mode. Refer to **OUTPUT TEST MODE (OTM)** .
- Activate the fuel pump to obtain maximum fuel pressure.

Is the fuel pressure within specification (refer to the fuel pressure chart in Pinpoint Test HC)?

Yes	No
Key in OFF position. GO to **A8**.	Key in OFF position. GO to Pinpoint Test **HC**.

A8 CHECK THE FUEL PRESSURE LEAKDOWN

WARNING: BEFORE REPAIRING OR REPLACING ANY COMPONENTS IN THE FUEL SYSTEM, REDUCE THE POSSIBILITY OF INJURY OR FIRE BY FOLLOWING THE WARNING, CAUTION, AND HANDLING DIRECTIONS IN PINPOINT TEST HC.

- Key ON, engine OFF.
- Enter output test mode. Refer to **OUTPUT TEST MODE (OTM)** .
- Activate the fuel pump to obtain maximum fuel pressure.
- Exit output test mode.
- Verify the fuel pressure remains within 34 kPa (5 psi) of the maximum pressure for 1 minute after turning the pump off.

Does the fuel pressure remain within 34 kPa (5 psi)?

Yes	No
Key in OFF position. GO to **A9**.	Key in OFF position. GO to Pinpoint Test **HC**.

A9 CHECK THE FUEL INJECTORS FOR VPWR

- Check at least 2 fuel injectors. A no start condition can exist only if greater than half of the fuel injectors are without VPWR.
- Disconnect any 2 fuel injectors.
- Key ON, engine OFF.
- Measure the VPWR voltage at the fuel injector harness connectors.

Is the voltage greater than 10.5 volts?

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Yes	No
Key in OFF position. GO to **A10**.	Key in OFF position. REPAIR the VPWR circuit.

A10 CHECK THE FUEL INJECTORS ABILITY TO DELIVER FUEL

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- Connect the fuel pressure test gauge to the vehicle.
- Cycle the key several times to activate the fuel system.
- Locate and activate the fuel inertia switch to disable the fuel pump.
- Monitor the fuel pressure gauge while cranking the engine for at least 5 seconds.

Is there a pressure drop greater than 34 kPa (5 psi) while cranking the engine?

Yes	No
Key in OFF position. The electronic engine control system is not the cause of the no start. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.	Key in OFF position. INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .

PINPOINT TEST AA: ENGINE DISABLED AND VEHICLE IMMOBILIZED

INTRODUCTION

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This pinpoint test is intended to diagnose the following:

- Harness circuits: ignition switch position run (ISP-R) and ignition switch position run/start (ISP-R/S)
- Powertrain control module (PCM) (12A650)
- Transaxle Assembly (7000)

TEST PROCEDURE

AA1 CHECK FOR IGNITION RUN INPUT AT THE PCM

- Access the PCM and monitor the IGN_R PID.
- Key ON, engine OFF.

Does the PID indicate YES (key in ISP-R position)?

Yes	No
Key in OFF position. GO to **AA2**.	Key in OFF position. GO to **FE3**.

AA2 CHECK FOR IGNITION RUN/START INPUT AT THE PCM

- Access the PCM and monitor the IGN_R/S PID.
- Attempt to start the engine.

Does the PID indicate YES (key in ISP-R/S position during engine crank)?

Yes	No
Key in OFF position. GO to **AA5**.	Key in OFF position. GO to **AA3**.

AA3 CHECK THE IGNITION RUN/START CIRCUIT FOR AN OPEN

- PCM connector disconnected.
- Turn the ignition key to the START position and hold.

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- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
ISP-R/S	Negative terminal

Is the voltage greater than 10.5 V?

Yes	No
GO to **AA4**.	CHECK for a damaged ignition switch. REFER to **COMPONENT TESTING** . If the ignition switch is OK, REPAIR the open circuit in the harness.

AA4 CHECK FOR GROUNDED IGNITION RUN/START CIRCUIT

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

(+) PCM Connector, Harness Side	(-) Vehicle Battery
ISP-R/S	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **AA9**.	CHECK the ignition switch for a short to ground. If OK, REPAIR the short to ground circuit in the harness.

AA5 CHECK THE VOLTAGE AND GROUND TO THE MODULES

- Key ON, engine OFF.
- Access the PCM and monitor the VBAT PID.
- Access the TCM and monitor the VBAT PID.

Are the voltages greater than 10.5 volts?

Yes	No
Key in OFF position. GO to **AA6**.	Key in OFF position. REPAIR as necessary.

AA6 CHECK THE STATUS OF THE CONTACTORS

- Key ON, engine OFF.
- Access the TCM and monitor the CONTACT PID.

Is the PID state CLOSED?

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Yes	No
Key in OFF position. GO to **AA7**.	Key in OFF position. The traction battery voltage must be in the correct operating range for the contactors to close. REFER to **HIGH VOLTAGE TRACTION BATTERY** for traction battery diagnosis.

AA7 CHECK HIGH VOLTAGE BATTERY POWER AT THE TRANSAXLE ASSEMBLY

- Key ON, engine running.
- Access the TCM and monitor the M_INV_V and G_INV_V PIDs.

Are the voltages between 216 - 400 V?

Yes	No
Key in OFF position. GO to **AA8**.	Key in OFF position. Diagnose the high voltage supply concern to the transaxle assembly. GO to Pinpoint Test **TT**.

AA8 CHECK FOR THE CORRECT VEHICLE MODE

- Key ON, engine running.
- Access the TCM and monitor the VEHMODE PID.

Is the PID state DRIVING?

Yes	No
Key in OFF position. The PCM and the transaxle assembly are not the cause of the engine no start. REFER to **SYMPTOM CHARTS** .	Key in OFF position. GO to **AA9**.

AA9 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE**	The system is operating correctly at this time. The concern may have been caused by a loose

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PROGRAMMABLE READ ONLY MEMORY (EEPROM) .	or corroded connector.

PINPOINT TEST B: POWERTRAIN CONTROL MODULE (PCM) POWER RELAY

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This pinpoint test is intended to diagnose the following:

- Harness circuit(s): vehicle power, ignition start/run, PCM power relay ground, battery positive voltage.
- PCM power relay (12A646).

Fig. 3: Identifying Powertrain Control Module Power (PCMPWR) Relay Connector
Courtesy of FORD MOTOR CO.

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Fig. 4: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

B1 CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- PCMPWR Relay connector disconnected.
- Measure the resistance between:

(+) PCMPWR Relay Connector, Harness Side	(-) PCM Connector, Harness Side
VPWR - Pin 5	VPWR - Pin B35, B36

Is the resistance less than 5 ohms?

Yes	No
GO to **B2**.	REPAIR the open circuit.

B2 CHECK THE B+ VOLTAGE TO PCMPR

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCMPWR Relay Connector, Harness Side	(-)
B+ - Pin 3	Ground
IGN START/RUN - Pin 1	Ground

Are the voltages greater than 10.5 V?

Yes	No
GO to **B3**.	Key in OFF position. REPAIR the open circuit.

B3 CHECK THE GROUND CIRCUIT TO THE PCM POWER RELAY

- Measure the voltage between:

(+) PCMPWR Relay Connector, Harness Side	(-) PCMPWR Relay Connector, Harness Side
B+ - Pin 3	GND - Pin 2

Is the voltage greater than 10.5 V?

Yes	No
INSTALL a new PCMPWR relay.	Key in OFF position. REPAIR the open circuit.

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PINPOINT TEST BA: POWER SUSTAIN RELAY (PSR)

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This pinpoint test is intended to diagnose the following:

- Power sustain relay (PSR) (14B192).
- Harness circuits: PSR, VPWR, B+.
- Powertrain control module (PCM) (12A650).

Fig. 5: Identifying Power Sustain Relay (PSR) Connector
Courtesy of FORD MOTOR CO.

Fig. 6: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

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BA1 DTC P0685: DETERMINE THE DTC BEING DIAGNOSED

Is DTC P0685 present in the KOEO or KOER self-test?

Yes	No
GO to **BA2**.	GO to **BA7**.

BA2 KOEO AND KOER DTC P0685: CHECK THE B+ VOLTAGE TO PSR

- PSR connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PSR Connector, Harness Side	(-)
B+ (coil) - Pin 1	Ground

Is the voltage greater than 10.5 V?

Yes	No
Key in OFF position. GO to **BA3**.	REPAIR the open circuit.

BA3 CHECK THE PSR RELAY

- Carry out the component test. Refer to **COMPONENT TESTING** to check the PSR relay.

Is the PSR relay OK?

Yes	No
GO to **BA4**.	INSTALL a new PSR.

BA4 CHECK THE PSR CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PSR Connector, Harness Side	(-)
PSR - Pin 2	Ground

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **BA5**.	REPAIR the short circuit.

BA5 CHECK THE PSR CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

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- Measure the resistance between:

(+) PSR Connector, Harness Side	(-)
PSR - Pin 2	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to **BA6**.	REPAIR the short circuit.

BA6 CHECK THE PSR CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PSR Connector, Harness Side	(-) PCM Connector, Harness Side
PSR - Pin 2	PSR - Pin B27

Is the resistance less than 5 ohms?

Yes	No
GO to **BA9**.	REPAIR the open circuit.

BA7 CONTINUOUS MEMORY DTC P0685: CHECK FOR AN INTERMITTENT SHORT TO GROUND IN THE PSR CIRCUIT

- PCM connector disconnected.
- Connect a non-powered test lamp between:

(+) Vehicle Battery	(-) PCM Connector, Harness Side
Positive terminal	PSR - Pin B27

- Key ON, engine OFF.
- Observe the test lamp for an indication of a fault while completing the following. (Note that the lamp illuminates when a fault is detected).
  - Shake, wiggle, and bend the PSR circuit(s).
  - Lightly tap on the PSR to simulate road shock.

Is a fault indicated?

Yes	No
Key in OFF position. ISOLATE the fault and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Key in OFF position. GO to **BA8**.

BA8 CHECK FOR AN INTERMITTENT OPEN IN THE PSR CIRCUIT

- PSR connector disconnected.

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- Measure the resistance between:

(+) PSR Connector, Harness Side	(-) PCM Connector, Harness Side
PSR - Pin 2	PSR - Pin B27

- Observe the DMM for an indication of a fault while completing the following. (Note that resistance changes suddenly when a fault is detected).
  - Shake, wiggle, and bend the PSR circuit.
  - Lightly tap on the PSR to simulate road shock.

Is a fault indicated?

Yes	No
Key in OFF position. ISOLATE the fault and REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	Key in OFF position. Unable to duplicate or identify the fault at this time. GO to Pinpoint Test **Z**.

BA9 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST BC: DTCS P0562 AND P0563: TRANSAXLE CONTROL MODULE (TCM) VOLTAGE CONCERN

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This pinpoint test is intended to diagnose the following harness circuits: B+, PSR, and GND.

The TCM stores continuous DTC P0562 when the ignition key is turned to the OFF position, and the vehicle travels for an additional 10 seconds.

Fig. 7: Identifying Transaxle Assembly-A Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

BC1 DTCS P0562 AND P0563: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during PCM or TCM self-test: P0562, P0563?

Yes	No
For DTC P0562, GO to **BC2**. For DTC P0563, GO to **BC6**.	Unable to duplicate or identify the fault at this time. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

BC2 DTC P0562: ARE THERE ANY OTHER TCM & PCM DTCS?

NOTE: This diagnostic trouble code is set when the TCM detects low system

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voltage or when the ignition key is turned to the OFF position and the vehicle travels for an additional 10 seconds.

Are any other DTCs received from the TCM or PCM module self-tests?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **BC3**.

BC3 CHECK THE POWER AND GROUND CIRCUITS TO THE TCM

- Transaxle Assembly-A connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Transaxle Assembly-A Connector, Harness Side	(-) Transaxle Assembly-A Connector, Harness Side
B+ - Pin 12	GND - Pin 2, 8
PSR - Pin 4, 5	GND - Pin 2, 8

Are the voltages greater than 10.5 V?

Yes	No
Key in OFF position. GO to **BC5**.	GO to **BC4**.

BC4 CHECK THE VOLTAGE TO THE TCM USING GROUND AS A REFERENCE

- Measure the voltage between:

(+) Transaxle Assembly-A Connector, Harness Side	(-)
B+ - Pin 12	Ground
PSR - Pin 4, 5	Ground

Are the voltages greater than 10.5 V?

Yes	No
Key in OFF position. CHECK the ground to Transaxle-A for corrosion or loose wires. REPAIR as necessary.	Key in OFF position. CHECK power to Transaxle-A for corrosion or loose wires. CHECK power to PSR for corrosion or loose wires. CHECK the power sustain relay (PSR) circuit(s) for corrosion or loose wires.

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	REPAIR as necessary.

BC5 CHECK THE TCM PWR & GND CIRCUIT(S) FOR INTERMITTENT CONCERNS

- Connect a non-powered test lamp between:

(+) Transaxle Assembly-A Connector, Harness Side	(-) Transaxle Assembly-A Connector, Harness Side
B+ - Pin 12	GND - Pin 2, 8

- Observe the test lamp for an indication of a fault while completing the following:
- (a fault is indicated by a sudden illumination change in the test lamp).
  - Shake, wiggle, and bend the B+, PSR, and GND circuit(s).
  - Visually inspect the transaxle and harness connectors for damage and corrosion.

Is a fault indicated?

Yes	No
ISOLATE the fault and REPAIR as necessary.	Key in OFF position. Unable to duplicate or identify the fault at this time. The DC/DC converter regulates voltage to the low voltage system. CHECK the wiring and the appropriate fuse. If OK, GO to Pinpoint Test **Z**.

BC6 DTC P0563: ARE THERE ANY OTHER TCM OR PCM DTCS?

Are any other DTCs received from the TCM or PCM self-tests?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	Unable to duplicate or identify the fault at this time. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

PINPOINT TEST C: REFERENCE VOLTAGE

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION

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KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

Important Safety Notice

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This article provides general directions for repairing vehicles with tested, effective techniques. Following them will help ensure reliability. There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles, as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

This pinpoint test is intended to diagnose the following:

- Accelerator pedal position sensor (APPS) (9F836).
- Electronic throttle body TPS (ETBTPS) (9N825).
- Fuel rail pressure temperature (FRPT) sensor (9G756).
- Fuel tank pressure (FTP) sensor (9C052).
- Intake manifold runner control monitor (IMRCM) sensor (9J559).
- Manifold absolute pressure (MAP) sensor (9F479).
- Harness circuits: VREF, ETCRTN, ETCREF1, ETCREF2, SIGRTN, ETCRTN1 and ETCRTN2.
- Powertrain control module (PCM) (12A650).

Fig. 8: Identifying Accelerator Pedal Position (APP) Sensor Connector
Courtesy of FORD MOTOR CO.

Fig. 9: Identifying Electronic Throttle Body (ETB) Connector
Courtesy of FORD MOTOR CO.

Fig. 10: Identifying Fuel Rail Pressure/Temperature (FRPT) Sensor Connector
Courtesy of FORD MOTOR CO.

Fig. 11: Identifying Fuel Tank Pressure (FTP) Sensor Connector
Courtesy of FORD MOTOR CO.

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Fig. 12: Identifying Intake Manifold Runner Control Monitor (IMRCM) Sensor Connector
Courtesy of FORD MOTOR CO.

Fig. 13: Identifying Manifold Absolute Pressure (MAP) Sensor Connector
Courtesy of FORD MOTOR CO.

Fig. 14: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

C1 CHECK FOR VREF GREATER THAN 6.0 VOLTS

Was VREF greater than 6 volts when measured in the last test step?

Yes	No
GO to **C11**.	GO to **C2**.

C2 CHECK THE VEHICLE BATTERY VOLTAGE

- Measure the voltage between:

(+) Vehicle Battery	(-) Vehicle Battery
Positive terminal	Negative terminal

Is the voltage greater than 10.5 V?

Yes	No
GO to **C3**.	Key in OFF position. Charging system concern. REFER to **CHARGING SYSTEM - GENERAL INFORMATION** to diagnose the low voltage concern.

C3 CHECK FOR AN OPEN IN POWER GROUND

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

(+) PCM Connector, Harness Side	(-)
PWRGND - Pin B47, B48, B49, B50	Ground

Is the resistance less than 5 ohms?

Yes	No
GO to **C4**.	REPAIR the open circuit.

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C4 CHECK THE VPWR VOLTAGE AT THE PCM HARNESS CONNECTOR

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VPWR - Pin B35, B36	PWRGND - Pin B47, B48, B49, B50

Is the voltage greater than 10.5 V?

Yes	No
Key in OFF position. GO to **C5 CHECK THE VPWR VOLTAGE COMPARED TO VBATT**.	Key in OFF position. VPWR circuit open. GO to Pinpoint Test **B**.

C5 CHECK THE VPWR VOLTAGE COMPARED TO VBATT

- PCM connector connected.
- Key ON, engine OFF.
- Use the measurement taken in the previous step.

Is the measured reading within 1 volt of the VBAT?

Yes	No
GO to **C6**.	GO to Pinpoint Test **B**.

C6 CHECK THE VOLTAGE BETWEEN THE VBAT AND THE SIGRTN, ETCRTN, ETCRTN1, AND ETCRTN2

NOTE: The following measurement is to be carried out using the SIGRTN at the sensor where failure is indicated.

- Key in OFF position.
- Disconnect the sensor where VREF failed.
- Measure the voltage between SIGRTNs, ETCRTN, ETCRTN1 and ETCRTN2, where the VREF failed and battery power.

Is the voltage greater than 10.5 V?

Yes	No
GO to **C7**.	Key in OFF position. REPAIR the open SIGRTN circuit.

C7 CHECK THE VREF WITH ALL THE SENSORS DISCONNECTED

NOTE: The following measurement is to be carried out using the SIGRTN at the sensor where failure is indicated.

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- Remove the harness connectors from all the sensors connected to VREF.
- Key ON, engine OFF.
- Measure the voltage between the VREF and SIGRTN circuits at the sensor harness connector.

Is the voltage between 4.5 volts - 5.5 volts?

Yes	No
For electronic throttle control (ETC) concerns, GO to **C14**. For all other VREF concerns, GO to **C15**.	Key in OFF position. GO to **C8**.

C8 CHECK FOR OPEN CIRCUITS BETWEEN THE PCM AND SIGRTN COMPONENTS

- PCM connector disconnected.
- Measure the resistance between SIGRTNs at the PCM connector and SIGRTNs at the sensors.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) ETB Connector, Harness Side
ETCRTN - Pin E7	ETCRTN - Pin 4

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) APP Sensor Connector, Harness Side
ETCRTN1 - Pin B6	ETCRTN1 - Pin 3
ETCRTN2 - Pin B18	ETCRTN2 - Pin 1

- Measure the resistance between SIGRTN and the sensor where the concern is indicated.

Are all the resistances less then 5 ohms?

Yes	No
GO to **C9**.	REPAIR the open circuit.

C9 CHECK THE VREF CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF - Pin B40, E40	SIGRTN - Pin B41, E41
VREF - Pin B40, E40	PWRGND - Pin B47, B48, B49, B50
ETCREF - Pin E9	ETCRTN - Pin E7
ETCREF1 - Pin B4	ETCRTN1 - Pin B6
ETCREF2 - Pin B16	ETCRTN2 - Pin B18

Are the resistances greater than 1K ohms?

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Yes	No
GO to **C10**.	REPAIR the short circuit to GND.

C10 CHECK THE VREF CIRCUIT FOR AN OPEN IN THE HARNESS

- Sensor where the VREF check failed disconnected.
- PCM connector disconnected.
- Measure the resistance of the VREF circuit between the PCM connector, harness side, and the appropriate sensor connector harness side, VREF pin.

Is the resistance less than 5 ohms?

Yes	No
GO to **C13**.	Key in OFF position. REPAIR the open circuit.

C11 CHECK THE VREF CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

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

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF - Pin B40, E40	VPWR - Pin B35, B36
ETCREF - Pin E9	VPWR - Pin B35, B36
ETCREF1 - Pin B4	VPWR - Pin B35, B36
ETCREF2 - Pin B16	VPWR - Pin B35, B36

Are the resistances greater than 10K ohms?

Yes	No
Key in OFF position. GO to **C12**.	Key in OFF position. REPAIR the short circuit to PWR.

C12 CHECK THE REFERENCE VOLTAGE FOR A SHORT TO POWER

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
VREF - Pin B40, E40	Ground
ETCREF - Pin E9	Ground
ETCREF1 - Pin B4	Ground
ETCREF2 - Pin B16	Ground

Is any voltage indicated?

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Yes	No
REPAIR the short circuit to PWR.	GO to **C19**.

C13 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	No
GO to **C19**.	The system is operating correctly at this time. Concern may have been caused by a loose or corroded connector. GO to Pinpoint Test **Z**.

C14 CHECK VREF VOLTAGE WITH THE ETBTPS SENSOR CONNECTED

- Key in OFF position.
- ETB connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
ETCREF1 - Pin 7	ETCRTN1 - Pin 3
ETCREF2 - Pin 6	ETCRTN2 - Pin 1

Are the voltages between 4.5 V - 5.5 V?

Yes	No
INSTALL a new APP sensor.	INSTALL a new ETB.

C15 CHECK VREF VOLTAGE WITH THE MAP SENSOR CONNECTED

- Key in OFF position.
- MAP Sensor connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FRPT Sensor Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 4

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Is the voltage between 4.5 V - 5.5 V?

Yes	No
GO to **C16**.	INSTALL a new MAP sensor.

C16 CHECK VREF VOLTAGE WITH THE IMRCM SENSOR CONNECTED

- Key in OFF position.
- IMRCM Sensor connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FRPT Sensor Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 4

Is the voltage between 4.5 V - 5.5 V?

Yes	No
GO to **C17**.	INSTALL a new IMRCM sensor.

C17 CHECK VREF VOLTAGE WITH THE FTP SENSOR CONNECTED

- Key in OFF position.
- FTP Sensor connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FRPT Sensor Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 4

Is the voltage between 4.5 V - 5.5 V?

Yes	No
GO to **C18**.	INSTALL a new FTP sensor.

C18 CHECK VREF VOLTAGE WITH THE FRPT SENSOR CONNECTED

- Key in OFF position.
- FRPT Sensor connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MAP Sensor Connector, Harness Side	(-) MAP Sensor Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 4

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Is the voltage between 4.5 V - 5.5 V?

Yes	No
Unable to duplicate or identify the concern at this time. GO to Pinpoint Test **Z**.	INSTALL a new FRPT sensor.

C19 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DA: INTAKE AIR TEMPERATURE (IAT) SENSOR

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY

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RESULT IN PERSONAL INJURY OR DEATH.

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This pinpoint test is intended to diagnose the following:

- Integrated mass air flow (MAF)/intake air temperature (IAT) sensor (12B579).
- Harness circuits IAT, VREF, and SIGRTN.
- Powertrain control module (PCM) (12A650).

Voltage values calculated for VREF = 5 volts. These values can vary by 15% due to sensor and VREF variations.

Fig. 15: Temperature And Voltage Graph
Courtesy of FORD MOTOR CO.

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
120	248	0.28	1.18
110	230	0.36	1.55
100	212	0.47	2.07
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.37
60	140	1.37	7.70
50	122	1.77	10.97
40	104	2.23	16.15
30	86	2.74	24.27
20	68	3.26	37.30
10	50	3.73	58.75
0	32	4.14	95.85
-10	14	4.45	160.31

Fig. 16: Identifying Mass Air Flow/Intake Air Temperature (MAF/IAT) Sensor Connector
Courtesy of FORD MOTOR CO.

Fig. 17: Identifying Powertrain Control Module (PCM) Connector

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Courtesy of FORD MOTOR CO.

TEST PROCEDURE

DA1 DTCS P0112, P0113 AND P0114: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during PCM or TCM self-test: P0112, P0113, or P0114?

Yes	No
For KOEO and KOER DTC P0112, GO to **DA6**. For KOEO and KOER DTC P0113, GO to **DA2**. For all others, GO to **DA8**.	Unable to duplicate or identify the fault at this time. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

DA2 DTC P0113: CHECK THE IAT SIGNAL CIRCUIT

- The DTC indicates the sensor signal is greater than the self-test maximum.
- MAF/IAT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MAF/IAT Sensor Connector, Harness Side	(-)
IAT - Pin 1	Ground

Is the voltage between 4.5 V - 5.5 V?

Yes	No
GO to **DA3**.	GO to **DA4**.

DA3 CHECK IAT SENSOR RESISTANCE

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

(+) MAF/IAT Sensor Connector, Component Side	(-) MAF/IAT Sensor Connector, Component Side
IAT - Pin 1	SIGRTN - Pin 2

Is the resistance between 1K ohms - 500K ohms?

Yes	No
GO to **DA4**.	INSTALL a new MAF/IAT sensor.

DA4 CHECK THE SIGNAL AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

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(+) MAF/IAT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IAT - Pin 1	IAT - Pin B39
SIGRTN - Pin 2	SIGRTN - Pin B41

Are the resistances less than 5 ohms?

Yes	No
GO to **DA5**.	REPAIR the open circuit.

DA5 CHECK THE SIGNAL FOR A SHORT TO POWER IN HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MAF/IAT Sensor Connector, Harness Side	(-)
IAT - Pin 1	Ground

Is the voltage greater than 1 V?

Yes	No
REPAIR the short circuit.	Key in OFF position. GO to **DA11**.

DA6 DTC P0112: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

NOTE: The DTC indicates the sensor signal is less than the self-test minimum.

- MAF/IAT Sensor connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the IAT V PID.

Is the voltage greater than 4.2 V?

Yes	No
Key in OFF position. INSTALL a new MAF/IAT sensor.	Key in OFF position. GO to **DA7**.

DA7 CHECK THE SENSOR SIGNAL FOR A SHORT TO GROUND

- PCM connector disconnected.
- Measure the resistance between:

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(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
IAT - Pin B39	SIGRTN - Pin B41

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
IAT - Pin B39	Negative terminal

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
IAT - Pin B39	MAF RTN - Pin B43

Is the resistance greater than 10K ohms?

Yes	No
GO to **DA11**.	REPAIR the short circuit.

DA8 SELF-TEST DTCS P0112, P0113, P0114 OR P1112: INTERMITTENT CHECK

- Key ON, engine OFF.
- Access the PCM and monitor the IAT V PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock.
  - Wiggle the sensor connector.

Is there a large change in the voltage reading?

Yes	No
DISCONNECT and INSPECT the connector. If OK, INSTALL a new MAF/IAT sensor.	GO to **DA9**.

DA9 CHECK THE WIRING HARNESS

- Access the PCM and monitor the IAT V PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness working from the sensor to the PCM.

Is there a large change in the voltage reading?

Yes	No
ISOLATE the fault REPAIR as necessary.	Key in OFF position. GO to **DA10**.

DA10 CHECK THE PCM AND VEHICLE HARNESS CONNECTORS

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- PCM connector disconnected.
- MAF/IAT Sensor connector disconnected.

Are the connectors and pins OK?

Yes	No
The fault is not present at this time. DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	REPAIR as necessary.

DA11 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DC: MASS AIR FLOW (MAF) SENSOR

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE

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CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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This pinpoint test is intended to diagnose the following:

- Mass air flow (MAF) sensor (12B579).
- Harness circuits: MAF SIG, MAF RTN, vehicle power (VPWR), power ground (PWRGND), IAT, and SIGRTN.
- Powertrain control module (PCM) (12A650).

Fig. 18: Identifying Mass Air Flow/Intake Air Temperature (MAF/IAT) Sensor Connector
Courtesy of FORD MOTOR CO.

Fig. 19: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

DC1 DTCS P0102, P0103 AND P1101: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during PCM or TCM self-test: P0102, P0103, or P1101?

Yes	No
For DTC P0102, GO to **DC3**. For DTC P0103, GO to **DC19**. For KOEO DTC P1101, GO to **DC7**. For KOER DTC P1101, GO to **DC2**.	GO to **DC25**.

DC2 DTC P1101: CHECK FOR MAF SENSOR CONTINUOUS MEMORY DTCS

- Retrieve any CMDTCs.

Is a continuous memory MAF DTC present with the KOER DTC P1101?

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Yes	No
GO to **DC3**.	Key in OFF position. GO to **DC5**.

DC3 VERIFY THE CONTINUOUS MEMORY DTC P0102

Is a continuous memory DTC P0102 present with the KOER DTC P1101?

Yes	No
GO to **DC5**.	GO to **DC4**.

DC4 VERIFY THE CONTINUOUS MEMORY DTC P0103

Is a continuous memory DTC P0103 present with the KOER DTC P1101?

Yes	No
GO to **DC19**.	All other continuous memory DTCs: DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DC5 KOER AND CONTINUOUS MEMORY DTCS P0102 OR P1101: CHECK THE INTAKE AIR SYSTEM FOR LEAKS, OBSTRUCTIONS, AND DAMAGE

- Check the air inlet system (air cleaner, housing, ductwork) for obstructions or blockage.
- Check for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in the air outlet tube, and worn gaskets between the MAF sensor and the air cleaner assembly. Verify the MAF sensor is connected. Repair as necessary.

Are there any concerns found during the visual inspection?

Yes	No
Key in OFF position. REPAIR as necessary.	GO to **DC6**.

DC6 CHECK THE MAF PID

- Start the engine using the engine running diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Run the engine up to 1,500 RPM for 5 seconds, then bring it back to idle.
- Access the PCM and monitor the MAF V PID.

Is the voltage less than 0.23 V?

Yes	No
Key in OFF position. GO to **DC9**.	Key in OFF position. GO to **DC7**.

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DC7 CHECK THE MAF SIGNAL

NOTE: DTC P1101 can be generated by a low charged 12 volt battery or the garage exhaust ventilation system. Repair the 12 volt battery as necessary, then remove the ventilation system and properly vent to the outside atmosphere. Check the air inlet system (air cleaner, housing, ductwork) for obstructions or blockage. Repeat the KOEO self-test.

- Key ON, engine OFF.
- Access the PCM and monitor the MAF V PID.

Is the voltage less than 0.2 V?

Yes	No
GO to **DC8**.	Key in OFF position. GO to **DC9**.

DC8 CHECK THE MAF SIGNAL SENT TO THE PCM

- Key ON, engine running.
- Access the PCM and monitor the MAF V PID.

Is the voltage between 0.46 V - 2.44 V?

Yes	No
Unable to identify the fault at this time. GO to Pinpoint Test **Z**.	Key in OFF position. GO to **DC9**.

DC9 CHECK THE VPWR TO THE MAF SENSOR

- MAF/IAT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 6	Negative terminal

Is the voltage greater than 10.5 V?

Yes	No
GO to **DC10**.	Key in OFF position. REPAIR the open circuit.

DC10 CHECK THE PWRGND CIRCUIT TO THE MAF SENSOR

- Measure the voltage between:

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(+) Vehicle Battery	(-) MAF/IAT Sensor Connector, Harness Side
Positive terminal	PWRGND - Pin 5

Is the voltage greater than 10.5 V?

Yes	No
Key in OFF position. GO to **DC11**.	Key in OFF position. REPAIR the open circuit.

DC11 CHECK FOR SHORTS BETWEEN CIRCUITS IN THE MAF HARNESS

- PCM connector disconnected.
- MAF Sensor connector disconnected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF - Pin 3	PWRGND - Pin 5
MAF - Pin 3	MAF RTN - Pin 4
MAF - Pin 3	SIGRTN - Pin 2
MAF - Pin 3	IAT - Pin 1

Are the resistances greater than 10K ohms?

Yes	No
GO to **DC12**.	REPAIR the short circuit.

DC12 CHECK THE MAF RTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF RTN - Pin B43	MAF RTN - Pin 4

Is the resistance less than 5 ohms?

Yes	No
GO to **DC13**.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

DC13 CHECK THE MAF RTN CIRCUIT FOR A SHORT TO PWRGND IN THE HARNESS

- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side

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MAF RTN - Pin 4	PWRGND - Pin 5

Is the resistance greater than 10K ohms?

Yes	No
GO to **DC14**.	REPAIR the short circuit to GND.

DC14 CHECK THE MAF CIRCUIT FOR A SHORT TO PWRGND IN THE PCM

- PCM connector connected.
- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF - Pin 3	PWRGND - Pin 5

Is the resistance greater than 10K ohms?

Yes	No
GO to **DC15**.	GO to **DC29**.

DC15 CHECK THE MAF CIRCUIT VOLTAGE CYCLING INTEGRITY

- Key ON, engine OFF.
- Access the MAF V PID.
- Connect a 5 amp fused jumper wire between the following:

MAF/IAT SENSOR CONNECTOR SPECIFICATION

Point A MAF/IAT Sensor Connector, Harness Side	Point B MAF/IAT Sensor Connector, Harness Side
MAF RTN - Pin 4	PWRGND - Pin 5
MAF - Pin 3	VPWR - Pin 6

- Record the PID reading while both jumpers are installed.
- Remove the VPWR jumper while monitoring the MAF V PID.

Does the MAF V PID change from greater than 4.50 volts to less than 0.26 volt when the VPWR jumper is removed?

Yes	No
INSTALL a new MAF/IAT sensor. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **DC16**.

DC16 CHECK THE MAF CIRCUIT FOR AN OPEN IN THE HARNESS

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

(+) PCM Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF - Pin B32	MAF - Pin 3

Is the resistance less than 5 ohms?

Yes	No
GO to **DC17**.	REPAIR the open circuit.

DC17 CHECK THE PWRGND CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) MAF/IAT Sensor Connector, Harness Side	(-) Vehicle Battery
PWRGND - Pin 5	Negative terminal

Is the resistance less than 5 ohms?

Yes	No
GO to **DC18**.	REPAIR the open circuit.

DC18 CHECK THE MAF RTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) MAF/IAT Sensor Connector, Harness Side
MAF RTN - Pin B43	MAF RTN - Pin 4

Is the resistance less than 5 ohms?

Yes	No
GO to **DC29**.	REPAIR the open circuit.

DC19 DTC P0103: CHECK THE MAF SENSOR SCREEN FOR CONTAMINATION

NOTE: DTC P0103 can be generated by foreign material blocking the MAF sensor screen, causing an air flow restriction.

- Check the MAF sensor screen for contamination or blockage.
- Check the air cleaner element and air tubes for proper installation and sealing.

Are any concerns present?

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Yes	No
REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	GO to **DC20**.

DC20 DTC P0103: CHECK THE MAF SENSOR SIGNAL HIGH INPUT TO THE PCM

- Key ON, engine OFF.
- Access the PCM and monitor the MAF V PID.

Is the voltage greater than 2.44 V?

Yes	No
GO to **DC21**.	GO to **DC23**.

DC21 CHECK THE MAF SENSOR SIGNAL SENT TO THE PCM

- Key in OFF position.
- MAF/IAT Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A MAF/IAT Sensor Connector, Harness Side	Point B MAF/IAT Sensor Connector, Harness Side
MAF RTN - Pin 4	PWRGND - Pin 5

- Key ON, engine OFF.
- Access the PCM and monitor the MAF V PID.

Is the voltage less than 0.1 V?

Yes	No
Key in OFF position. REMOVE the jumper wire(s) CHECK the MAF sensor electrical connector for damage, corrosion, and water intrusion. If OK, INSTALL a new MAF sensor. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **DC22**.

DC22 CHECK THE MAF CIRCUIT FOR A SHORT TO POWER

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)

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MAF - Pin B32	Ground

Is the voltage less than 1 V?

Yes	No
GO to **DC24**.	Key in OFF position. REPAIR the short circuit to PWR.

DC23 CHECK THE MAF SENSOR SIGNAL SENT TO THE PCM

- Start the engine using the engine running diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Access the PCM and monitor the MAF V PID.
- Monitor the MAF signal voltage while increasing the engine RPM from idle to approximately 2,500 RPM, then back to idle.

Is the voltage between 0.23 - 4.6 V?

Yes	No
Key in OFF position. The concern is intermittent. GO to Pinpoint Test **Z**.	Key in OFF position. GO to **DC21**.

DC24 VERIFY THE IDLE CONCERN

- Start the engine using the engine running diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- PCM connector connected.
- MAF/IAT sensor connector connected.

Is there an idle concern present?

Yes	No
DISREGARD DTC P0103 at this time. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.	GO to **DC29**.

DC25 SYMPTOMS WITHOUT DTCS: CHECK THE CONDITIONS RELATED TO THE MAF SENSOR

- Check the air inlet system (air cleaner, housing, ductwork) for obstructions or blockage.
- Check for broken/loose air outlet tube clamps (throttle body and air cleaner assembly ends), cracks/holes in the air outlet tube, and worn gaskets between the MAF sensor and the air cleaner assembly. Verify the MAF sensor is connected.

Is a concern present?

Yes	No
REPAIR as necessary. RESET the keep alive memory (KAM). REFER to	GO to **DC26**.

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RESETTING THE KEEP ALIVE MEMORY (KAM) .	

DC26 DTCS P0171, P0172, P2195 OR P2196: CHECK THE FUNCTIONALITY OF THE MAF SENSOR

NOTE: A MAF V PID value of less than 0.6 volt may indicate an incorrectly installed air cleaner or a leak in the air inlet system.

- Start the engine using the engine running diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Allow the engine to stabilize at the correct operating temperature.
- Access the PCM and monitor the MAF V PID.
- Check that the MAF V PID at idle and neutral is not greater than 30% of the normal MAF V listed in **REFERENCE VALUES** (or not greater than 2 volts).

Is the PID value within the expected range?

Yes	No
GO to **DC28**.	GO to **DC27**.

DC27 CHECK TO ISOLATE THE MAF SENSOR FROM A LEAN DRIVEABILITY OCCURRENCE

NOTE: Due to increasingly stringent emission/OBD requirements, a fuel system DTC on some vehicles can be generated without a noticeable driveability concern with or without the MAF sensor disconnected. Under these conditions, if the MAF PID indicates a MAF sensor concern, install a new MAF sensor.

- Key in OFF position.
- MAF/IAT Sensor connector disconnected.
- Key ON, engine running.
- Drive the vehicle on the road.

Is the lean driveability symptom (lack of power, spark knock/detonation, buck/jerk or hesitation/surge on acceleration) gone?

Yes	No
INSTALL a new MAF/IAT sensor. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **DC28**.

DC28 VERIFY THE DTC

Are any of the following DTCs present: P0171, P0172, P2195, P2196?

Yes	No
Unable to duplicate or identify the fault at this	

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time. GO to Pinpoint Test **Z**.	The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

DC29 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DD: FUEL RAIL PRESSURE TEMPERATURE (FRPT) SENSOR

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
VEHICLE FUEL SYSTEMS ARE PRESSURIZED EVEN WHEN THE ENGINE IS NOT RUNNING. TO AVOID FIRE OR PERSONAL INJURY,

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DISABLE THE FUEL DELIVERY SYSTEM AND RELIEVE FUEL SYSTEM PRESSURE BEFORE REMOVING ANY FUEL SYSTEM COMPONENT. REFER TO THE FUEL SYSTEM INFORMATION AT THE BEGINNING OF PINPOINT HC.

Important Safety Notice

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This article provides general directions for repairing vehicles with tested, effective techniques. Following them will help ensure reliability. There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles, as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

This pinpoint test is intended to diagnose the following:

- Fuel rail pressure temperature (FRPT) sensor (9G756).
- Harness circuits: FRP, FRT, SIGRTN, VREF.
- Powertrain control module (PCM) (12A650).

Tables and Graphs

FRPT SENSOR VOLTAGE AND PRESSURE SPECIFICATIONS

Voltage	Pressure (kPa)	Pressure (psi)
4.5	482	70
3.9	413	60
3.4	344	50
2.8	275	40
2.2	207	30
1.6	138	20
1.1	69	10
0.5	0	0

FRPT SENSOR TEMPERATURE, VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Sensor	
°C	°F	Volts	Resistance (K ohms)
100	212	0.47	2.073
95	203	0.54	2.405
90	194	0.61	2.800
85	185	0.70	3.273
80	176	0.80	3.840
75	167	0.92	4.524
70	158	1.06	5.351
65	149	1.21	6.356
60	140	1.38	7.584

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55	131	1.56	9.091
50	122	1.77	10.949
45	113	1.99	13.252
40	104	2.23	16.123
35	95	2.48	19.720
30	86	2.74	24.253
25	77	3.00	30.000
20	68	3.26	37.332
15	59	3.50	46.745
10	50	3.73	58.911
5	41	3.95	74.745
0	32	4.13	95.501

Fig. 20: Identifying Fuel Rail Pressure/Temperature (FRPT) Sensor Connector
Courtesy of FORD MOTOR CO.

Fig. 21: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

DD1 DTCS P0182, P0183, P0190, P0191, P0192 AND P0193: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during the PCM self-test: P0182, P0183, P0190, P0191, P0192 or P0193?

Yes	No
For KOEO and KOER DTCs P0182 and P0183, GO to **DD16**. For continuous memory DTCs P0182 and P0183, GO to **DD23**. For continuous memory DTC P0190, GO to **DD2**. For DTC P0191, GO to **DD11**. For KOEO and KOER DTCs P0192 and P0193, GO to **DD2**. For continuous memory DTCs P0192 and P0193, GO to **DD10**.	Unable to duplicate or identify the fault at this time. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

DD2 CONTINUOUS MEMORY DTC P0190, KOEO AND KOER DTCS P0192 AND P0193: CHECK THE FRPT SENSOR FOR FUEL LEAKS

NOTE: Repair any fuel pump DTCs prior to this test.

- Start the engine using the engine running diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Idle the engine for 2 minutes.
- Key in OFF position.

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- Remove FRPT sensor vacuum hose.
- Inspect the FRPT sensor and vacuum hose for traces of fuel.

Is fuel present?

Yes	No
Key in OFF position. INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to Pinpoint Test **HC**.	RECONNECT the vacuum hose. GO to **DD3**.

DD3 CHECK THE VREF VOLTAGE TO FRPT SENSOR

- FRPT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FRPT Sensor Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 4

Is the voltage between 4 V - 6 V?

Yes	No
Key in OFF position. For DTC P0190, GO to **DD10**. For DTC P0192, GO to **DD4**. For DTC P0193, GO to **DD6**.	Key in OFF position. GO to Pinpoint Test **C**.

DD4 INDUCE A HIGH VOLTAGE ON THE FRP CIRCUIT

- Connect a 5 amp fused jumper wire between the following:

Point A FRPT Sensor Connector, Harness Side	Point B FRPT Sensor Connector, Harness Side
FRP - Pin 1	VREF - Pin 2

- Key ON, engine OFF.
- Access the PCM and monitor the FRP V PID.

Is the voltage greater than 4.75 V?

Yes	No
Key in OFF position. INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to Pinpoint Test **HC**.	Key in OFF position. REMOVE the jumper wire. GO to **DD5**.

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DD5 CHECK THE FRP CIRCUIT FOR A SHORT TO SIGRTN AND GND IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) FRPT Sensor Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
FRP - Pin 1	SIGRTN - Pin 4

- Measure the resistance between:

(+) FRPT Sensor Connector, Harness Side	(-) Vehicle Battery
FRP - Pin 1	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **DD24**.	REPAIR the short circuit.

DD6 INDUCE A LOW VOLTAGE ON THE FRP CIRCUIT

- Connect a 5 amp fused jumper wire between the following:

Point A FRPT Sensor Connector, Harness Side	Point B FRPT Sensor Connector, Harness Side
FRP - Pin 1	SIGRTN - Pin 4

- Key ON, engine OFF.
- Access the PCM and monitor the FRP V PID.

Is the voltage less than 0.1 V?

Yes	No
Key in OFF position. INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to Pinpoint Test **HC**.	Key in OFF position. GO to **DD7**.

DD7 CHECK THE FRP CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) FRPT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
FRP - Pin 1	FRP - Pin E27

Is the resistance less than 5 ohms?

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Yes	No
GO to **DD8**.	REPAIR the open circuit.

DD8 CHECK THE FRP CIRCUIT FOR A SHORT TO VREF

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF - Pin E40	FRP - Pin E27

Is the resistance greater than 10K ohms?

Yes	No
GO to **DD9**.	REPAIR the short circuit.

DD9 CHECK THE FRP CIRCUIT FOR A SHORT TO PWR IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) FRPT Sensor Connector, Harness Side	(-)
FRP - Pin 1	Ground

Is any voltage present?

Yes	No
Key in OFF position. REPAIR the short circuit to PWR.	GO to **DD24**.

DD10 CONTINUOUS MEMORY DTCS P0192 AND P0193: CHECK THE FRP CIRCUIT FOR AN INTERMITTENT CONCERN

NOTE: Repair any fuel pump DTCs prior to this test.

NOTE: The FRP can vary from 275 - 485 kPa (40 - 70 psi).

- Key ON, engine OFF.
- Access the PCM and monitor the FRP V and FRP PIDs.
- Carefully wiggle all accessible wiring and connectors associated with the circuit and look for a change in the PID state.

Is a fault indicated during the wiggle test?

Yes	No
Key in OFF position.	Key in OFF position.

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REPAIR as necessary.	GO to Pinpoint Test **Z**.

DD11 DTC P0191: CHECK FOR FUEL PUMP DRIVER MODULE (FPDM) DTCS

- Check for self-test DTCs.

Are DTCs P1233, P1235 or P1237 present?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DD12**.

DD12 INSPECT ALL THE VACUUM HOSES CONNECTED TO THE INTAKE MANIFOLD FOR LEAKS

- Key in OFF position.
- FRPT Sensor connector connected.
- Key ON, engine running.
- Allow the engine idle to stabilize.
- Inspect all the vacuum hoses connected to the intake manifold for leaks.

Are any vacuum hose concerns present?

Yes	No
ISOLATE the fault and REPAIR as necessary.	GO to **DD13**.

DD13 CHECK THE FRPT CONNECTOR FOR DAMAGE OR CORROSION

- Key in OFF position.
- FRPT Sensor connector disconnected.
- Inspect the sensor, wiring, and connector for damage, corrosion, or water intrusion.

Is a concern present?

Yes	No
REPAIR as necessary.	GO to **DD14**.

DD14 CHECK THE FRP PID

NOTE: The fuel pressure is likely to increase after the fuel pressure is relieved with the system closed. The rate and amount of the fuel pressure increase is dependent upon the ambient air and fuel temperatures.

NOTE: Prepare to record the FRP PID value within 5 seconds after the engine is shut off and also after the fuel pressure is relieved.

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- FRPT Sensor connector connected.
- Key ON, engine running.
- Allow the engine idle to stabilize.
- Access the PCM and monitor the FRP PID.
- Key in OFF position.
- Key ON, engine OFF.
- Record the FRP PID value within 5 seconds of the key off.
- Relieve the fuel pressure. Refer to the **FUEL SYSTEM PRESSURE RELEASE** procedure.
- Disable the fuel pump.
- Key ON, engine OFF.
- Record the FRP PID value within 5 seconds of completing the fuel system pressure release procedure.

Is the difference between the recorded FRP PID values greater than 34 kPa (5 psi)?

Yes	No
GO to Pinpoint Test **HC**.	GO to **DD15**.

DD15 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.

- Key in OFF position.
- Connect a mechanical fuel pressure gauge.
- Key ON, engine OFF.
- Monitor the mechanical gauge.
- Access the PCM and monitor the FRP PID.
- Compare the FRP PID value to the mechanical gauge.
- Key in OFF position.
- Pressurize the fuel system. Refer to the **FUEL SYSTEM PRESSURE RELEASE** procedure.
- Key ON, engine running.
- Allow the fuel pressure to stabilize.
- Key in OFF position.
- Key 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	No

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GO to **DD24**.	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to Pinpoint Test **HC**.

DD16 KOEO AND KOER DTCS P0182 OR P0183: CHECK THE RESISTANCE OF THE FRPT SENSOR

- Key in OFF position.
- FRPT Sensor connector disconnected.
- Measure the resistance between:

(+) FRPT Sensor Connector, Component Side	**(-) FRPT Sensor Connector, Component Side**
FRT - Pin 3	SIGRTN - Pin 4

Is the resistance between 2K ohms - 96k ohms?

Yes	No
GO to **DD17**.	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to Pinpoint Test **HC**.

DD17 CHECK THE FRPT FOR INTERNAL SHORTS

- Measure the resistance between:

(+) FRPT Sensor Connector, Component Side	**(-)**
FRT - Pin 3	Ground

- Measure the resistance between:

(+) FRPT Sensor Connector, Component Side	**(-) FRPT Sensor Connector, Component Side**
FRT - Pin 3	FRP - Pin 1
FRT - Pin 3	VREF - Pin 2

Are the resistances greater than 10K ohms?

Yes	No
For DTC P0182, GO to **DD18**. For DTC P0183, GO to **DD20**.	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to Pinpoint Test **HC**.

DD18 CHECK THE FRT CIRCUT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

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- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRT - Pin E6	SIGRTN - Pin E41

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
FRT - Pin E6	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to **DD19**.	REPAIR the short circuit.

DD19 INDUCE A HIGH VOLTAGE ON THE FRT CIRCUIT

- PCM connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the FRT V PID.

Is the voltage greater than 4.5 V?

Yes	No
Unable to identify the fault at this time. GO to Pinpoint Test **Z**.	GO to **DD24**.

DD20 CHECK THE FRT AND SIG RTN CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
FRT - Pin E6	FRT - Pin 3
SIGRTN - Pin E41	SIGRTN - Pin 4

Are the resistances less than 5 ohms?

Yes	No
GO to **DD21**.	REPAIR the open circuit.

DD21 CHECK THE FRT SIGNAL FOR A SHORT TO VREF AND FRP

- Measure the resistance between:

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(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FRT - Pin E6	VREF - Pin E40
FRT - Pin E6	FRP - Pin E27

Are the resistances greater than 10K ohms?

Yes	No
GO to **DD22**.	REPAIR the short circuit.

DD22 INDUCE A LOW VOLTAGE ON THE FRT CIRCUIT

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A FRPT Sensor Connector, Harness Side	Point B FRPT Sensor Connector, Harness Side
FRT - Pin 3	SIGRTN - Pin 4

- Key ON, engine OFF.
- Access the PCM and monitor the FRT V PID.

Is the voltage less than 0.2 V?

Yes	No
Unable to identify the fault at this time. GO to Pinpoint Test **Z**.	GO to **DD24**.

DD23 CONTINUOUS MEMORY DTCS P0182 OR P0183: INTERMITTENT CHECK

NOTE: The PID referred to below may read as EFT on some diagnostic tools.

- Key ON, engine OFF.
- Access the PCM and monitor the FRT V PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock.
  - Wiggle the sensor connector.
  - Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- Check the FRPT and the PCM connectors for damage and corrosion.

Is a concern present?

Yes	No
	DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO

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ISOLATE the fault and REPAIR as necessary.	to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DD24 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DG: KNOCK SENSOR (KS)

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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This pinpoint test is intended to diagnose the following:

- Knock sensor (KS1) (12A699).
- Powertrain control module (PCM) (12A650).
- Harness circuits: KS1+, and KS1-.

Fig. 22: Identifying Knock Sensor (KS) Connector
Courtesy of FORD MOTOR CO.

Fig. 23: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

DG1 DETERMINE THE DTC BEING DIAGNOSED

Is DTC P0325 present in the KOEO or KOER self-test?

Yes	No
GO to **DG2**.	GO to **DG10**.

DG2 CHECK THE RESISTANCE OF THE KS1

- Verify the KS is connected and properly installed.
- KS connector disconnected.
- Measure the resistance between:

(+) KS Connector, Component Side	(-) KS Connector, Component Side
KS1+ - Pin 1	KS1- - Pin 2

Is the resistance between 4.39M ohms - 5.35M ohms?

Yes	No
GO to **DG3**.	INSTALL a new KS.

DG3 CHECK THE KS1+ CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

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(+) KS Connector, Harness Side	(-) Vehicle Battery
KS1+ - Pin 1	Negative terminal

Is the voltage less than 1 V?

Yes	No
GO to **DG4**.	Key in OFF position. REPAIR the short circuit to PWR.

DG4 CHECK THE KS1- CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Measure the voltage between:

(+) KS Connector, Harness Side	(-) Vehicle Battery
KS1- - Pin 2	Negative terminal

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **DG5**.	Key in OFF position. REPAIR the short circuit to PWR.

DG5 CHECK THE KS1+ CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
KS1+ - Pin 1	KS1+ - Pin E32

Is the resistance less than 5 ohms?

Yes	No
GO to **DG6**.	REPAIR the open circuit.

DG6 CHECK THE KS1+ CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) Vehicle Battery
KS1+ - Pin 1	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **DG7**.	REPAIR the short circuit to GND.

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DG7 CHECK THE KS1- CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) PCM Connector, Harness Side
KS1- - Pin 2	KS1- - Pin E20

Is the resistance less than 5 ohms?

Yes	No
GO to **DG8**.	REPAIR the open circuit.

DG8 CHECK THE KS1- CIRCUIT FOR A SHORT TO GND IN THE HARNESS

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) Vehicle Battery
KS1- - Pin 2	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **DG9**.	REPAIR the short circuit to GND.

DG9 CHECK FOR KS HARNESS CIRCUITS SHORTED TOGETHER

- Measure the resistance between:

(+) KS Connector, Harness Side	(-) KS Connector, Harness Side
KS1+ - Pin 1	KS1- - Pin 2

Is the resistance greater than 10K ohms?

Yes	No
GO to **DG11**.	REPAIR the short circuit.

DG10 CHECK THE KS CIRCUIT(S) FOR INTERMITTENT CONCERNS

- Check for short to PWR, short to GND, or open KS1+ and KS1- circuit(s) while carrying out a wiggle test on all accessible wiring and connectors associated with the KS.

Is a concern present during the wiggle test?

Yes	No
REPAIR as necessary.	No concern present. The problem may be intermittent. GO to Pinpoint Test **Z**.

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DG11 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DJ: AIR CONDITIONER EVAPORATOR TEMPERATURE (ACET) SENSOR

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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directions for repairing vehicles with tested, effective techniques. Following them will help ensure reliability. There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles, as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

This pinpoint test is intended to diagnose the following:

- ACET sensor (19C734).
- Harness circuits ACET and SIGRTN.
- Powertrain control module (PCM) (12A650).

AIR CONDITIONER EVAPORATOR TEMPERATURE SENSOR

°C	°F	Voltage	Resistance (K ohms)
100	212	0.47	2.08
90	194	0.61	2.8
80	176	0.80	3.84
70	158	1.05	5.34
60	140	1.37	7.55
50	122	1.77	10.93
40	104	2.23	16.11
30	86	2.74	24.25
20	68	3.26	37.34
10	50	3.73	58.99
0	32	4.14	95.85
-10	14	4.45	160.31
-20	-4	4.66	276.96

NOTE: These values can vary by 15% due to sensor and VREF variations. Voltage values calculated for VREF = 5 volts.

Fig. 24: Identifying Air Conditioner Evaporator Temperature (ACET) Sensor Connector
Courtesy of FORD MOTOR CO.

Fig. 25: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

DJ1 DTCS P0537 AND P0538: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during PCM or TCM self-test: P0537 or P0538?

Yes	No
For KOEO and KOER DTC P0537, GO to **DJ6**. For KOEO and KOER DTC P0538, GO to **DJ2**.	Unable to duplicate or identify the fault at this time.

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For continuous memory DTCs P0537 or P0538, GO to **DJ9**.	The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

DJ2 KOEO AND KOER DTC P0538: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- Key in OFF position.
- ACET Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A ACET Sensor Connector, Harness Side	Point B ACET Sensor Connector, Harness Side
ACET - Pin 1	SIGRTN - Pin 2

- Key ON, engine OFF.
- Carry out the self-test.

Is DTC P0537 present?

Yes	No
INSTALL a new ACET sensor.	Key in OFF position. GO to **DJ3**.

DJ3 CHECK THE ACET & SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Remove the jumper wire(s).
- PCM connector disconnected.
- Measure the resistance between:

(+) ACET Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
ACET - Pin 1	ACET - Pin B1
SIGRTN - Pin 2	SIGRTN-C - Pin B41

Are the resistances less than 5 ohms?

Yes	No
GO to **DJ4**.	REPAIR the open circuit.

DJ4 CHECK THE ACET CIRCUIT FOR A SHORT TO VREF IN THE HARNESS

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

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
ACET - Pin B1	VREF - Pin E40

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Is the resistance greater than 10K ohms?

Yes	No
GO to **DJ5**.	REPAIR the short circuit to VREF.

DJ5 CHECK THE ACET CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) ACET Sensor Connector, Harness Side	(-)
ACET - Pin 1	Ground

Is the voltage greater than 1 V?

Yes	No
REPAIR the short circuit to PWR.	INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .

DJ6 KOEO AND KOER DTC P0537: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- ACET Sensor connector disconnected.
- Carry out the self-test.

Is DTC P0538 present?

Yes	No
INSTALL a new ACET sensor.	GO to **DJ7**.

DJ7 CHECK THE ACET CIRCUIT FOR A SHORT TO SIGRTN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) ACET Sensor Connector, Harness Side	(-) ACET Sensor Connector, Harness Side
ACET - Pin 1	SIGRTN - Pin 2

Is the resistance greater than 10K ohms?

Yes	No
GO to **DJ8**.	REPAIR the short circuit.

DJ8 CHECK THE ACET CIRCUIT FOR A SHORT TO GND IN THE HARNESS

- Measure the resistance between:

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(+) ACET Sensor Connector, Harness Side	(-)
ACET - Pin 1	Ground

Is the resistance greater than 10K ohms?

Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	REPAIR the short circuit.

DJ9 CONTINUOUS MEMORY DTCS P0537 OR P0538: CHECK THE ACET & SIGRTN CIRCUIT FOR AN INTERMITTENT CONCERN

- ACET Sensor connector disconnected.
- Measure the voltage between:

(+) ACET Sensor Connector, Harness Side	(-) ACET Sensor Connector, Harness Side
ACET - Pin 1	SIGRTN - Pin 2

- Key ON, engine OFF.
- While monitoring the voltage reading on the DMM, carry out the following (The voltage should be between 4.5 and 5.5 volts. The voltage reading will change suddenly when a fault is detected. For P0537, a sudden change could indicate a short to ground. For P0538, a sudden change could indicate an open ACET or SIGRTN circuit).
- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- Key in OFF position.
- Inspect connectors for signs of damage, water ingress, corrosion, etc.

Is there any change in the voltage reading, or is a concern found?

Yes	No
ISOLATE the fault REPAIR as necessary.	Unable to duplicate or identify the fault at this time. GO to Pinpoint Test **Z**.

PINPOINT TEST DK: ACCELERATOR PEDAL POSITION (APP) SENSOR

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE

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HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
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This pinpoint test is intended to diagnose the following:

- Accelerator pedal position (APP) sensor (9F836)
- Harness circuits: ETCRTN, SIGRTN, ETCREF, APPS1, APPS2, APPS3
- Powertrain control module (PCM) (12A650)

Fig. 26: Identifying Accelerator Pedal Position (APP) Sensor Connector
Courtesy of FORD MOTOR CO.

Fig. 27: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

DK1 DTCS P2121, P2122, P2123, P2126, P2127, P2128, P2131, P2132 AND P2133: CHECK THE APPS FOR OBSTRUCTION

NOTE: Diagnose and repair DTCs P0102 and P0103 before entering this pinpoint.

- Key ON, engine OFF.
- Press the accelerator pedal fully to the floor and release.

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Does the pedal move freely to the floor and back?

Yes	No
For DTCs P2111 or P2112, GO to **DV2**. For all others, GO to **DK2**.	ISOLATE the concern and REPAIR as necessary.

DK2 CHECK THE APP SENSOR SIGNAL VOLTAGE RANGES FOR THE ACCELERATOR PEDAL FULLY APPLIED AND RELEASED POSITIONS

- Access the PCM and monitor the APP1, APP2 and APP3 PIDs.
- Press the accelerator pedal fully to the floor and release.
- Record APP1, APP2 and APP3 voltages with the accelerator pedal fully applied and fully released.
- Compare recorded voltages to voltages in the tables below.

ACCELERATOR PEDAL FULLY APPLIED VOLTAGE VALUES

APPS1	APPS2	APPS3
0.48 - 1.76	2.95 - 4.62	2.43 - 4.02

ACCELERATOR PEDAL FULLY RELEASED VOLTAGE VALUES

APPS1	APPS2	APPS3
3.43 - 4.69	1.13 - 1.88	0.64 - 1.28

Are all 3 APPS signals out of range for the pedal fully applied and released positions?

Yes	No
GO to **DK3**.	For DTCs P2121, P2122, P2123, P2126, P2127, P2128, P2131, P2132 or P2133 alone, GO to **DK7**. For continuous memory DTCs P2121 and P2126 with P2131, GO to **DK7**. For any combination of ETC related DTCs, GO to **DK3**.

DK3 CHECK THE VREF VOLTAGE TO THE APPS

- Key in OFF position.
- APP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
ETCREF1 - Pin 7	ETCRTN1 - Pin 3

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to **DK4**.	GO to Pinpoint Test **C**.

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DK4 CHECK THE FUNCTIONALITY OF THE APPS1 CIRCUIT

NOTE: Use the voltage measurements from DK2.

Was APPS1 out of range?

Yes	No
GO to **DK7**.	GO to **DK5**.

DK5 CHECK THE FUNCTIONALITY OF THE APPS2 CIRCUIT

NOTE: Use the voltage measurements from DK2.

Was APPS2 out of range?

Yes	No
GO to **DK7**.	GO to **DK6**.

DK6 CHECK THE FUNCTIONALITY OF THE APPS3 CIRCUIT

NOTE: Use the voltage measurements from DK2.

Was APPS3 out of range?

Yes	No
GO to **DK7**.	GO to **DK21**.

DK7 CHECK THE FUNCTIONALITY OF THE APPS

- Key in OFF position.
- APP Sensor connector disconnected.
- Measure the resistance between:
- For vehicles with a 7-pin APP sensor:

(+) APP Sensor Connector, Component Side	(-) APP Sensor Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
APPS1	ETCREF	600	1,370
APPS1	ETCRTN	720	1,660
APPS1	APPS2	1,300	2,960
APPS1	APPS3	1,250	2,860
APPS2	ETCREF	750	1,720
APPS2	ETCRTN	660	1,520

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APPS2	APPS3	1,230	2,810
APPS3	ETCREF	710	1,640
APPS3	ETCRTN	580	1,340
ETCREF	ETCRTN	200	470

- For vehicles with an 8-pin APP sensor:

(+) APP Sensor Connector, Component Side	(-) APP Sensor Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
APPS1	ETCREF	150	350
APPS1	ETCRTN	290	650
APPS1	APPS2	900	2,010
APPS1	APPS3	820	1,840
APPS2	ETCREF	800	1,790
APPS2	ETCRTN	700	1,580
APPS2	APPS3	1,270	2,860
APPS3	ETCREF	720	1,630
APPS3	ETCRTN	580	1,330
ETCREF	ETCRTN	210	470

Are all the resistances within specifications?

Yes	No
For DTCs P2121, P2122 or P2123 alone or in combination, GO to **DK9**. For DTCs P2126, P2127 or P2128 alone or in combination, GO to **DK13**. For DTCs P2131, P2132 or P2133 alone or in combination, GO to **DK17**. For all others, GO to **DK21**.	INSTALL a new APP sensor. Key ON, engine OFF. CLEAR the DTCs. PRESS the accelerator pedal several times and REPEAT the self-test. If DTCs are present: GO to **DK8**.

DK8 CHECK THE APPS CIRCUIT INTEGRITY

- Key in OFF position.
- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Component Side	(-) APP Sensor Connector, Component Side
ETCREF1 - Pin 7	ETCRTN1 - Pin 3

Is the resistance between 200 ohms - 470 ohms (vehicles with a 7-pin APP sensor) or 210 ohms - 470 ohms (vehicles with an 8-pin APP sensor)?

Yes	No
For continuous memory DTCs P2121 with P2122	INSTALL a new APP sensor.

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or P2123, or with P2126 and P2131, GO to **DK9**. For continuous memory DTCs P2126 with P2127 or P2128, or with P2121 and P2131, GO to **DK13**. For continuous memory DTCs P2121 and P2122 or P2131 and P2133, GO to **DK17**.	Key ON, engine OFF. CLEAR the DTCs. PRESS the accelerator pedal several times and REPEAT the self-test. If DTCs are present: GO to **DK9**.

DK9 CHECK THE APPS1 CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APPS1 - Pin 2	APPS1 - Pin B5

Is the resistance less than 5 ohms?

Yes	No
GO to **DK10**.	REPAIR the open circuit.

DK10 CHECK THE APPS1 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) Vehicle Battery
APPS1 - Pin 2	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **DK11**.	REPAIR the short circuit to GND.

DK11 CHECK THE APPS1 CIRCUIT FOR A SHORT IN THE HARNESS

- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APPS1 - Pin 2	ETCRTN1 - Pin 3
APPS1 - Pin 2	ETCREF1 - Pin 7

Are the resistances greater than 10K ohms?

Yes	No
GO to **DK12**.	REPAIR the short circuit.

DK12 CHECK THE APPS1 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

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- Key ON, engine OFF.
- Measure the voltage between:

(+) APP Sensor Connector, Harness Side	(-) Vehicle Battery
APPS1 - Pin 2	Negative terminal

Is any voltage present?

Yes	No
REPAIR the short circuit.	GO to **DK21**.

DK13 CHECK THE APPS2 CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APPS2 - Pin 5	APPS2 - Pin B17

Is the resistance less than 5 ohms?

Yes	No
GO to **DK14**.	REPAIR the open circuit.

DK14 CHECK THE APPS2 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
APPS2 - Pin B17	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **DK15**.	REPAIR the short circuit to GND.

DK15 CHECK THE APPS2 CIRCUIT FOR A SHORT IN THE HARNESS

- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APPS2 - Pin 5	ETCRTN1 - Pin 3
APPS2 - Pin 5	ETCREF1 - Pin 7

Are the resistances greater than 10K ohms?

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Yes	No
GO to **DK16**.	REPAIR the short circuit.

DK16 CHECK THE APPS2 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
APPS2 - Pin B17	Negative terminal

Is any voltage present?

Yes	No
REPAIR the short circuit.	GO to **DK22**.

DK17 CHECK THE APPS3 CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APPS3 - Pin 8	APPS3 - Pin B28

Is the resistance less than 5 ohms?

Yes	No
GO to **DK18**.	REPAIR the open circuit.

DK18 CHECK THE APPS3 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
APPS3 - Pin B28	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **DK19**.	REPAIR the short circuit to GND.

DK19 CHECK THE APPS3 CIRCUIT FOR A SHORT IN THE HARNESS

- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side

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APPS3 - Pin 8	ETCRTN1 - Pin 3
APPS3 - Pin 8	ETCREF1 - Pin 7

Are the resistances greater than 10K ohms?

Yes	No
GO to **DK20**.	REPAIR the short circuit.

DK20 CHECK THE APPS3 CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
APPS3 - Pin B28	Negative terminal

Is any voltage present?

Yes	No
REPAIR the short circuit.	GO to **DK23**.

DK21 CHECK THE APPS1 CIRCUIT FOR A SHORT TOGETHER

- Key in OFF position.
- PCM connector disconnected.
- APP Sensor connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APPS1 - Pin 2	APPS2 - Pin 5
APPS1 - Pin 2	APPS3 - Pin 8
APPS1 - Pin 2	ETCREF2 - Pin 6
APPS1 - Pin 2	ETCREF1 - Pin 7
APPS1 - Pin 2	ETCRTN2 - Pin 1
APPS1 - Pin 2	ETCRTN1 - Pin 3

Are the resistances greater than 10K ohms?

Yes	No
GO to **DK22**.	REPAIR the short circuit.

DK22 CHECK FOR THE APPS2 CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

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

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(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APPS2 - Pin 5	APPS1 - Pin 2
APPS2 - Pin 5	APPS3 - Pin 8
APPS2 - Pin 5	ETCREF1 - Pin 7
APPS2 - Pin 5	ETCREF2 - Pin 6
APPS2 - Pin 5	ETCRTN1 - Pin 3
APPS2 - Pin 5	ETCRTN2 - Pin 1

Are the resistances greater than 10K ohms?

Yes	No
GO to **DK23**.	REPAIR the short circuit.

DK23 CHECK FOR THE APPS3 CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

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

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APPS3 - Pin 8	APPS1 - Pin 2
APPS3 - Pin 8	APPS2 - Pin 5
APPS3 - Pin 8	ETCREF1 - Pin 7
APPS3 - Pin 8	ETCREF2 - Pin 6
APPS3 - Pin 8	ETCRTN1 - Pin 3
APPS3 - Pin 8	ETCRTN2 - Pin 1

Are the resistances greater than 10K ohms?

Yes	No
GO to **DK24**.	REPAIR the short circuit.

DK24 CHECK THE APPS CIRCUIT FOR AN INTERMITTENT CONCERN

- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APPS1 - Pin 2	APPS1 - Pin B5
APPS2 - Pin 5	APPS2 - Pin B17
APPS3 - Pin 8	APPS3 - Pin B28

Are the resistances less than 5 ohms?

Yes	No

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GO to **DK25**.	ISOLATE the fault and REPAIR as necessary.

DK25 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DL: CYLINDER HEAD TEMPERATURE (CHT) SENSOR

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

Important Safety Notice

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor

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vehicles, as well as the personal safety of the individual doing the work. This article provides general directions for repairing vehicles with tested, effective techniques. Following them will help ensure reliability. There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles, as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

This pinpoint test is intended to diagnose the following:

- Cylinder head temperature (CHT) sensor (6G004).
- Harness circuits: CHT, VREF, and SIGRTN.
- Powertrain control module (PCM) (12A650).

On applications that do not use an ECT sensor, the CHT sensor is used to determine the engine coolant temperature in place of the ECT sensor. To cover the entire temperature range of both the CHT and ECT sensors, the PCM has a dual switching resistor circuit on the CHT input. A graph showing the temperature switching from the COLD END line to the HOT END line, with increasing temperature and back with decreasing temperature is included. Note the temperature to voltage overlap zone. Within this zone it is possible to have either a COLD END or HOT END voltage at the same temperature. For example, at 90°C (194°F) the voltage could read either 0.60 volt or 3.71 volts. Refer to **CYLINDER HEAD TEMPERATURE SENSOR EXPECTED VALUES**.

Fig. 28: CHT Sensor Temperature And Voltage Graph
Courtesy of FORD MOTOR CO.

Voltage values calculated for VREF = 5 volts. These values can vary by 15% due to sensor and VREF variations.

CYLINDER HEAD TEMPERATURE SENSOR EXPECTED VALUES

temperature		CHT Sensor Values		
°C	°F	COLD END (volts)	HOT END (volts)	Resistance (K ohms)
-40	-40	4.89	-	965.808
-30	-22	4.81	-	513.019
-20	-4	4.67	-	283.664
-10	14	4.45	-	162.584
0	32	4.14	-	96.255
10	50	3.73	-	59.175
20	68	3.26	-	37.387
30	86	2.74	-	24.215
40	104	2.23	-	16.043
50	122	1.76	-	10.85
60	140	1.36	-	7.487
70	158	1.04	-	5.268
80	176	0.79	3.99	3.775
85	185	0.69	3.86	3.215
90	194	0.60	3.71	2.75

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95	203	0.53	3.56	2.361
100	212	0.46	3.41	2.034
110	230	-	3.07	1.523
120	248	-	2.74	1.155
130	266	-	2.41	0.8866
140	284	-	2.10	0.6891
150	302	-	1.81	0.5417
160	320	-	1.55	0.4301
170	338	-	1.33	0.3449
180	356	-	1.13	0.2791
190	374	-	0.96	0.2278
200	392	-	0.82	0.1875
210	410	-	0.70	0.155
220	428	-	0.60	0.130
230	446	-	0.51	0.109
240	464	-	0.44	0.092
250	482		0.35	0.078
260	500		0.33	0.067

Fig. 29: Identifying Cylinder Head Temperature (CHT) Sensor Connector
Courtesy of FORD MOTOR CO.

Fig. 30: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

DL1 DTCS P0116, P0119, P0128, P1285, P1288, P1289, P1290 AND P1299: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during PCM or TCM self-test: P0116, P0119, P0128, P1285, P1288, P1289, P1290 or P1299?

Yes	No
For continuous memory DTC P0116, GO to **DL24**. For continuous memory DTC P0119, GO to **DL15**. For continuous memory DTC P0128, GO to **DL22**. For DTC P1285, GO to **DL18**. For DTC P1288, GO to **DL2**. For KOEO and KOER DTCs P1289 or P1290, GO to **DL7**. For continuous memory DTCs P1289 or P1290, GO to **DL15**. For KOER and continuous memory DTC P1299, GO to **DL21**.	Unable to duplicate or identify the fault at this time. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

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DL2 SELF-TEST DTC P1288: CHECK THE COOLING SYSTEM

WARNING: TO AVOID PERSONAL INJURY DO NOT UNSCREW THE COOLANT PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR HOT. THE COOLING SYSTEM IS UNDER PRESSURE. STEAM AND HOT LIQUID CAN COME OUT FORCEFULLY WHEN THE CAP IS LOOSENED SLIGHTLY.

NOTE: The DTC indicates the temperature sensor is out of self-test range. The engine is not at normal operating temperature.

- Check the vehicle coolant level.

Is the cooling system OK?

Yes	No
GO to **DL3**.	REFER to **ENGINE COOLING - HYBRID** for cooling system diagnostics. REPAIR as necessary.

DL3 CHECK IF THE ENGINE STARTS

- Attempt to start the engine.

Does the engine start and run normally?

Yes	No
GO to **DL6**.	GO to **DL4**.

DL4 CHECK THE RESISTANCE OF THE CHT SENSOR WITH THE ENGINE OFF

NOTE: Refer to CYLINDER HEAD TEMPERATURE SENSOR EXPECTED VALUES for the resistance specifications.

- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

Is the resistance within specification?

Yes	No
CONNECT the CHT sensor. GO to **DL5**.	INSTALL a new CHT sensor.

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DL5 CHECK IF THE VEHICLE ENGINE STARTS NORMALLY

- Attempt to start the engine.

Does the engine start?

Yes	No
GO to **DL6**.	GO to Pinpoint Test **A**.

DL6 CHECK THE OPERATION OF THE CYLINDER HEAD TEMPERATURE SENSOR

- Start the engine using the engine running diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Run the engine until it reaches normal operating temperature.
- Carry out the KOEO self-test.

Is DTC P1288 present?

Yes	No
GO to **DL20**.	The engine temperature was not stabilized. REPAIR any other DTCs as necessary.

DL7 DTCS P1289 OR P1290: ACCESS THE CHT PID AND CHECK THE VOLTAGE

- Key ON, engine OFF.
- Access the PCM and monitor the CHT V PID.

Is the voltage less than 0.2 V?

Yes	No
Key in OFF position. GO to **DL8**.	Key in OFF position. GO to **DL9**.

DL8 CHECK FOR A GROUNDED CIRCUIT

- CHT Sensor connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the CHT V PID.

Is the voltage greater than 4.6 V?

Yes	No
INSTALL a new CHT sensor.	GO to **DL14**.

DL9 CHECK FOR A VREF SHORT

- CHT Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

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Point A CHT Sensor Connector, Harness Side	Point B CHT Sensor Connector, Harness Side
CHT - Pin 1	SIGRTN - Pin 2

- Key ON, engine OFF.
- Access the PCM and monitor the CHT V PID.

Is the voltage less than 0.2 V?

Yes	No
REMOVE the jumper. GO to **DL11**.	REMOVE the jumper. GO to **DL10**.

DL10 CHECK THE CHT CIRCUIT FOR A SHORT TO POWER

- CHT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CHT Sensor Connector, Harness Side	(-)
CHT - Pin 1	Ground

Is the voltage greater than 5.5 V?

Yes	No
Key in OFF position. REPAIR the short circuit to PWR. CHECK the CHT sensor for damage. GO to **DL11**.	Key in OFF position. GO to **DL11**.

DL11 CHECK THE RESISTANCE OF THE CHT SENSOR WITH THE ENGINE OFF

NOTE: Refer to CYLINDER HEAD TEMPERATURE SENSOR EXPECTED VALUES for the resistance specifications.

- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

Is the resistance within specification?

Yes	No
GO to **DL12**.	INSTALL a new CHT sensor.

DL12 CHECK THE SIGNAL AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

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- PCM connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
CHT - Pin 1	CHT - Pin E33
SIGRTN - Pin 2	SIGRTN - Pin E41

Are the resistances less than 5 ohms?

Yes	No
GO to **DL13**.	REPAIR the open circuit.

DL13 CHECK THE SENSOR SIGNAL FOR A SHORT TO VREF

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

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
CHT - Pin E33	VREF - Pin E40

Is the resistance greater than 10K ohms?

Yes	No
GO to **DL26**.	REPAIR the short circuit to VREF.

DL14 CHECK THE SENSOR SIGNAL FOR A SHORT TO GROUND

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

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
CHT - Pin E33	SIGRTN - Pin E41

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
CHT - Pin E33	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **DL26**.	REPAIR the short circuit.

DL15 DTCS P0119, P1289 AND P1290: INTERMITTENT CHECK

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- Key ON, engine OFF.
- Access the PCM and monitor the CHT V PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock.
  - Wiggle the sensor connector.

Is there a large change in the voltage reading?

Yes	No
DISCONNECT and INSPECT the connector. If OK, INSTALL a new CHT sensor.	GO to **DL16**.

DL16 CHECK THE ELECTRONIC ENGINE CONTROL (EEC) WIRING HARNESS

- Access the PCM and monitor the CHT V PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness working from the sensor to the PCM.

Is there a large change in the voltage reading?

Yes	No
ISOLATE the fault REPAIR as necessary.	GO to **DL17**.

DL17 CHECK THE PCM AND VEHICLE HARNESS CONNECTORS

- PCM connector disconnected.
- CHT Sensor connector disconnected.

Are the connectors and terminals OK?

Yes	No
Key in OFF position. Unable to duplicate or identify the fault at this time. DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	REPAIR as necessary.

DL18 SELF-TEST DTC P1285: EARLY WARNING OF ENGINE OVERHEAT CONDITION

WARNING: TO AVOID PERSONAL INJURY DO NOT UNSCREW THE COOLANT PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR HOT. THE COOLING SYSTEM IS UNDER PRESSURE. STEAM AND HOT LIQUID CAN COME OUT FORCEFULLY WHEN THE CAP IS LOOSENED SLIGHTLY.

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NOTE: An engine overheat condition was sensed by the CHT sensor.

NOTE: If the electric cooling fan does not operate, return to DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS for electric cooling fan DTC or SYMPTOM CHARTS for symptom diagnosis.

- Check the cooling system for:
  - correct coolant level.
  - internal or external coolant leaks.
  - blockage of the radiator.
  - cooling fan operation.

Is the cooling system OK?

Yes	No
For CHT sensor check GO to **DL19**.	REFER to **ENGINE COOLING - HYBRID** for cooling system diagnostics. REPAIR as necessary.

DL19 CHECK THE OPERATION OF THE CHT SENSOR

- Start the engine using the engine running diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Run the engine until it reaches normal operating temperature.
- Carry out the KOEO self-test.

Is DTC P1285 present?

Yes	No
GO to **DL20**.	An engine overheat temperature was not detected. REPAIR any other DTCs as necessary.

DL20 CHECK THE RESISTANCE OF THE CHT SENSOR WITH THE ENGINE RUNNING

CAUTION: While conducting checks with a running engine make sure adequate safety precautions are observed to prevent contact with moving engine parts. For example; make sure ties or loose clothing do not come into contact with the cooling fan or drive belts.

NOTE: Refer to CYLINDER HEAD TEMPERATURE SENSOR EXPECTED VALUES for the resistance specifications.

- Run the engine until it reaches normal operating temperature.
- CHT Sensor connector disconnected.
- Measure the resistance between:

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(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

Is the resistance within specification?

Yes	No
GO to **DL26**.	INSTALL a new CHT sensor.

DL21 SELF-TEST DTC P1299: INDICATES AN ENGINE OVERHEAT CONDITION

WARNING: TO AVOID PERSONAL INJURY DO NOT UNSCREW THE COOLANT PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR HOT. THE COOLING SYSTEM IS UNDER PRESSURE. STEAM AND HOT LIQUID CAN COME OUT FORCEFULLY WHEN THE CAP IS LOOSENED SLIGHTLY.

- Check the engine coolant level.

Is the engine coolant fill level correct?

Yes	No
REFER to **ENGINE COOLING - HYBRID** to diagnose the engine overheat condition.	REFER to **ENGINE COOLING - HYBRID** to diagnose the coolant loss condition.

DL22 SELF-TEST DTC P0128: CHECK THE ENGINE COOLANT LEVEL

WARNING: TO AVOID PERSONAL INJURY DO NOT UNSCREW THE COOLANT PRESSURE RELIEF CAP WHILE THE ENGINE IS OPERATING OR HOT. THE COOLING SYSTEM IS UNDER PRESSURE. STEAM AND HOT LIQUID CAN COME OUT FORCEFULLY WHEN THE CAP IS LOOSENED SLIGHTLY.

NOTE: DTC P0128 indicates the engine coolant temperature has not achieved the required engine operation temperature level, since start-up within a specified amount of time.

- Check the engine coolant level.

Is the engine coolant fill level correct?

Yes	No
GO to **DL23**.	REFER to **ENGINE COOLING - HYBRID** to diagnose the coolant loss condition.

DL23 CHECK THE SENSOR OPERATION

- Start the engine using the engine running diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Run the engine until it reaches normal operating temperature.

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- Access the PCM and monitor the CHT PID.

Is the temperature greater than 77°C (170.6°F)?

Yes	No
Unable to duplicate or identify the fault at this time.	REFER to **ENGINE COOLING - HYBRID** to diagnose why the engine does not reach operating temperature.

DL24 DTC P0116: CHECK THE RESISTANCE OF THE CHT SENSOR WITH THE ENGINE OFF

NOTE: Verify the engine temperature is at ambient room temperature before continuing with this test. A soak period of 6 hours may be required. Refer to DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS for information concerning P0116.

NOTE: Refer to the chart at the beginning of this test for the resistance specifications.

- Key in OFF position.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

Is the resistance within specification?

Yes	No
CONNECT the CHT GO to **DL25**.	INSTALL a new CHT sensor.

DL25 DTC P0116: CHECK THE RESISTANCE OF THE CHT SENSOR WITH THE ENGINE RUNNING

CAUTION: While conducting checks with a running engine make sure adequate safety precautions are observed to prevent contact with moving engine parts. For example; make sure ties or loose clothing do not come into contact with the cooling fan or drive belts.

NOTE: Verify the engine is at normal operating temperature before taking the CHT reading.

NOTE: Refer to CYLINDER HEAD TEMPERATURE SENSOR EXPECTED VALUES for the resistance specifications.

- Start the engine using the engine running diagnostic mode. Refer to **DIAGNOSTIC MODES** .

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- Run the engine until it reaches normal operating temperature.
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT - Pin 1	SIGRTN - Pin 2

Is the resistance within specification?

Yes	No
Unable to duplicate or identify the fault at this time.	INSTALL a new CHT sensor.

DL26 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DM: MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

Important Safety Notice

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This article provides general directions for repairing vehicles with tested, effective techniques. Following them will help ensure reliability. There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles, as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

This pinpoint test is intended to diagnose the following:

- MAP sensor (9F479).
- Harness circuits: MAP, SIGRTN, VREF.
- Powertrain control module (PCM) (12A650).

Fig. 31: Identifying Manifold Absolute Pressure (MAP) Sensor Connector
Courtesy of FORD MOTOR CO.

Fig. 32: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

DM1 DTCS P0106, P0107 AND P0108: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during PCM or TCM self-test: P0106, P0107, or P0108?

Yes	No
For DTC P0106, GO to **DM9**. For KOEO and KOER DTCs P0107 and P0108, GO to **DM2**. For continuous memory DTCs P0107 and P0108, GO to **DM8**.	Unable to duplicate or identify the fault at this time. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

DM2 KOEO AND KOER DTCS P0107 AND P0108: CHECK THE VREF VOLTAGE TO THE MAP SENSOR

- MAP Sensor connector disconnected.
- Key ON, engine OFF.

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- Measure the voltage between:

(+) MAP Sensor Connector, Harness Side	(-) MAP Sensor Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 4

Is the voltage between 4 V - 6 V?

Yes	No
Key in OFF position. For DTC P0107, GO to **DM3**. For DTC P0108, GO to **DM5**.	Key in OFF position. GO to Pinpoint Test **C**.

DM3 INDUCE THE OPPOSITE MAP SENSOR VOLTAGE BY SIMULATING HIGH CONDITION

- Connect a 5 amp fused jumper wire between the following:

Point A MAP Sensor Connector, Harness Side	Point B MAP Sensor Connector, Harness Side
MAP - Pin 1	VREF - Pin 2

- Key ON, engine OFF.
- Access the PCM and monitor the MAP_V PID.

Is the voltage greater than 4.75 V?

Yes	No
Key in OFF position. INSTALL a new MAP sensor.	Key in OFF position. REMOVE the jumper wire. GO to **DM4**.

DM4 CHECK THE MAP CIRCUIT FOR A SHORT TO SIGRTN AND GND IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) MAP Sensor Connector, Harness Side	(-) MAP Sensor Connector, Harness Side
MAP - Pin 1	SIGRTN - Pin 4

- Measure the resistance between:

(+) MAP Sensor Connector, Harness Side	(-) Vehicle Battery
MAP - Pin 1	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **DM11**.	REPAIR the short circuit.

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DM5 INDUCE THE OPPOSITE MAP SENSOR VOLTAGE BY SIMULATING LOW CONDITION

- Connect a 5 amp fused jumper wire between the following:

Point A MAP Sensor Connector, Harness Side	Point B MAP Sensor Connector, Harness Side
MAP - Pin 1	SIGRTN - Pin 4

- Key ON, engine OFF.
- Access the PCM and monitor the MAP_V PID.

Is the voltage less than 0.1 V?

Yes	No
Key in OFF position. INSTALL a new MAP sensor.	Key in OFF position. GO to **DM6**.

DM6 CHECK THE MAP CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) MAP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
MAP - Pin 1	MAP - Pin E23

Is the resistance less than 5 ohms?

Yes	No
GO to **DM7**.	REPAIR the open circuit.

DM7 CHECK THE MAP CIRCUIT FOR A SHORT TO PWR IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) MAP Sensor Connector, Harness Side	(-)
MAP - Pin 1	Ground

Is the voltage greater than 1 V?

Yes	No
Key in OFF position. REPAIR the short circuit to PWR.	Key in OFF position. GO to **DM11**.

DM8 CONTINUOUS MEMORY DTCS P0107 AND P0108: CHECK THE MAP CIRCUIT FOR AN INTERMITTENT CONCERN

- Key ON, engine OFF.

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- Access the PCM and monitor the MAP_V PID.
- Carefully wiggle all accessible wiring and connectors associated with the circuit and look for a change in the PID state.
- Lightly tap on the MAP sensor to simulate road shock.

Is a fault indicated during the wiggle test?

Yes	No
Key in OFF position. REPAIR as necessary.	Key in OFF position. GO to Pinpoint Test **Z**.

DM9 DTC P0106: MAP RANGE/PERFORMANCE

NOTE: If MAP DTCs P0107 or P0108 are present, diagnose those DTCs first.

If any mass air flow (MAF) sensor related DTCs are present, diagnose those DTCs prior to diagnosing MAP DTC P0106.

Disregard any DTCs generated as a result of this test.

- Key in OFF position.
- MAP Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A MAP Sensor Connector, Harness Side	Point B MAP Sensor Connector, Component Side
VREF - Pin 2	VREF - Pin 2
SIGRTN - Pin 4	SIGRTN - Pin 4

- Key ON, engine running.
- Measure the voltage between:

(+) MAP Sensor Connector, Harness Side	(-)
MAP - Pin 1	Ground

Is the voltage between 1 V - 2 V?

Yes	No
GO to **DM10**.	CHECK the MAP harness for open and short circuits.

DM10 COMPARE ACTUAL MAP VOLTAGE TO MAP_V PID VOLTAGE

- Key ON, engine OFF.
- Record the actual MAP voltage values at KOEO, idle, 1,000 and 2,000 RPM.

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- Record the MAP_V PID voltage values at KOEO, idle, 1,000 and 2,000 RPM.

Does the MAP_V PID voltage stay within 0.5 volt of the actual MAP voltage?

Yes	No
The fault is not present at this time. CLEAR the DTCs. REPEAT the self-test.	INSTALL a new MAP sensor.

DM11 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DN: MOTOR ELECTRONICS COOLANT TEMPERATURE (MECT) SENSOR

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE

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HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

Important Safety Notice

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This article provides general directions for repairing vehicles with tested, effective techniques. Following them will help ensure reliability. There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles, as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

NOTE: Carefully check the motor electronics cooling system integrity. Over-temperature DTCs can be stored as a result of extreme driving conditions.

This pinpoint test is intended to diagnose the following:

- MECT (12B579).
- Harness circuits: MECT, VREF, and SIGRTN.
- Powertrain control module (PCM) (12A650).

Voltage values calculated for VREF = 5 volts. These values can vary by 15% due to sensor and VREF variations.

Fig. 33: Motor Electronics Coolant Temperature Sensor Temperature And Voltage Graph
Courtesy of FORD MOTOR CO.

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values	
°C	°F	Voltage	Resistance (K ohms)
120	248	0.28	1.18
110	230	0.36	1.55
100	212	0.47	2.07
90	194	0.61	2.80
80	176	0.80	3.84
70	158	1.05	5.37
60	140	1.37	7.70
50	122	1.77	10.97
40	104	2.23	16.15
30	86	2.74	24.27
20	68	3.26	37.30
10	50	3.73	58.75
0	32	4.14	95.85

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-10	14	4.45	160.31

Fig. 34: Identifying Motor Electronics Coolant Temperature (MECT) Sensor Connector
Courtesy of FORD MOTOR CO.

Fig. 35: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

DN1 DTCS P0A00, P0A01, P0A02, P0A03 AND P0A7C: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during PCM or TCM self-test: P0A00, P0A01, P0A02, P0A03, or P0A7C?

Yes	No
For DTCs P0A00 and P0A7C, GO to **DN2**. For DTC P0A01, GO to **DN14**. For KOEO and KOER DTC P0A02, GO to **DN9**. For KOEO and KOER DTC P0A03, GO to **DN5**. For continuous memory DTCs P0A02 or P0A03, GO to **DN11**.	Unable to duplicate or identify the fault at this time. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

DN2 DTCS P0A00 AND P0A7C: VISUALLY INSPECT THE MOTOR ELECTRONICS COOLING SYSTEM

NOTE: Repair any motor electronics coolant pump (MECP) DTCs before proceeding.

- Visually inspect the motor electronics cooling system for leaks, pinched hoses, restricted radiator air flow, correct coolant level, fan operation, and loose electrical connections.

Is the motor electronics cooling system OK?

Yes	No
GO to **DN3**.	Refer to **TRANSAXLE/TRANSMISSION COOLING - HYBRID** to diagnose the motor electronics cooling system (MECS) overheating concern.

DN3 ROAD TEST THE VEHICLE AND MONITOR THE MECT_V PID

NOTE: Refer to TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS for voltage specifications.

- Access the PCM and monitor the MECT_V PID.
- Road test the vehicle with heavy loads on the vehicle such as the A/C on MAX, the headlamps on, and the rear window defroster on.

Does the MECT sensor operate in the normal temperature range?

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Yes	No
GO to **DN11**.	GO to **DN4**.

DN4 CHECK THE RESISTANCE OF THE MECT SENSOR

NOTE: Refer to TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS for temperature versus resistance specifications.

- MECT Sensor connector disconnected.
- Measure the resistance between:

(+) MECT Sensor Connector, Component Side	(-) MECT Sensor Connector, Component Side
MECT - Pin 1	SIGRTN-C - Pin 2

Does the resistance of the MECT sensor match the ambient engine coolant temperature?

Yes	No
Refer to **TRANSAXLE/TRANSMISSION COOLING - HYBRID** to diagnose the motor electronics cooling system (MECS) overheating concern.	INSTALL a new MECT sensor.

DN5 DTC P0A03: CHECK THE MECT CIRCUIT FOR A SHORT TO PWR IN THE HARNESS

- MECT Sensor connector disconnected.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MECT Sensor Connector, Harness Side	(-)
MECT - Pin 1	Ground

Is the voltage less than 5 V?

Yes	No
Key in OFF position. GO to **DN6**.	Key in OFF position. REPAIR the short circuit to PWR. CHECK MECT sensor for damage. GO to **DN6**.

DN6 CHECK THE RESISTANCE OF THE MECT SENSOR WITH THE ENGINE OFF

NOTE: Refer to TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS for the resistance specifications.

- Key in OFF position.

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- Measure the resistance between:

(+) MECT Sensor Connector, Component Side	(-) MECT Sensor Connector, Component Side
MECT - Pin 1	SIGRTN-C - Pin 2

Is the resistance within specification?

Yes	No
Key in OFF position. GO to **DN7**.	Key in OFF position. INSTALL a new MECT sensor.

DN7 CHECK THE SIGNAL AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

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

(+) MECT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
MECT - Pin 1	MECT - Pin T3
SIGRTN-C - Pin 2	SIGRTN-C - Pin B41

Is each resistance less than 5 ohms?

Yes	No
GO to **DN8**.	REPAIR the open circuit.

DN8 CHECK THE SENSOR SIGNAL FOR A SHORT TO VREF

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

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
MECT - Pin T3	VREF - Pin B40

Is the resistance greater than 10K ohms?

Yes	No
GO to **DN17**.	REPAIR the short circuit to VREF.

DN9 DTC P0A02: SIMULATE AN OPPOSITE SIGNAL TO THE PCM

- MECT Sensor connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the MECT_V PID.

Is the voltage greater than 4.2 V?

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Yes	No
Key in OFF position. INSTALL a new MECT sensor.	Key in OFF position. GO to **DN10**.

DN10 CHECK THE SENSOR SIGNAL FOR A SHORT TO GROUND

- PCM connector disconnected.
- Measure the resistance between:

(+) MECT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
MECT - Pin 1	SIGRTN-C - Pin B41

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
MECT - Pin T3	Negative terminal

Are the resistances greater than 10,000 ohms?

Yes	No
GO to **DN17**.	REPAIR the short circuit to GND.

DN11 CONTINUOUS MEMORY DTCS P0A00, P0A02, P0A03 AND P0A7C: CHECK THE MECT SENSOR FOR AN INTERMITTENT CONCERN

- Key ON, engine OFF.
- Access the PCM and monitor the MECT_V PID.
- While observing the PID, carry out the following:
  - Tap on the sensor to simulate road shock.
  - Wiggle the sensor connector.

Does the MECT_V PID voltage indicate a fault in the MECT sensor?

Yes	No
DISCONNECT and INSPECT the connector. If OK, INSTALL a new MECT sensor.	GO to **DN12**.

DN12 CHECK THE MECT CIRCUIT FOR AN INTERMITTENT CONCERN

- Access the PCM and monitor the MECT_V PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness working from the sensor to the PCM.

Does the MECT_V PID voltage indicate a fault in the MECT circuit?

Yes	No

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ISOLATE the fault and REPAIR as necessary. CARRY OUT the Comprehensive Component Monitor Drive Cycle. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .	GO to **DN13**.

DN13 CHECK THE PCM AND VEHICLE HARNESS CONNECTORS

- PCM connector disconnected.
- MECT Sensor connector disconnected.

Are the connectors and terminals OK?

Yes	No
Unable to duplicate or identify the fault at this time. GO to Pinpoint Test **Z**.	REPAIR as necessary.

DN14 DTC P0A01: CHECK FOR THE PRESENCE OF PCM DTCS P0A00, P0A02, P0A03, P0A7C

NOTE: The TCM DTC P0A01 may be stored as a result of the MECT sensor or a corresponding circuit concern.

The PCM DTCs P0A00, P0A02, P0A03, or P0A7C present along with a P0A05 indicate the MECT sensor or harness concern.

Are any of the above listed DTCs present?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DN15**.

DN15 VERIFY THAT THE HARD FAULT IS PRESENT

NOTE: Clearing the TCM DTCs will erase any TCM recorded freeze frame data. Make sure to record any TCM freeze frame information before proceeding any further. Refer to the diagnostic tool instruction manual for freeze frame PID menu.

- Clear and retrieve the TCM continuous DTCs.

Is DTC P0A01 present?

Yes	No
GO to **DN16**.	Unable to duplicate or identify the fault at this time.

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DN16 CHECK THE TCM MECT PID

- Key ON, engine OFF.
- Access the TCM and monitor the MECT PID.
- Start the engine using the engine running diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Turn on all optional electrical loads.
- Idle the engine for 5 minutes with the load on and monitor the MECT PID.

Does the MECT PID temperature increase by at least 1 degree?

Yes	No
Key in OFF position. INSTALL a new transaxle assembly.	Key in OFF position. GO to **DN17**.

DN17 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DP: POWERTRAIN CONTROL MODULE (PCM) VEHICLE SPEED

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE

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TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
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The Escape Hybrid has 3 methods of calculating vehicle speed:

- from the anti-lock brake system (ABS).
- from the transaxle control module (TCM).
- from the powertrain control module (PCM) engine speed and the TCM generator speed.

Refer to **DESCRIPTION AND OPERATION** for more information.

This pinpoint test is intended to determine which of the 3 vehicle speed inputs caused the PCM vehicle speed DTC.

TEST PROCEDURE

DP1 DTCS P0500 OR P1500: CHECK FOR TCM DTCS

- Carry out the TCM self-test.

Are any TCM DTCs present?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DP2**.

DP2 CHECK FOR CORRECT TIRE SIZE AND INFLATION

- Verify the correct tire size and inflation.

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Are the tire size and inflation OK?

Yes	No
GO to **DP3**.	REPAIR as necessary.

DP3 CHECK FOR ABS DTCS

- Check the ABS module for wheel speed sensor DTCs.

Are any ABS DTCs present?

Yes	No
REFER to **VEHICLE DYNAMIC SYSTEMS** to diagnose the wheel speed sensor DTCs.	GO to **DP4**.

DP4 CHECK FOR CORRECT TRACTION MOTOR RPM DURING THE ROAD TEST

- Access the freeze frame data (if available) and record the DTC malfunction conditions.
- Access the TCM and monitor the M_SPEED and VSS PIDs.

Vehicle Speed KM/H (MPH)	Traction Motor RPM
0 (0)	0
26 (16)	1,996
55 (34)	4,392
80 (50)	6,389
109 (68)	8,784

- Road test the vehicle. Test drive using freeze frame data conditions. (if available).
- Refer to the table above.

Does the traction motor RPM correspond with the vehicle speed?

Yes	No
GO to **DP5**.	GO to Pinpoint Test **TP**.

DP5 CHECK FOR CORRECT GENERATOR RPM

- Access the TCM and monitor the RPM and G_SPEED PIDs.

Engine RPM	Generator Motor RPM
0	0
800	2,715
1,000	3,394
1,200	4,073
1,400	4,752
1,600	5,430

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1,800	6,109
2,000	6,788

- Place the gear selector lever in PARK.
- Start the engine using the engine running diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Refer to the table above.

Does the generator RPM correspond with the engine RPM?

Yes	No
GO to **DP6**.	GO to **TO2**.

DP6 CLEAR PCM DTCS

- Clear the PCM DTCs.
- Road test the vehicle.
- Repeat the KOEO and KOER self-tests and retrieve the continuous memory DTCs.

Are any DTCs present?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	Test complete.

PINPOINT TEST DR: CAMSHAFT POSITION (CMP) SENSOR

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE

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COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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This pinpoint test is intended to diagnose the following:

- CMP sensor (12K073).
- Harness circuits: CMP and SIGRTN.
- Powertrain control module (PCM) (12A650).

Fig. 36: Identifying Camshaft Position (CMP) Sensor Connector
Courtesy of FORD MOTOR CO.

Fig. 37: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

DR1 CONTINUOUS MEMORY DTC P0340: CHECK IF THE ENGINE WILL START

- Attempt to start engine.

Does the engine start?

Yes	No
GO to **DR2**.	The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

DR2 CONTINUOUS MEMORY DTC P0340: CLEAR AND ATTEMPT TO REGENERATE THE DTC

- Clear the DTCs.
- Increase the engine speed to greater than 1,500 RPM for 10 seconds.
- Repeat this 3 times.
- Check for self-test DTCs.

Is DTC P0340 present?

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Yes	No
Key in OFF position. A hard fault is present. GO to **DR3**.	Key in OFF position. GO to **DR8**.

DR3 CHECK THE CMP SENSOR RESISTANCE

NOTE: The CMP sensor resistance values change significantly with temperature rise.

- CMP Sensor connector disconnected.
- Measure the resistance between:

(+) CMP Sensor Connector, Component Side	(-) CMP Sensor Connector, Component Side
CMP - Pin 2	SIGRTN - Pin 1

Is the resistance between 250 ohms - 1K ohms?

Yes	No
GO to **DR4**.	INSTALL a new CMP sensor.

DR4 CHECK THE CMP CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CMP Sensor Connector, Harness Side	(-) Vehicle Battery
CMP - Pin 2	Negative terminal

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **DR5**.	REPAIR the short circuit.

DR5 CHECK THE CMP CIRCUIT FOR AN OPEN IN THE HARNESS

NOTE: Refer to the PCM connector pin numbers in the beginning of this pinpoint test. VR-type sensors are susceptible to electrical interference (noise). Harness shielding, where present, should be reinstalled properly when removed for testing.

- Measure the resistance between:

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

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CMP - Pin E10	CMP - Pin 2
SIGRTN - Pin B41, E41	SIGRTN - Pin 1

Are the resistances less than 5 ohms?

Yes	No
GO to **DR6**.	REPAIR the open circuit.

DR6 CHECK THE CMP CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

- Measure the resistance between:

(+) CMP Sensor Connector, Harness Side	(-) CMP Sensor Connector, Harness Side
CMP - Pin 2	SIGRTN - Pin 1

- Measure the resistance between:

(+) CMP Sensor Connector, Harness Side	(-) Vehicle Battery
CMP - Pin 2	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **DR7**.	REPAIR the short circuit.

DR7 CHECK THE CMP SENSOR OUTPUT

- PCM connector connected.
- CMP Sensor connector disconnected.
- Crank the engine using the engine cranking diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Digital multimeter on low voltage AC scale.
- Measure the voltage between:

(+) CMP Sensor Connector, Component Side	(-) CMP Sensor Connector, Component Side
CMP - Pin 2	SIGRTN - Pin 1

Is the voltage greater than 0.25 V?

Yes	No
GO to **DR9**.	INSTALL a new CMP sensor.

DR8 CHECK THE CMP CIRCUIT FOR AN INTERMITTENT CONCERN

- Access the PCM and monitor the CMPFM PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness working from the sensor to the PCM.

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Is a concern present during the wiggle test?

Yes	No
ISOLATE the fault and REPAIR as necessary.	GO to Pinpoint Test **Z**.

DR9 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DV: ELECTRONIC THROTTLE BODY (ETB)

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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WARNING: SUBSTANTIAL OPENING AND CLOSING TORQUE IS APPLIED BY THIS SYSTEM. TO PREVENT INJURY, BE CAREFUL TO KEEP FINGERS AWAY FROM THROTTLE MECHANISM WHEN ACTUATED.

Important Safety Notice

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This article provides general directions for repairing vehicles with tested, effective techniques. Following them will help ensure reliability. There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles, as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

This pinpoint test is intended to diagnose the following:

- ETB (9F991)
- Harness circuits: ETCRTN, ETCREF, TP1, TP2, TACM+, TACM-.
- Powertrain control module (PCM) (12A650)

Fig. 38: Identifying Electronic Throttle Body (ETB) Connector
Courtesy of FORD MOTOR CO.

Fig. 39: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

DV1 DTCS P0068, P0121, P0122, P0123, P0221, P0222, P0223, P2100, P2101, P2107, P2111, P2112 AND P2135: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during PCM or TCM self-test: P0068, P0121, P0122, P0123, P0221, P0222, P0223, P2100, P2101, P2107, P2111, P2112, or P2135?

Yes	No
For continuous memory DTC P0068, GO to **DV13**. For DTCs P0121, P0122, P0123, P0221, P0222, P0223, P2111 and P2112, GO to **DV2**. For DTCs P2100 and P2107, GO to **DV18**. For DTC P2101, GO to **DV24**. For DTC P2135, GO to **DV5**.	Unable to duplicate or identify the fault at this time. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

DV2 CHECK THE TP OPEN AND CLOSED VOLTAGES

NOTE: Do not apply the accelerator pedal more than once while engine cranking diagnostic mode is activated. It may cause continuous DTCs P2110 and P2111 to set.

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- Key ON, engine OFF.
- Access the PCM and monitor the TP1 and TP2 PIDs.
- Activate the engine cranking diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Do not crank the engine.
- Apply the brake pedal and press the accelerator pedal to the floor and release.

ELECTRONIC THROTTLE CONTROL THROTTLE POSITION SENSOR SIGNAL VOLTAGES

Accelerator Pedal Position	TP1	TP2
Pedal fully released	3.7 - 4.7	0.3 - 1.9
Pedal fully applied	0.7 - 2.9	4.1 - 4.7

Are both PIDs within the chart ranges?

Yes	No
GO to **DV16**.	GO to **DV3**.

DV3 CHECK FOR OBSTRUCTION OF THE THROTTLE BODY

WARNING: SUBSTANTIAL OPENING AND CLOSING TORQUE IS APPLIED BY THIS SYSTEM. TO PREVENT INJURY, BE CAREFUL TO KEEP FINGERS AWAY FROM THROTTLE MECHANISM WHEN ACTUATED.

- Key in OFF position.
- Remove the inlet tube from the throttle body.
- Visually inspect for throttle plate obstruction.
- Slowly push the throttle plate to wide open and release.

Does the throttle plate move freely to wide open and back?

Yes	No
For continuous memory DTCs P0121, P0122, P0221 or P0222, GO to **DV4**. For continuous memory DTCs P2100, P2101, P2107, P2111 or P2112, GO to **DV18**. For all others, GO to **DV5**.	Key in OFF position. ISOLATE the concern and REPAIR as necessary.

DV4 CHECK THE VREF VOLTAGE TO THE TP SENSOR

- ETB connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ETB Connector, Harness Side	(-) ETB Connector, Harness Side
ETCREF - Pin 5	ETCRTN - Pin 4

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Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to **DV5**.	GO to Pinpoint Test **C**.

DV5 DETERMINE THE TYPE OF ETB ON THE VEHICLE

NOTE: There are 2 types of ETBs available. Compare the sensor housing of the ETB on the vehicle to the illustration.

- Key in OFF position.
- Determine if the vehicle is equipped with a Type I ETB.

Fig. 40: Identifying Sensor Housing Of Type I ETB
Courtesy of FORD MOTOR CO.

Is the vehicle equipped with a Type I ETB?

Yes	No
GO to **DV7**.	GO to **DV6**.

DV6 CHECK FOR A TYPE II ETB

NOTE: There are 2 types of ETBs available. Compare the sensor housing of the ETB on the vehicle to the illustration.

- Determine if the vehicle is equipped with a Type II ETB.

Fig. 41: Identifying Sensor Housing Of Type II ETB
Courtesy of FORD MOTOR CO.

Is the vehicle equipped with a Type II ETB?

Yes	No
GO to **DV8**.	GO to **DV5**.

DV7 CHECK THE RESISTANCE OF THE TYPE I ETB

- ETB connector disconnected.
- Measure the resistance between:

Type I

(+) ETB Connector, Component Side	(-) ETB Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
TP1	ETCREF	1,100	3,500
TP1	ETCRTN	2,500	5,900

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TP2	ETCREF	1,800	4,900
TP2	ETCRTN	800	2,800
ETCREF	ETCRTN	1,800	4,900

Are all the resistances within the specifications?

Yes	No
GO to **DV9**.	INSTALL a new ETB. CLEAR the DTCs. REPEAT the self-test.

DV8 CHECK THE RESISTANCE OF THE TYPE II ETB

- ETB connector disconnected.
- Measure the resistance between:

Type II

(+) ETB Connector, Component Side	(-) ETB Connector, Component Side	Minimum Resistance (ohms)	Maximum Resistance (ohms)
TP1	ETCREF	700	1,800
TP1	ETCRTN	1,300	2,800
TP2	ETCREF	1,000	2,400
TP2	ETCRTN	500	1,500
ETCREF	ETCRTN	700	2,100

Are all the resistances within the specifications?

Yes	No
GO to **DV9**.	INSTALL a new ETB. CLEAR the DTCs. REPEAT the self-test.

DV9 CHECK THE TP1 AND TP2 CIRCUIT(S) FOR A SHORT TO VOLTAGE IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) ETB Connector, Harness Side	(-)
TP1 - Pin 3	Ground
TP2 - Pin 6	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit to PWR.	GO to **DV10**.

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DV10 CHECK THE TP1 AND TP2 CIRCUIT(S) FOR AN OPEN IN THE HARNESS

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

(+) ETB Connector, Harness Side	(-) PCM Connector, Harness Side
TP1 - Pin 3	TP1 - Pin E19
TP2 - Pin 6	TP2 - Pin E8

Are the resistances less than 5 ohms?

Yes	No
GO to **DV11**.	REPAIR the open circuit.

DV11 CHECK THE TP1 AND TP2 CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) ETB Connector, Harness Side	(-) Vehicle Battery
TP1 - Pin 3	Negative terminal
TP2 - Pin 6	Negative terminal

Are the resistances greater than 10K ohms?

Yes	No
GO to **DV12**.	REPAIR the short circuit to GND.

DV12 CHECK THE TPS CIRCUIT FOR A SHORT TOGETHER

- Measure the resistance between:

(+) ETB Connector, Harness Side	(-) ETB Connector, Harness Side
TP1 - Pin 3	TP2 - Pin 6
TP1 - Pin 3	ETCREF - Pin 5
TP1 - Pin 3	ETCRTN - Pin 4
TP2 - Pin 6	ETCREF - Pin 5
TP2 - Pin 6	ETCRTN - Pin 4

Are the resistances greater than 10K ohms?

Yes	No
GO to **DV13**.	REPAIR the short circuit.

DV13 CHECK FOR TP2 SIGNAL HIGH VERSUS LOAD WHILE DRIVING THE VEHICLE

- ETB connector connected.

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- PCM connector connected.
- Key ON, engine running.
- Access the PCM and monitor the LOAD and TP2 PIDs.
- Drive the vehicle while exercising the throttle and ETCTP sensor and accessing the PIDS.

Is the TP2 greater than 2.44 volts and the LOAD PID less than 30%?

Yes	No
LISTEN for air noise around the MAF sensor and throttle body while the engine is running. REPAIR as necessary. If no faults are found: GO to **DV14**.	GO to **DV14**.

DV14 CHECK FOR TP2 SIGNAL LOW VERSUS LOAD WHILE DRIVING THE VEHICLE

- Key ON, engine running.
- Drive the vehicle while exercising the throttle and ETCTP sensor and accessing the PIDS.

Is the TP2 PID less than 0.24 volt and the LOAD PID greater than 55%?

Yes	No
GO to **DV15**.	GO to **DV16**.

DV15 CHECK FOR SELF-TEST DTCS

- Key in OFF position.
- Key ON, engine OFF.
- Clear the DTCs.
- Drive the vehicle while exercising the throttle.
- Retrieve the continuous memory DTCs.

Are any DTCs present?

Yes	No
GO to **DV16**.	Unable to duplicate or identify the concern at this time. GO to Pinpoint Test **Z**.

DV16 CHECK THE TP SENSOR OPERATION

WARNING: SUBSTANTIAL OPENING AND CLOSING TORQUE IS APPLIED BY THIS SYSTEM. TO PREVENT INJURY, BE CAREFUL TO KEEP FINGERS AWAY FROM THROTTLE MECHANISM WHEN ACTUATED.

CAUTION: This test step requires the throttle plate to be manually moved. There

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may be some tension present when moving the throttle plate. Using excessive force may damage the electronic throttle body.

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

(+) ETB Connector, Component Side	(-) ETB Connector, Component Side
TP1 - Pin 3	ETCRTN - Pin 4
TP2 - Pin 6	ETCRTN - Pin 4

- While observing the DMM slowly move the throttle plate from fully closed to fully open position.

Do both resistance values change smoothly when the throttle plate is moved?

Yes	No
For continuous memory DTC P0068, CHECK the mass air flow (MAF) sensor and connector for damage and corrosion. REPAIR as necessary. For all others, GO to **DV17**.	INSTALL a new ETB.

DV17 CHECK THE TPS CIRCUIT FOR AN INTERMITTENT CONCERN

- Access the PCM and monitor the TP1 and TP2 PIDs.
- Wiggle, shake, and bend the harness from the TP to the PCM.

Are the voltages between 0.49 - 4.65 V?

Yes	No
GO to **DV26**.	REPAIR as necessary. If DTC P2100 or P2101 are present, GO to **DV18**.

DV18 CHECK THE TACM MOTOR VISUALLY

NOTE: Make sure the TACM harness connector is properly connected.

- Key in OFF position.
- Inspect the TACM for damaged housing, harness connector, and harness.

Are there any faults with the TACM hardware?

Yes	No
INSTALL a new ETB.	GO to **DV19**.

DV19 CHECK THE TACM FOR A SHORT OR OPEN

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- ETB connector disconnected.
- Measure the resistance between:

(+) ETB Connector, Component Side	(-) ETB Connector, Component Side
TACM+	TACM-

Is the resistance between 1 ohm - 900 ohms?

Yes	No
Key in OFF position. For DTCs P2100, P2112 or P2100, P2111, GO to **DV25**. For DTCs P2100, P2107, GO to **DV21**. For DTCs P2100, P2107, P2111, P2112, GO to **DV23**. For DTCs P2101, P2111, P2112 GO to **DV20**.	Key in OFF position. INSTALL a new ETB.

DV20 CHECK THE TACM HARNESS FOR AN OPEN

- PCM connector disconnected.
- Measure the resistance between:

(+) ETB Connector, Harness Side	(-) PCM Connector, Harness Side
TACM+	TACM+
TACM-	TACM-

Are the resistances less than 5 ohms?

Yes	No
Key in OFF position. GO to **DV21**.	REPAIR the open circuit.

DV21 CHECK THE HARNESS FOR A SHORT TO GND, PWR, ETCREF, AND ETCRTN

- Measure the resistance between:

(+) ETB Connector, Harness Side	(-) PCM Connector, Harness Side
TACM+	PWRGND - Pin B47
TACM+	VPWR - Pin B35
TACM+	ETCRTN - Pin E7
TACM+	ETCREF - Pin E9
TACM-	PWRGND - Pin B47
TACM-	ETCRTN - Pin E7
TACM-	VPWR - Pin B35
TACM-	ETCREF - Pin E9

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Are the resistances greater than 10K ohms?

Yes	No
GO to **DV22**.	REPAIR the short circuit.

DV22 CHECK FOR SELF-TEST CODES

- ETB connector connected.
- PCM connector connected.
- Carry out the self-test.

Is DTC P2101 present?

Yes	No
GO to **DV23**.	GO to **DV24**.

DV23 CHECK FOR TACM HARNESS CIRCUITS SHORTED TOGETHER

- ETB connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) ETB Connector, Harness Side	(-) ETB Connector, Harness Side
TACM+	TACM-

Is the resistance greater than 10K ohms?

Yes	No
GO to **DV24**.	REPAIR the short circuit.

DV24 CHECK FOR PROPER TACM+ WIRING IN THE HARNESS CONNECTOR

- Measure the resistance between:

(+) ETB Connector, Harness Side	(-) PCM Connector, Harness Side
TACM+	TACM+

Is the resistance less than 5 ohms?

Yes	No
GO to **DV25**.	REPAIR the open circuit. Properly wire the TACM harness connector per the TACM and PCM connector diagrams.

DV25 CHECK FOR PROPER TACM- WIRING IN THE HARNESS CONNECTOR

- Measure the resistance between:

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(+) ETB Connector, Harness Side	(-) PCM Connector, Harness Side
TACM-	TACM-

Is the resistance less than 5 ohms?

Yes	No
GO to **DV27**.	GO to **DV26**.

DV26 CHECK THE REPAIR THROUGH PROCEDURE

- Key ON, engine OFF.
- Record and clear the DTCs.
- Press the accelerator pedal to the floor and back several times.

Are any ETC system related DTCs set?

Yes	No
GO to **DV27**.	GO to Pinpoint Test **Z**.

DV27 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST DW: HEATED OXYGEN SENSOR (HO2S)

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE

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HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

WARNING: WHILE CONDUCTING TESTS ON A HOT ENGINE TAKE ALL SAFETY PRECAUTIONS TO PREVENT SKIN CONTACT WITH HOT ENGINE COMPONENTS. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

Important Safety Notice

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This article provides general directions for repairing vehicles with tested, effective techniques. Following them will help ensure reliability. There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles, as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

This pinpoint test is intended to diagnose the following:

- HO2S/O2S (9F472).
- HO2S/O2S (9G444).
- harness circuits: HO2S, HO2S Heater, VPWR, and SIGRTN.
- powertrain control module (PCM) (12A650).

Fig. 42: Identifying HO2S Location
Courtesy of FORD MOTOR CO.

Fig. 43: Identifying Heated Oxygen Sensor Bank 1, Sensor 1 (HO2S11) Connector
Courtesy of FORD MOTOR CO.

Fig. 44: Identifying Heated Oxygen Sensor Bank 1, Sensor 2 (HO2S12) Connector
Courtesy of FORD MOTOR CO.

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

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Fig. 45: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

DW1 DTCS P0053, P0054, P0132, P0133, P0135, P0138, P0141 AND P1127: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during the PCM self-test: P0053, P0054, P0132, P0133, P0135, P0138, P0141, or P1127?

Yes	No
For DTCs P0053 or P0054, GO to **DW12**. For DTCs P0132 or P0138, GO to **DW18**. For DTC P0133, GO to **DW2**. For DTCs P0135 or P0141, GO to **DW8**. For DTC P1127, GO to **DW17**.	For all others, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

DW2 CONTINUOUS MEMORY DTC P0133: CARRY OUT THE KOER SELF-TEST

- Engine at normal operating temperature.
- Carry out the KOER self-test.

Is DTC P1127 present?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **DW3**.

DW3 CHECK THE HO2S RESPONSE TEST RESULTS

- Key ON, engine OFF.
- Access the diagnostic monitoring test results for the HO2S11.

Is the indicated value greater than the minimum threshold?

Yes	No
CLEAR the DTCs. GO to **DW2**.	GO to **DW4**.

DW4 CHECK FOR UNMETERED AIR LEAKS

NOTE: Fuel calculations can be affected by unmetered air leaks.

- Carefully inspect the following areas for potential air leaks:
  - hoses connecting to the mass air flow (MAF) sensor assembly.

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- hoses connecting to the throttle body.
- intake manifold gasket leaks.
- PCV disconnected.
- the vacuum lines are disconnected.
- improperly seated engine oil dipstick, tube or oil fill cap.
- exhaust leaks at flanges and gaskets.

Are any air leaks present?

Yes	No
REPAIR the source of the air leak. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **DW5**.

DW5 CHECK HO2S CIRCUIT CONTINUITY

NOTE: HO2S is displayed as O2S on the diagnostic tool.

- HO2S connector disconnected.
- Check the connector (both halves) for any water contamination.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side
HO2S Signal	VPWR

- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.

Is the voltage greater than 1 V?

Yes	No
INSTALL a new HO2S. CHANGE the engine oil and oil filter. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **DW6**.

DW6 CHECK THE HO2S CIRCUIT(S) FOR AN OPEN IN THE HARNESS

NOTE: A vehicle hoist may be required to access the HO2S harness.

- Key in OFF position.
- Remove the jumper wire(s).

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- Visually inspect the HO2S harness for exposed wiring, water contamination, corrosion, and proper assembly.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Signal	HO2S Signal
SIGRTN - Pin E41	SIGRTN

Are the resistances less than 5 ohms?

Yes	No
GO to **DW7**.	REPAIR the open circuit.

DW7 CHECK THE HO2S CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	VPWR - Pin B35

Is the resistance greater than 10K ohms?

Yes	No
GO to **DW8**.	GO to **DW10**.

DW8 DTCS P0135 OR P0141: CHECK FOR A SOURCE OF POTENTIAL HO2S CONTAMINATION

- Investigate the following items as potential sources of HO2S contamination:
  - use of unapproved silicon sealers.
  - fuel contaminated by silicon additives.
  - excessive oil burning (rings, valve seals, oil overfill).
  - glycol leaking internally in the engine.
  - lead-contaminated fuel.
  - short drive cycles in cold weather.
  - use of unapproved cleaning agents.

Is a concern present?

Yes	No
REPAIR the source of the contamination. CHANGE the engine oil and oil filter. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **DW9**.

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DW9 VISUALLY INSPECT THE HO2S HARNESS

- PCM connector connected.
- Visually inspect the HO2S harness for exposed wiring, water contamination, corrosion, and proper assembly.

Is a concern present?

Yes	No
REPAIR as necessary.	GO to **DW10**.

DW10 CHECK THE HO2S AND SIGRTN CIRCUITS FOR AN OPEN IN THE HARNESS

NOTE: Verify the harness pins are in the proper location.

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Signal	HO2S Signal
SIGRTN - Pin E41	SIGRTN

Are the resistances less than 5 ohms?

Yes	No
GO to **DW11**.	REPAIR as necessary.

DW11 CARRY OUT THE KOEO ON DEMAND SELF-TEST

- Key ON, engine OFF.
- Check for KOEO DTCs.

Are DTCs P0135 or P0141 present?

Yes	No
GO to **DW12**.	GO to **DW13**.

DW12 DTCS P0053 AND P0054: CHECK FOR VPWR IN THE HARNESS

NOTE: If DTCs P0053 or P0054 are present, test their related circuits individually.

- Key in OFF position.
- HO2S connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

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(+) HO2S Connector, Harness Side	(-) HO2S Connector, Harness Side
VPWR	SIGRTN

Is the voltage greater than 10 V?

Yes	No
GO to **DW13**.	REPAIR the open circuit. CHECK the fuses.

DW13 CHECK THE HO2S HEATER FOR SHORTS IN THE HARNESS

NOTE: If DTCs P0053 or P0054 are present, test their related circuits individually.

- Key in OFF position.
- HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) Vehicle Battery
HO2S Heater	Negative terminal

- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Heater	VPWR
HO2S Heater	SIGRTN
HO2S Heater	HO2S Signal

Are the resistances greater than 10K ohms?

Yes	No
GO to **DW14**.	REPAIR the short circuit.

DW14 CHECK THE HO2S HEATER CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Heater	HO2S Heater

Is the resistance less than 5 ohms?

Yes	No
GO to **DW15**.	REPAIR the open circuit.

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DW15 CHECK THE INTERNAL RESISTANCE OF THE HO2S HEATER

- Measure the resistance between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Heater	VPWR

Is the resistance between 3 ohms - 30 ohms?

Yes	No
GO to **DW16**.	INSTALL a new HO2S. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .

DW16 CHECK THE HO2S HEATER CIRCUIT FOR AN INTERNAL SHORT TO SIGRTN OR GND

- Measure the resistance between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Heater	SIGRTN

- Measure the resistance between:

(+) HO2S Connector, Component Side	(-) Vehicle Battery
HO2S Heater	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **DW23**.	INSTALL a new HO2S. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .

DW17 KOER DTC P1127: EXHAUST TEMPERATURE OUT OF RANGE

NOTE: Address all other DTCs before proceeding.

- Key ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the HO2S Heater PID.

Is the PID state ON?

Yes	No

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CARRY OUT the KOER self-test.	RUN the engine until the PID indicates ON. CARRY OUT the KOER self-test.

DW18 DTCS P0132 AND P0138: VISUALLY INSPECT THE SUSPECT HO2S HARNESS

NOTE: Disconnect the suspect HO2S harness connector. Only the suspect HO2S needs to be diagnosed.

- Key in OFF position.
- HO2S connector disconnected.
- Visually inspect the HO2S harness.
  - Check the connector (both halves) for any water contamination.
  - Make sure the connector pins are fully seated.

Is a concern present?

Yes	No
REPAIR as necessary.	GO to **DW19**.

DW19 CHECK THE SUSPECT HO2S SIGNAL LEVEL TOO HIGH

- HO2S connector connected.
- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.

Is the voltage less than 1.1 V?

Yes	No
GO to **DW20**.	GO to **DW21**.

DW20 CARRY OUT A THOROUGH WIGGLE TEST ON THE SUSPECT HO2S HARNESS

- Key in OFF position.
- Key ON, engine OFF.
- Access the PCM and monitor the HO2S Signal PID.
- Carry out a thorough wiggle test on the HO2S harness.

Does the voltage change during the wiggle test?

Yes	No
REPAIR as necessary.	GO to Pinpoint Test **Z**.

DW21 CHECK THE SUSPECT HO2S SIGNAL FOR A SHORT TO VPWR INSIDE THE SENSOR

- Key in OFF position.
- HO2S connector disconnected.

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- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.

Is the voltage less than 1.1 V?

Yes	No
INSTALL a new HO2S. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **DW22**.

DW22 CHECK THE SUSPECT HO2S CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HO2S Connector, Harness Side	(-)
HO2S Signal	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit.	GO to **DW23**.

DW23 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST EM: EMISSION COMPLIANCE

INTRODUCTION

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WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

Important Safety Notice

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This article provides general directions for repairing vehicles with tested, effective techniques. Following them will help ensure reliability. There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles, as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

NOTE: Canada and some states or metropolitan areas in the United States require periodic emission, or I/M tests. All Ford products are designed to pass these tests. If a Ford product fails an I/M test, it is probably because 1) the engine or catalyst temperature was not warm and stabilized before the test, or 2) the vehicle had idled excessively before the test.

If any new emission components are installed, carry out the following steps before repeating the I/M test procedure:

- Reset the keep alive memory (KAM). Refer to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .
- To relearn some basic adaptive learning (trim) values, run the engine at 2,500 RPM for 1 minute and idle the engine for 2 minutes.

Fig. 46: Exhaust Gas Analysis Chart
Courtesy of FORD MOTOR CO.

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Verifying an Excessive Grams Per Mile (GPM) Indication Using a Parts Per Million (PPM) Reading.

For vehicle gas reading(s) that are excessive, compare the actual GPM reading to the gas cutpoint level needed to pass testing. This gives an indication of how much the PPM reading has to be reduced (if the actual reading is twice the cutpoint, the baseline reading has to be cut in half or more).

Example:

- The actual HC produced by a vehicle was 1.6 gpm. The cutpoint for HC in this example is 0.8 gpm. The actual reading is twice the cutpoint.
- The HC reading obtained for the same vehicle during the baseline drive averages 440 ppm. In order for this vehicle to pass the I/M test, the HC reading from the verification trip must be at least half of the baseline reading, or an average of 220 ppm or less.
- This method only gives a general idea of how much the PPM reading needs to be reduced in order for the vehicle to pass an I/M test that calculates GPM. This test is not exact. Experience still has to be used to determine if the emission readings are reduced enough for the vehicle to pass the I/M test.

TEST PROCEDURE

EM1 ANALYZE THE I/M TEST REPORT

- Analyze the I/M test report for data entry errors.
  - Model.
  - Model Year.
  - Correct calibration, if included on the report.
  - Correct test weight, if included on the report (this number is less than the vehicle's GVW).
- Analyze the I/M test report results.
  - Identify high and low gas readings.
  - For reports that include a drive trace, identify during which mode the gas(es) failed. Be aware that if all gases were high early then decreased, the catalyst may have been cool when testing began.

Has the I/M test report been analyzed?

Yes	No
GO to **EM2**.	REPEAT the test step.

EM2 EVAP SYSTEM LEAK OR PURGE FLOW TEST (IF THESE TESTS WERE CARRIED OUT)

Did the vehicle fail only an EVAP system leak or purge flow test (if these tests were carried out) .

Yes	No
EVAP concern only. GO to **EM22**.	GO to **EM3**.

EM3 BASELINE VEHICLES

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NOTE: Baselining the vehicle exhaust gas readings is important so the baseline readings can be used for comparison after any repair is made.

- Baseline the vehicle using an exhaust gas analyzer. If the vehicle must be driven, be certain any baseline drive used is repeatable. The same drive cycle will be used to verify any repair.
- During the baseline, check for any related symptoms that may be present, such as driveability, transmission shifting or exhaust smoke concerns.

Has the vehicle been baselined?

Yes	No
GO to **EM4**.	REPEAT the test step.

EM4 SYMPTOM CHECKS

- Check if any of the following symptoms are present:
  - Transmission concerns.
  - Idle concerns.
  - Driveability concerns.
  - Exhaust smoke.
  - Cooling system concerns.

Are any of the symptoms present?

Yes	No
CARRY OUT the PCM Quick Test. GO to **QT: STEP 1: POWERTRAIN CONTROL MODULE (PCM) / TRANSAXLE CONTROL MODULE (TCM) QUICK TEST** . REFER to **Fig. 46** at the beginning of this pinpoint test. After any repair, GO to **EM26**.	GO to **EM5**.

EM5 PRELIMINARY CHECKS

- Carry out the following checks:
  - Vacuum lines (leak/blockage).
  - Electrical connections.
  - Proper scheduled maintenance.
  - Ford authorized emission controls and components installed on vehicle.
  - Intake air tube and air cleaner concerns (such as obstructions, leaks, or a dirty air cleaner element).

Are all the checks OK?

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Yes	No
GO to **EM6**.	REPAIR as necessary. After any repair, GO to **EM26**.

EM6 CARRY OUT THE PCM QUICK TEST

- Carry out the PCM Quick Test to access any PCM DTCs. GO to **QT: STEP 1: POWERTRAIN CONTROL MODULE (PCM) / TRANSAXLE CONTROL MODULE (TCM) QUICK TEST** .

Is a fault indicated?

Yes	No
FOLLOW the **QT: STEP 1: POWERTRAIN CONTROL MODULE (PCM) / TRANSAXLE CONTROL MODULE (TCM) QUICK TEST** direction. After any repair, GO to **EM26**.	GO to **EM7**.

EM7 CHECK FOR EXCESSIVE CARBON MONOXIDE (CO) LEVELS

Does the vehicle have excessive CO levels?

Yes	No
Excessive CO levels indicate the engine is running rich. GO to **EM10**.	GO to **EM8**.

EM8 CHECK FOR EXCESSIVE HYDROCARBON (HC) LEVELS

Does the vehicle have excessive HC levels?

Yes	No
Excessive HC levels with low to normal CO levels indicate the engine is running lean. GO to **EM16**.	GO to **EM9**.

EM9 CHECK FOR EXCESSIVE OXIDES OF NITROGEN (NOX) LEVELS

Does the vehicle have excessive NOx levels?

Yes	No
GO to **EM20**.	VERIFY the test step results.

EM10 HIGH CO LEVELS: CHECK THE HC LEVELS

Does the vehicle have excessive HC levels?

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Yes	No
CHECK for the engine running rich and incomplete combustion. GO to **EM11**.	GO to **EM12**.

EM11 CHECK THE SECONDARY IGNITION SYSTEM

- GO to Pinpoint Test **JB** and follow the pinpoint test direction.

Is a fault indicated?

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM12**.

EM12 CHECK THE FUEL DELIVERY SYSTEM FOR CONCERNS SUCH AS HIGH FUEL PRESSURE AND THE ABILITY TO HOLD PRESSURE

- GO to Pinpoint Test **HC** and follow the pinpoint test direction.

Is a fault indicated?

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM13**.

EM13 CHECK FOR VACUUM LEAKS/OBSTRUCTION IN THE PCV SYSTEM (SUCH AS OIL CAP, PCV VALVE, HOSES, CUT GROMMETS, VALVE COVER BOLT TORQUE/GASKET LEAK)

- GO to Pinpoint Test **HG** and follow the pinpoint test direction.

Is a fault indicated?

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM14**.

EM14 CHECK THE EXHAUST SYSTEM

- GO to Pinpoint Test **HF** and follow the pinpoint test direction.

Is a fault indicated?

Yes	No
FOLLOW the pinpoint test direction. After any repair,	GO to **EM15**.

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GO to **EM26**.	

EM15 CHECK THE BASE ENGINE

- Check for base engine concerns. Refer to **ENGINE SYSTEM-GENERAL INFORMATION** .

Is a fault indicated?

Yes	No
REPAIR as necessary. After any repair, GO to **EM26**.	GO to **EM27**.

EM16 HIGH HC WITH A NORMAL TO LOW CO LEVEL

- Check the fuel delivery system for concerns.
- GO to Pinpoint Test **HC** and follow the pinpoint test direction.

Is a fault indicated?

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM17**.

EM17 CHECK THE SECONDARY IGNITION

- GO to Pinpoint Test **JB** and follow the pinpoint test direction.

Is a fault indicated?

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM18**.

EM18 CHECK FOR VACUUM LEAKS/OBSTRUCTION IN THE PCV SYSTEM (SUCH AS OIL CAP, PCV VALVE, HOSES, CUT GROMMETS, VALVE COVER BOLT TORQUE/GASKET LEAK)

- GO to Pinpoint Test **HG** and follow the pinpoint test direction.

Is a fault indicated?

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to **EM26**.	GO to **EM19**.

EM19 CHECK THE BASE ENGINE

- Check for base engine concerns such as intake manifold leaks, improper compression, or valvetrain or camshaft damage. Refer to **ENGINE SYSTEM-GENERAL INFORMATION** .

Is a fault indicated?

Yes	No
REPAIR as necessary. After any repair, GO to **EM26**.	GO to **EM27**.

EM20 HIGH NOX WITH NORMAL TO LOW HC AND CO LEVELS: CHECK THE BASE ENGINE

- Check for base engine concerns such as excessive carbon build up in the combustion chamber. Refer to **ENGINE SYSTEM-GENERAL INFORMATION** .

Is a fault indicated?

Yes	No
REPAIR as necessary. After any repair, GO to **EM26**.	GO to **EM21**.

EM21 ADDITIONAL CHECKS

- Check the following:
  - Cooling system concerns (such as an aftermarket front fascia covering the intake air or intake air system modifications).
  - Engine running lean (concerns such as vacuum leaks or low fuel pressure).

Are all the checks OK?

Yes	No
GO to **EM27**.	REPAIR as necessary. After any repair, GO to **EM26**.

EM22 EVAP SYSTEM CONCERN: PRELIMINARY CHECKS

- Analyze the I/M test report to determine when the concern is present. Attempt to verify the concern.
- Check the following:
  - Fuel filler cap.
  - EVAP system lines/hoses (check for proper connections, damage or blockage).
  - Fuel vapor storage canister damage.

Are all the checks OK?

Yes	No

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GO to **EM23**.	REPAIR as necessary. After any repair, GO to **EM25**.

EM23 CARRY OUT THE PCM QUICK TEST

- Carry out the PCM Quick Test to access any PCM DTCs. GO to **QT: STEP 1: POWERTRAIN CONTROL MODULE (PCM) / TRANSAXLE CONTROL MODULE (TCM) QUICK TEST** .

Is a fault indicated?

Yes	No
FOLLOW the **QT: STEP 1: POWERTRAIN CONTROL MODULE (PCM) / TRANSAXLE CONTROL MODULE (TCM) QUICK TEST** direction. After any repair, GO to **EM25**.	GO to **EM24**.

EM24 EVAP SYSTEM CHECK

- Check the EVAP system for leaks. Refer to **EVAPORATIVE EMISSIONS - HYBRID** .

Is a fault indicated?

Yes	No
REPAIR as necessary. After any repair, GO to **EM25**.	VERIFY the test step results. If all the test steps are OK, GO to Pinpoint Test **Z**. For additional symptoms, REFER to **SYMPTOM CHARTS** . After any repair, GO to **EM25**.

EM25 EVAP SYSTEM REPAIR VERIFICATION

- Confirm the vehicle repair.
- Reset the keep alive memory (KAM). Refer to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . Be aware that this will set DTC P1000 and reset the On-Board System Readiness test.
- To relearn some basic adaptive learning (trim) values, run the engine at 2,500 RPM for 1 minute and idle the engine for 2 minutes.
- Carry out the PCM Quick Test to access any PCM DTCs. GO to **QT: STEP 1: POWERTRAIN CONTROL MODULE (PCM) / TRANSAXLE CONTROL MODULE (TCM) QUICK TEST** .
- Carry out the EVAP system leak test and flow check.

Does the vehicle pass the EVAP system leak test and flow check?

Yes	No

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SAVE any repair documentation that may be required by local/federal laws. RETURN the vehicle to the customer.	The original concern was not repaired, or another concern exists. GO to **EM1**.

EM26 REPAIR AND VERIFICATION

NOTE: If the vehicle needs to be driven for the baseline test, it may be necessary to drive the vehicle first up to 8 km (5 mi) to relearn some additional adaptive learning (trim) values. Also, during the baseline make sure to use the same drive mode that was used for the original baseline test.

- Confirm the vehicle repair.
- Reset the keep alive memory (KAM). Refer to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . Be aware that this will set DTC P1000 and reset the On-Board System Readiness test.
- To relearn some basic adaptive learning (trim) values, run the engine at 2,500 RPM for 1 minute and idle the engine for 2 minutes.
- Carry out the PCM Quick Test to access any PCM DTCs. GO to **QT: STEP 1: POWERTRAIN CONTROL MODULE (PCM) / TRANSAXLE CONTROL MODULE (TCM) QUICK TEST** .
- Repair any other DTCs.
- Carry out the baseline test using the exhaust gas analyzer.
- For I/M 240 emission testing areas:
  - Refer to the beginning of this pinpoint test for information on verifying an excessive grams per mile indication using a parts per million (PPM) reading.
- All others (original gas concentrations reported in parts per million):
  - Verify the gas levels are within the acceptable range.

Are all gases within the acceptable range?

Yes	No
SAVE any repair documentation that may be required by local/federal laws. RETURN the vehicle to the customer.	The gas level is still high, or another gas level is above the acceptable range. GO to **EM1**.

EM27 CATALYST DELTA TEMPERATURE TEST

- Complete all previous testing.
- Run the engine for 2 minutes at 2,500 RPM to heat the exhaust system.
- Key in OFF position.
- Disconnect 1 coil connector.
- Run the engine at approximately 1,000 RPM.
- Measure the surface temperature at both the inlet and outlet of each catalytic converter.
- Compare the difference in temperature between the inlet and outlet readings of each catalytic converter.

Does each catalytic converter have a difference of more than 28°C (50°F) between its inlet and outlet reading?

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Yes	No
The catalytic converter(s) is operating correctly. CONNECT the coil. CLEAR the DTCs. VERIFY the test step results. If all test steps are OK, GO to Pinpoint Test **Z**. For additional symptoms, refer to **SYMPTOM CHARTS** . After any repair, GO to **EM26**.	CONNECT the coil. For catalytic converter(s) that have less than 28°C (50°F) difference, testing indicates the catalytic converter(s) is not working. REPEAT the test to verify the results. If the temperature difference is still less than required, INSTALL a new catalytic converter. After any repair, GO to **EM26**.

PINPOINT TEST FC: BATTERY POWER OFF

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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This pinpoint test is intended to diagnose the following:

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- Traction battery (10B759)
- Harness circuits: Battery power off (BPO)
- Powertrain control module (PCM) (12A650)

Fig. 47: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

Fig. 48: Identifying Traction Battery-A (TB-A) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

FC1 DTC P0A27: CHECK FOR SELF-TEST DTCS

Is TBCM DTC P0A27 present during self-test?

Yes	No
For KOEO and KOER DTC P0A27, GO to **FC2**. For continuous memory DTC P0A27, GO to **FC7**.	Unable to duplicate or identify the fault at this time. RETURN to **SYMPTOM CHARTS** for further direction.

FC2 CHECK THE BATTERY POWER OFF PID FREQUENCY

- Access the PCM and monitor the BPO_Hz PID.

Is the frequency between 1.96 - 2.04 Hz?

Yes	No
GO to **FC7**.	GO to **FC3**.

FC3 CHECK THE BATTERY POWER OFF CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- TB-A connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) TB-A Connector, Harness Side
BPO - Pin B24	BPO - Pin 8

Is the resistance less than 5 ohms?

Yes	No
GO to **FC4**.	REPAIR the open circuit.

FC4 CHECK THE BATTERY POWER OFF CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

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- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
BPO - Pin B24	Negative terminal

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **FC5**.	Key in OFF position. REPAIR the short circuit to PWR.

FC5 CHECK THE BATTERY POWER OFF CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
BPO - Pin B24	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **FC6**.	REPAIR the short circuit to GND.

FC6 CHECK THE BATTERY POWER OFF CIRCUIT INTEGRITY

- PCM connector connected.
- TB-A connector connected.
- Isolate the BPO circuit at the TB-A connector.
- Connect a 5 amp fused jumper wire between the following:

Point A TB-A Connector, Harness Side	Point B PCM Connector, Harness Side
BPO - Pin 8	MSDN - Pin T11

- Key ON, engine OFF.
- Access the PCM and monitor the BPO_Hz PID.

Is the PID frequency between 49 and 75 Hz?

Yes	No
Key in OFF position. REFER to **HIGH VOLTAGE TRACTION BATTERY** to continue the battery power off circuit diagnosis.	Key in OFF position. GO to **FC8**.

FC7 CHECK THE BATTERY POWER OFF CIRCUIT FOR AN INTERMITTENT CONCERN

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- PCM connector connected.
- Transaxle Assembly-A connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the BPO_Hz PID.
- Carefully wiggle all accessible wiring and connectors associated with the circuit and look for a change in the PID state.

Is a fault indicated during the wiggle test?

Yes	No
Key in OFF position. REPAIR as necessary.	Key in OFF position. GO to Pinpoint Test **Z**.

FC8 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST FD: BRAKE PEDAL INPUTS

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL

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INJURY OR DEATH.
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This pinpoint test is intended to diagnose the following:

- Brake Pedal Position (BPP) switch (13480).
- Brake pedal switch (BPS) (9F924).
- Harness circuits: B+, BPP, BPS.
- Powertrain control module (PCM) (12A650).

Fig. 49: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

FD1 SELF-TEST DTCS P1572 AND P1703: ARE ANY OF THE FOLLOWING DTCS PRESENT DURING PCM OR TCM SELF-TEST: ?

Are any of the following continuous DTCs present: P1572, P1703 ?

Yes	No
For KOEO and continuous memory DTCs P1572 and P1703, GO to **FD3**. For KOER DTC P1703, GO to **FD2**.	The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

FD2 KOER DTC P1703: VERIFY THE BRAKE PEDAL WAS APPLIED

Was the brake pedal applied and released during the KOER self-test?

Yes	No
	REPEAT the KOER self-test.

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GO to **FD3**.	APPLY and RELEASE the brake pedal during the KOER test.

FD3 DTCS P1572 AND P1703: CHECK THE OPERATION OF THE STOPLAMPS

- Key ON, engine OFF.
- Apply and release the brake pedal and check the stop lamp operation.

Do the stoplamps operate correctly?

Yes	No
GO to **FD4**.	REFER to **EXTERIOR LIGHTING** to diagnose the inoperative stoplamps.

FD4 CHECK SPEED CONTROL OPERATION

- Check for correct speed control operation.

Does speed control operate correctly?

Yes	No
GO to **FD5**.	REFER to the **SPEED CONTROL** to diagnose the speed control system.

FD5 CHECK FOR BPP CIRCUIT CYCLING

- Key in OFF position.
- PCM connector disconnected.
- Key ON, engine OFF.
- Apply and release the brake pedal while monitoring the voltage.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
BPP - Pin B8	Ground

Is voltage less than 1 volt with the brake pedal released and greater than 10 volts with the brake pedal fully applied?

Yes	No
GO to **FD6**.	REPAIR the open circuit.

FD6 CHECK FOR BPS CIRCUIT CYCLING

- Key ON, engine OFF.
- Apply and release the brake pedal while monitoring the voltage.
- Measure the voltage between:

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(+) PCM Connector, Harness Side	(-)
BPS - Pin B20	Ground

Is voltage greater than 10 volts with the brake pedal released and less than 1 volt with the brake pedal fully applied?

Yes	No
Key in OFF position. GO to **FD8**.	GO to **FD7**.

FD7 CHECK THE BPS CIRCUIT VOLTAGE

- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
BPS - Pin B20	Ground

Is the voltage reading greater than 10.5 volts?

Yes	No
Key in OFF position. REPAIR the short circuit.	Key in OFF position. REPAIR the open circuit.

FD8 BPP AND BPS RATIONALITY CHECK

- BPP Switch connector connected.
- BPS connector connected.
- Clear all continuous memory DTCs.
- Key ON, engine running.
- Apply and release the brake pedal several times.
- Retrieve all continuous memory DTCs from the PCM.

Is DTC P1572 present?

Yes	No
REFER to **EXTERIOR LIGHTING** to check for correct BPP and BPS switch installation. If OK, GO to **FD10**.	GO to **FD9**.

FD9 CHECK PCM FOR REOCCURRING BPP DTCS

- Carry out the PCM KOER self-test.

Is DTC P1703 present?

Yes	No
GO to **FD10**.	Unable to duplicate or identify the fault at this time.

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FD10 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST FE: IGNITION SWITCH INPUTS

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

Important Safety Notice

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This article provides general directions for repairing vehicles with tested, effective techniques. Following them will help ensure reliability. There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles,

as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

This pinpoint test is intended to diagnose the following:

- Harness circuits ignition switch position run (ISP-R) and ignition switch position run/start (ISP-R/S).
- Powertrain control module (PCM) (12A650).

Fig. 50: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

FE1 DTCS P2531 AND P2535: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during PCM or TCM self-test: P2531 or P2535?

Yes	No
For DTC P2531, GO to **FE2**. For DTC P2535, GO to **FE6**.	GO to **FE8**.

FE2 DTC P2531: CHECK THE ISP-R PID

- Access the PCM and monitor the IGN_R PID.
- Key ON, engine OFF.

Does the PID indicate YES (key in ISP-R position)?

Yes	No
Key in OFF position. GO to **FE8**.	Key in OFF position. GO to **FE3**.

FE3 CHECK FUSES

- Inspect all the ignition switch related fuses.

Are the ignition switch fuses OK?

Yes	No
GO to **FE4**.	INSTALL a new fuse as necessary. GO to **FE5**.

FE4 CHECK THE IGNITION SWITCH AND HARNESS FOR AN OPEN

- PCM connector disconnected.
- Key ON, engine OFF.

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- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
ISP-R - Pin B22	Negative terminal

Is the voltage greater than 10.5 V?

Yes	No
Key in OFF position. GO to **FE9**.	Key in OFF position. CHECK for a damaged ignition switch. REFER to **COMPONENT TESTING** . If the ignition switch is OK, REPAIR the open circuit.

FE5 CHECK THE ISP-R CIRCUIT FOR A SHORT TO GND IN THE HARNESS

- Ignition Switch connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
ISP-R - Pin B22	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
CHECK the ignition switch for a short to ground. If OK, GO to **FE9**.	REPAIR the short circuit to GND.

FE6 DTC P2535: CHECK THE ISP-R/S PID

- Key ON, engine OFF.

Does the engine start with the ignition key in ON position?

Yes	No
GO to **FE7**.	Key in OFF position. GO to **FE8**.

FE7 CHECK THE ISP-R/S CIRCUIT FOR A SHORT TO POWER

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery

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ISP-R/S - Pin B21	Negative terminal

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **FE9**.	Key in OFF position. CHECK for a damaged ignition switch. REFER to **COMPONENT TESTING** . If the ignition switch is Ok, REPAIR the short to PWR circuit in the harness.

FE8 CHECK THE ISP-R AND ISP-R/S CIRCUIT FOR INTERMITTENT FAULTS

- Key ON, engine OFF.
- Access the PCM and monitor the IGN_R and IGN_R/S PIDs.
- Turn the key to the ON and START positions, while observing the related ignition PID.
- Carefully wiggle all accessible wiring and connectors associated with the circuit and look for a change in the PID state.

Is a concern present during the wiggle test?

Yes	No
Key in OFF position. REPAIR as necessary.	Key in OFF position. GO to Pinpoint Test **Z**.

FE9 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST H: FUEL CONTROL

INTRODUCTION

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WARNING: WHILE CONDUCTING TESTS ON A HOT ENGINE TAKE ALL SAFETY PRECAUTIONS TO PREVENT SKIN CONTACT WITH HOT ENGINE COMPONENTS. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

Important Safety Notice

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This article provides general directions for repairing vehicles with tested, effective techniques. Following them will help ensure reliability. There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles, as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

This pinpoint test is intended to diagnose the following:

- heated oxygen sensor(s) (HO2S).
- fuel injector(s) (9F593).
- vacuum system.
- harness circuits: HO2S11, HO2S12, HTR11, HTR12, VPWR, and SIGRTN.
- powertrain control module (PCM) (12A650).

Fig. 51: Identifying HO2S Location
Courtesy of FORD MOTOR CO.

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Fig. 52: Identifying Heated Oxygen Sensor Bank 1, Sensor 1 (HO2S11) Connector
Courtesy of FORD MOTOR CO.

Fig. 53: Identifying Heated Oxygen Sensor Bank 1, Sensor 2 (HO2S12) Connector
Courtesy of FORD MOTOR CO.

Fig. 54: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

H1 DTCS P0171, P0172, P2195, P2196, P2270 AND P2271: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during the PCM self-test: P0171, P0172, P2195, P2196, P2270, or P2271?

Yes	No
For DTCs P2270 or P2271, GO to **H25**. For DTCs P0171 or P2195, GO to **H2**. For DTCs P0172 or P2196, GO to **H7**.	For all others, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

H2 DTCS P0171 OR P2195: LEAN SYSTEM DTCS

NOTE: Do not clear the DTCs or reset the keep alive memory (KAM).

- Access the PCM and record the ECT PID from the freeze frame data. The freeze frame data is used to recreate the concern.
- Retrieve and record the self-test DTCs.

Are any DTCs present other than the following: P0171 or P2195?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **H3**.

H3 CARRY OUT A VISUAL INSPECTION ON THE INTAKE AIR SYSTEM AND ALL VACUUM HOSES

- Key in OFF position.
- Check the intake air system for leaks, obstructions, and damage.
- Inspect the entire length of all the vacuum hoses for:
  - proper connections.
  - damage or cracks.
  - damaged or cracked vacuum tees.
- Verify the integrity of the positive crankcase ventilation (PCV) system.

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- Verify the proper PCV valve part number.

Is a concern present?

Yes	No
GO to **H6**.	GO to **H4**.

H4 CHECK FOR THE PRESENCE OF A VACUUM LEAK

NOTE: Fuel trim values at idle are more sensitive to a vacuum leak. The vacuum leak (unmetered air) represents a larger portion of the total air flow at idle than at part throttle.

NOTE: The barometric pressure (BARO) PID is not a recommended PID to monitor when diagnosing a vacuum leak. Barometric pressure is calculated during high engine load, when the vacuum leak represents a small portion of the total air flow.

NOTE: When calculating the total fuel correction in the following steps, if LONGFT1 equals +13% and SHRTFT1 equals +23%, the total fuel correction for bank 1 equals +36%. If LONGFT1 equals +24% and SHRTFT1 equals -3% the total fuel correction for bank 1 equals +21%.

NOTE: If the freeze frame ECT PID is available, stabilize the engine at the temperature recorded by the freeze frame ECT PID. If the freeze frame ECT PID is not available, maintain the engine coolant temperature between 82°C - 101°C (180°F - 215°F) and the intake air temperature less than 46°C (115°F).

- Key ON, engine running.
- Access the PCM and monitor the ECT, CHT, IAT, LONGFT1 and SHRTFT1 PIDs.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- Mathematically add and record the LONGFT PID value to the SHRTFT PID value, for a total fuel correction at idle.
- Increase the engine speed to 2,500 RPM for 10 seconds.
- Record the LONGFT1 and SHRTFT1 PID values.
- Mathematically add and record the LONGFT PID value to the SHRTFT PID value, for a total fuel correction at 2,500 RPM.

Is the total fuel correction value difference, between idle and 2,500 RPM, less than 15 percent?

Yes	No
No vacuum leak is present. For DTC P0171, GO to **H15**. For DTC P2195, GO to **H9**.	GO to **H5**.

H5 LOCATE THE VACUUM LEAK

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CAUTION: Do not clamp or pinch a hard plastic hose. Use a vacuum cap or equivalent to restrict the hose.

NOTE: Restricting the EVAP vapor hose while the EVAP emission canister is purging may shift the SHRTFT. Carry out a visual inspection as necessary.

NOTE: When monitoring for a decrease in the SHRTFT1 PID in the following steps, if SHRTFT1 is +15%, but when the hose is restricted SHRTFT1 decreases to -7%, the decrease in the SHRTFT1 PID equals 22%.

- Locate the vacuum tees for the intake air and PCV systems.
- Access the PCM and monitor the SHRTFT1 PID.
- Restrict the vacuum lines one at a time for 30 seconds. If a vacuum leak is present, the SHRTFT1 PID value decreases as the hose is restricted.

Is the decrease in the SHRTFT1 PID greater than 15 percent when one of the vacuum hoses is restricted?

Yes	No
GO to **H6**.	INSPECT the intake air system for a vacuum leak in the intake manifold or intake gaskets. REPAIR as necessary. For repair verification, GO to **H6**.

H6 VACUUM LEAK REPAIR VERIFICATION

NOTE: If the freeze frame ECT PID is available, stabilize the engine at the temperature recorded by the freeze frame ECT PID. If the freeze frame ECT PID is not available, maintain the engine coolant temperature between 82°C - 101°C (180°F - 215°F) and the intake air temperature less than 46°C (115°F).

- Access the PCM and monitor the SHRTFT1 PID.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- Record the SHRTFT1 PID value.
- Key in OFF position.
- Repair the vacuum leak.
- Key ON, engine running.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- Access the PCM and monitor the SHRTFT1 PID.
- Compare the recorded SHRTFT1 PID value, prior to the vacuum leak repair, to the current SHRTFT1 PID value.

Is the decrease in the SHRTFT1 PID greater than 15 percent?

Yes	No

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RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .	A vacuum leak is still present. GO to **H5**.

H7 DTCS P0172 OR P2196: RICH SYSTEM DTCS

NOTE: Do not clear the DTCs or reset the keep alive memory (KAM).

- Access the PCM and record the freeze frame data.
- Retrieve and record the self-test DTCs.

Are any DTCs present other than the following: P0172 or P2196?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **H8**.

H8 INSPECT THE ENTIRE INTAKE AIR SYSTEM FOR DEBRIS, BLOCKAGE OR OTHER DAMAGE

- Check the intake air system for obstructions, restrictions, and damage.
- Check the air filter element and housing for blockage.

Is a concern present?

Yes	No
REPAIR as necessary.	For DTC P0172, GO to **H15**. For DTC P2196, GO to **H13**.

H9 CHECK THE HO2S AND SIGRTN CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- Disconnect the HO2S related to the current DTC.
- PCM connector disconnected.
- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal - Pin 4	HO2S Signal
SIGRTN - Pin 3	SIGRTN - Pin E41

Are the resistances less than 5 ohms?

Yes	No
GO to **H10**.	REPAIR the open circuit.

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H10 CHECK THE HO2S CIRCUIT FOR A SHORT TO SIGRTN IN THE HARNESS

- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Signal - Pin 4	SIGRTN - Pin 3

Is the resistance greater than 10K ohms?

Yes	No
GO to **H11**.	REPAIR the short circuit.

H11 CHECK THE HO2S CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) HO2S Connector, Harness Side	(-)
HO2S Signal - Pin 4	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to **H12**.	REPAIR the short circuit to GND.

H12 HO2S CIRCUIT TEST (WITH LEAN DTCS)

- PCM connector connected.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side
HO2S Signal - Pin 4	VPWR - Pin 1

- Key ON, engine OFF.
- Access the PCM and monitor the HO2S Signal PID.

Is the voltage greater than 1.3 V?

Yes	No
GO to **H15**.	GO to **H33**.

H13 HO2S CIRCUIT TEST (WITH RICH DTCS)

- Disconnect the HO2S related to the current DTC.
- Key ON, engine OFF.
- Access the PCM and monitor the HO2S Signal PID.

Is the voltage less than 0.2 V?

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Yes	No
GO to **H15**.	GO to **H14**.

H14 CHECK THE HO2S CIRCUIT FOR A SHORT TO THE VPWR OR HEATER IN THE HARNESS

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

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	HO2S Heater
HO2S Signal	VPWR - Pin B35

Are the resistances greater than 10K ohms?

Yes	No
GO to **H33**.	REPAIR the short circuit.

H15 CHECK THE FUEL PRESSURE

WARNING: WHEN CHECKING THE FUEL SYSTEM REMEMBER THAT THE FUEL SYSTEM MAY STILL BE PRESSURIZED WHEN THE ENGINE IS SWITCHED OFF. ALWAYS FOLLOW THE INSTRUCTIONS RELATED TO FUEL SYSTEM PRESSURE RELIEF. ALL FUEL HANDLING SAFETY PRECAUTIONS MUST BE OBSERVED. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

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

- Remove the jumper wire(s).
- HO2S connector connected.
- Mechanical fuel pressure gauge connected.
- Key ON, engine OFF.
- Access the PCM and control the FP PID.
- Run the fuel pump to obtain maximum fuel pressure.

Is the fuel pressure between 138 - 517 kPa (20 - 75 psi)?

Yes	No
GO to **H16**.	GO to Pinpoint Test **HC**.

H16 CHECK THE FUEL SYSTEM FOR PRESSURE STABILITY - FAST LEAKDOWN

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

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

- Key in OFF position.
- Key ON, engine OFF.
- Access the PCM and control the FP 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 10 seconds.

Does the fuel pressure remain within 34 kPa (5 psi) of the recorded reading after 10 seconds?

Yes	No
GO to **H18**.	GO to **H17**.

H17 CHECK FOR AN EXTERNAL FUEL LEAK

- Inspect the fuel tank, lines, and filler pipe for a fuel leak.

Is a concern present?

Yes	No
REPAIR as necessary. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to Pinpoint Test **HC**.	GO to **H19**.

H18 CHECK THE FUEL SYSTEM FOR PRESSURE STABILITY - SLOW LEAKDOWN

- Continue to monitor the fuel pressure for 1 minute.

Is the fuel pressure greater than 275 kPa (40 psi) after 1 minute?

Yes	No
GO to **H19**.	GO to **HC7**.

H19 FLOW TEST

- Key in OFF position.
- PCM connector connected.
- Flow test the injector using the fuel injector tester.

Is the flow rate for each injector within specification?

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Yes	No
For DTCs P0171 or P0172, GO to **DC26**. For DTC P2195, GO to **H20**. For DTC P2196, GO to **H21**.	INSTALL a new fuel injector. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .

H20 CHECK THE HO2S OUTPUT VOLTAGE

- HO2S connector disconnected.
- Visually inspect the HO2S circuit for exposed wiring, contamination, corrosion and correct assembly. Repair as necessary.
- Measure the voltage between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Signal - Pin 4	SIGRTN - Pin 3

- Increase the engine speed to 2,000 RPM for 3 minutes.
- Carry out the KOER self-test.
- Monitor the signal voltage during the self-test.

Is the voltage greater than 0.5 volt at any time during the self-test?

Yes	No
GO to **H23**.	INSTALL a new HO2S. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .

H21 ATTEMPT TO RETRIEVE DTC P2195

- HO2S connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B Vehicle Battery
HO2S Signal - Pin 4	Negative terminal

- Carry out the KOER self-test.

Is DTC P2195 present?

Yes	No
GO to **H22**.	GO to **H33**.

H22 HO2S VOLTAGE CHECK

- Key in OFF position.
- Remove the jumper wire(s).

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- HO2S connector disconnected.
- Increase the engine speed to 2,000 RPM for 30 seconds.
- Measure the voltage between:

(+) HO2S Connector, Component Side	(-) HO2S Connector, Component Side
HO2S Signal - Pin 4	SIGRTN - Pin 3

- Carry out the KOER self-test.
- Monitor the signal voltage during the self-test.

Is the voltage less than 0.4 volt at any time during the self-test?

Yes	No
GO to **H23**.	INSTALL a new HO2S. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .

H23 CARRY OUT A THOROUGH WIGGLE TEST ON THE HO2S HARNESS

- Key in OFF position.
- HO2S connector connected.
- Key ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the HO2S Signal PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.

While monitoring the HO2S PID, does the HO2S stop switching?

Yes	No
ISOLATE the fault and REPAIR as necessary.	GO to **H24**.

H24 TEST DRIVE THE VEHICLE WHILE MONITORING THE HO2S PID FOR SWITCHING

- Access the PCM and monitor the HO2S Signal and OL PIDs.
- Start the engine and let idle until the vehicle goes into the closed loop fuel condition.
- Drive the vehicle in a manner consistent with the freeze frame data in an attempt to simulate the original fault.

Does the HO2S PID switch?

Yes	No
GO to **DC26**.	INSTALL a new HO2S. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY**

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	(KAM) .

H25 DTCS P2270 OR P2271: HO2S LACK OF SWITCHES STUCK LEAN OR RICH

NOTE: Address all continuous memory ignition and misfire DTCs before any KOER HO2S DTCs.

- Key in OFF position.
- Visually inspect for:
  - pinched, shorted, and corroded wiring and pins.
  - oil or water contamination.
  - crossed sensor wires.
  - contaminated or damaged sensor.

Is a concern present?

Yes	No
REPAIR as necessary.	For KOER DTCs P2270 or P2271, GO to **H27**. For continuous memory DTCs P2270 or P2271, GO to **H26**.

H26 CHECK FOR KOER DTCS

- Key ON, engine OFF.
- Clear the DTCs.
- Key ON, engine running.
- Run the engine at approximately 2,000 RPM. Maintain the engine speed for 3 minutes.
- Retrieve the continuous memory DTCs.

Are DTCs P2270 or P2271 present?

Yes	No
GO to **H27**.	Unable to duplicate or identify the fault at this time. GO to Pinpoint Test **Z**.

H27 CHECK THE HO2S SIGNAL LEVEL TOO HIGH

NOTE: Fuel calculations can be affected by unmetered air leaks.

- Key in OFF position.
- Carefully inspect the following areas for potential air leaks:
  - hoses connecting to the mass air flow (MAF) sensor assembly.
  - hoses connecting to the throttle body.

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  - intake manifold gasket leaks.
  - PCV disconnected.
  - the vacuum lines are disconnected.
  - improperly seated engine oil dipstick, tube or oil fill cap.
  - exhaust leaks at flanges and gaskets.
- With the vehicle in NEUTRAL, position it on a hoist. Refer to **JACKING & LIFTING** for the locations of the lifting points.
- Visually inspect for:
  - exhaust leaks at flanges and gaskets.
  - HO2S not tightened to specification.
  - physical exhaust system concerns.
  - aftermarket exhaust.
  - punctures or cracks in the catalyst.

Is a concern present?

Yes	No
REPAIR as necessary.	GO to **H28**.

H28 CHECK FOR SHORTS BETWEEN CIRCUITS IN THE HO2S HARNESS

- PCM connector disconnected.
- Disconnect the HO2S harness connector.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
HO2S Signal	Negative terminal

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S Signal	SIGRTN - Pin E41
HO2S Signal	VPWR - Pin B35
HO2S Signal	HO2S Heater

Are the resistances greater than 10K ohms?

Yes	No
GO to **H29**.	REPAIR the short circuit.

H29 CHECK THE HO2S CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

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(+) PCM Connector, Harness Side	(-) HO2S Connector, Harness Side
HO2S Heater	HO2S Heater - Pin 2
VPWR - Pin B35	VPWR - Pin 1
HO2S Signal	HO2S Signal - Pin 4
SIGRTN - Pin E41	SIGRTN - Pin 3

Are the resistances less than 5 ohms?

Yes	No
GO to **H30**.	REPAIR the open circuit.

H30 CHECK THE HO2S CIRCUIT VOLTAGE

- PCM connector connected.
- HO2S connector connected.
- Key ON, engine running.
- Access the PCM and monitor the HO2S Signal PID.

Is the voltage greater than 1.5 V?

Yes	No
GO to **H32**.	GO to **H31**.

H31 CHECK THE HO2S CIRCUIT VOLTAGE

- Key in OFF position.
- PCM connector connected.
- HO2S connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A HO2S Connector, Harness Side	Point B HO2S Connector, Harness Side
HO2S Signal - Pin 4	VPWR - Pin 1

- Key ON, engine OFF.
- Access the PCM and monitor the HO2S Signal PID.

Is the voltage greater than 1.5 V?

Yes	No
INSTALL a new HO2S. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **H33**.

H32 CHECK FOR OVER VOLTAGE IN THE PCM

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- Key in OFF position.
- HO2S connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HO2S Connector, Harness Side	(-) Vehicle Battery
SIGRTN - Pin 3	Negative terminal
HO2S Signal - Pin 4	Negative terminal

Are the voltages less than 1.5 V?

Yes	No
INSTALL a new HO2S. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to **H33**.

H33 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HC: FUEL DELIVERY SYSTEM

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5

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MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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 A ROTUNDA FUEL PRESSURE GAUGE 134R0087 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.**

CAUTION: Use care to prevent combustion from fuel spillage. No smoking, open flames, or any kind of arcing.

SAFE FUEL HANDLING PRACTICES .

Gasoline, Methanol, and Methanol Blends .

FIRE .

- **Report all fires to the appropriate authorities** .
- **Flames from methanol or methanol-gasoline blends can be invisible** .
- **Know the locations of portable fire extinguishers, fire blankets, fire alarms, and the eye/wash shower facilities. Know how to use them** .
- **Use a B or AFFF (light water) type fire extinguisher to fight flammable liquid fires** .

FIRST AID .

- **If gasoline has been swallowed, do not induce vomiting. Seek medical attention immediately!**

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- **If methanol or methanol/gasoline blend has been swallowed, induce vomiting under the direction of a physician or a Poison Control Center. Seek medical attention immediately!**
- **When overcome by vapors move the victim to fresh air, if safe. If not breathing, give artificial respiration or cardiopulmonary resuscitation (CPR) as appropriate. Seek medical attention immediately!**
- **If splashed in eyes, flush with large amounts of water for 15 minutes. Remove contact lenses, if worn. Seek medical attention immediately!**
- **If splashed on skin, remove contaminated clothing. Wash skin thoroughly with soap and water .**

HEALTH .

- **All fuels can be harmful or fatal if swallowed .**
- **Be aware, if fuel is swallowed the onset of serious health effects can be delayed 12 to 24 hours .**
- **Fuels and products containing methanol (windshield washer fluid) can cause blindness if swallowed .**
- **All fuel vapors can be harmful if inhaled .**
- **All fuels can be harmful if absorbed through the skin .**
- **All fuels are irritating to the eyes and respiratory system .**
- **Some fuels made with gasoline contain benzene which is a cancer-causing agent .**

HANDLING .

- **Use flammable liquid handling precautions .**
- **Wear chemical goggles and nitrile gloves. Additional protective clothing and equipment may be necessary in some instances .**
- **Keep flammable liquids in approved, labeled, closed containers .**
- **Use in well ventilated areas and control vapors. Be aware that vapors are not visible, are heavier than air, can travel along the floor, and settle in lower areas .**
- **When transferring flammable liquids, bond the receiving container to the source and ground the source to the earth .**
- **Do not smoke or use heat/spark producing equipment near vapors .**
- **Do not smoke, eat, or drink where these products are handled, processed, or stored .**
- **Never siphon by mouth .**
- **Wash hands thoroughly after handling any fuel .**

SPILLS .

- **Notify the proper authorities in the event of any spill you are not trained to clean up .**
- **Stop, contain, and clean up small spills with an absorbent material .**

Important Safety Notice

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This article provides general directions for repairing vehicles with tested, effective techniques. Following them will help ensure reliability. There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles,

as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

This pinpoint test is intended to diagnose the following:

- chassis components.
- engine vacuum.
- fuel pressure.
- fuel filter.
- fuel supply line.
- fuel supply.
- fuel injector (9F593).

Description

Refer to **FUEL SYSTEMS** for additional information on the fuel delivery system.

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.

- 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 for IFS switch location.

NOTE: In the closed position, the button can be pressed an additional 1.57 mm (0.06 in) against a spring.

- Key ON, engine OFF.
- Key in OFF position.
- Key ON, engine OFF.
- Key in OFF position.
- Check for leaking fuel.

TEST PROCEDURE

HC1 CHECK THE SYSTEM INTEGRITY

- Visually inspect the complete fuel delivery system for damage and leakage.
- Check the following:
  - fuel lines and connections.

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  - 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 IFS switch is set (button pushed in). Refer to the Owner's Literature for location.
- Verify the fuse integrity.
- Verify the 12 volt battery is fully charged.
- Verify the fuel level, grade, and quality is sufficient to support normal operation of the engine.

Are any of the above concerns present?

Yes	No
REPAIR as necessary.	GO to **HC2**.

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

- Key in OFF position.
- FP connector connected.
- Key ON, engine running.
- Check for manifold vacuum at each system related component with a vacuum line.
- Key in OFF position.
- Wait 10 seconds.
- Key ON, engine running.
- Run the engine for approximately 10 seconds.
- Key in OFF position.
- 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.

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

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

HC3 CHECK THE FUEL PRESSURE

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

- Key in OFF position.
- Relieve the fuel pressure. Refer to **FUEL SYSTEM-GENERAL INFORMATION** for the Fuel System Pressure Release procedure.
- Mechanical fuel pressure gauge connected.
- Pressurize the fuel system. Refer to **FUEL SYSTEM-GENERAL INFORMATION** for the Fuel System Pressure Release procedure.
- Key ON, engine OFF.
- Access the PCM and control the FP PID.
- Control the FP ON.

Is the fuel pressure between 275 - 485 kPa (40 - 70 psi) ?

Yes	No
EXIT the output state control. GO to **HC6**.	EXIT the output state control. GO to **HC4**.

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

- Key in OFF position.
- FP connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

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

Is the voltage greater than 10 V?

Yes	No
GO to **HC5**.	REPAIR the open circuit.

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 IFS switch is set (button pushed in). Refer to the Owner's Literature for location.
- FP connector disconnected.
- Key ON, engine OFF.
- Access the PCM and control the FP PID.
- Control the FP ON.
- Measure the voltage between:

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

Is the voltage greater than 10 V?

Yes	No
EXIT the output state control. GO to **HC6**.	REPAIR the open circuit.

HC6 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.
- Key ON, engine OFF.
- Access the PCM and control the FP PID.
- Run the fuel pump to obtain maximum fuel pressure.
- Command the fuel pump off.
- Allow the fuel pressure to stabilize.
- Monitor the fuel pressure for 1 minute.

Does the fuel pressure remain greater than 275 kPa (40 psi) after 1 minute?

Yes	No
GO to **HC8**.	GO to **HC7**.

HC7 CHECK FUEL INJECTOR FLOW AND LEAKAGE

NOTE: Observe the warnings, cautions, and notes at the beginning of this pinpoint test.

- Check the fuel injectors for leakage and flow rate using the injector flow tester.

Are test results satisfactory?

Yes	No
GO to **HC8**.	INSTALL a new fuel injector as necessary.

HC8 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

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comparison, the engine must be off.

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

- Key in OFF position.
- Relieve the fuel pressure. Refer to **FUEL SYSTEM-GENERAL INFORMATION** for the Fuel System Pressure Release procedure.
- Disable the fuel pump.
- Key ON, engine OFF.
- Monitor the mechanical gauge.
- Access the PCM and monitor the FRP PID.
- Compare the FRP PID value to the mechanical gauge.
- Key in OFF position.
- Pressurize the fuel system. Refer to **FUEL SYSTEM-GENERAL INFORMATION** for the Fuel System Pressure Release procedure.
- Key ON, engine running.
- Allow the fuel pressure to stabilize.
- Key in OFF position.
- Key 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	No
GO to **HC9**.	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of this pinpoint test.

HC9 CHECK THE FUEL SUPPLY LINE FOR RESTRICTION

NOTE: Observe the warnings, cautions, and notes at the beginning of this pinpoint test.

- 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	No
INSTALL a new FP module.	REPAIR the cause of the restriction.

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PINPOINT TEST HD: MISFIRE DETECTION MONITOR

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

Important Safety Notice

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This article provides general directions for repairing vehicles with tested, effective techniques. Following them will help ensure reliability. There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles, as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

This pinpoint test is intended to diagnose the misfire detection monitor.

Fig. 55: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

HD1 DTCS P0300, P0301, P0302, P0303, P0304, P0315 AND P0316: CHECK FOR SELFTEST DTCS

Are any of the following DTCs present during PCM or TCM self-test: P0300, P0301, P0302, P0303, P0304, P0315, or P0316?

Yes	No

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For KOER and continuous memory DTCs P0300, P0301, P0302, P0303, P0304 and P0316, GO to **HD2**.	Unable to duplicate or identify the fault at this time.
For continuous memory DTC P0315, GO to **HD24**.	The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

HD2 CHECK FOR ADAPTIVE FUEL MONITOR AND HEGO MONITOR DTCS (CONTINUOUS MEMORY)

- Check the PCM for continuous memory DTCs.

Are DTCs P0171, P0172, P2270 or P2271 present?

Yes	No
GO to **HD4**.	GO to **HD3**.

HD3 CHECK FOR OTHER NON-MISFIRE CONTINUOUS MEMORY DTCS

Are there any non-misfire continuous memory DTCs present?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **HD4**.

HD4 CHECK FOR ANY OTHER KOEO SELF-TEST DTCS

Are any other KOEO DTCs present?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **HD5**.

HD5 CHECK FOR ANY OTHER KOER DTCS

Are any other KOER DTCs present?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **HD6**.

HD6 CHECK THE INJECTOR DRIVER PIDS INJ1F THROUGH INJ4F

- Key ON, engine OFF.

- Access the PCM and monitor the INJ1F, INJ2F, INJ3F and INJ4F PIDs.

Do any injector faults PID indicate YES?

Yes	No
GO to **HD8**.	GO to **HD7**.

HD7 CHECK THE SECONDARY IGNITION SYSTEM

- GO to Pinpoint Test **JB** and follow the pinpoint test direction.

Is a fault indicated?

Yes	No
FOLLOW the pinpoint test direction. REPAIR as necessary.	GO to **HD9**.

HD8 CHECK THE FUEL INJECTORS AND HARNESS FOR AN OPEN

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

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VPWR - Pin B35, B36	Suspect INJ

Is the resistance between 11 ohms - 18 ohms?

Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	GO to **KG2**.

HD9 CHECK THE FUEL PRESSURE

WARNING: THE FUEL SYSTEM REMAINS PRESSURIZED WHEN THE ENGINE IS NOT RUNNING. TO PREVENT INJURY OR FIRE, USE CAUTION WHEN WORKING ON THE FUEL SYSTEM.
REFER TO THE FUEL SYSTEM WARNING INFORMATION AT THE BEGINNING OF PINPOINT TEST HC.

- Key in OFF position.
- Relieve the fuel pressure.
- Mechanical fuel pressure gauge connected.
- Start the engine using the engine running diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Record the fuel pressure gauge reading.

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- Increase the engine speed to a minimum of 2,000 RPM and maintain for 2 minutes.
- Record the fuel pressure gauge reading.

Is the fuel pressure between 275 kPa (40 psi) - 485 kPa (70 psi) ?

Yes	No
Key in OFF position. GO to **HD10**.	Key in OFF position. GO to **HC4**.

HD10 CHECK THE FUEL PRESSURE LEAKDOWN

- Mechanical fuel pressure gauge connected.
- Key ON, engine OFF.
- Access the PCM and control the FP PID.
- Run the fuel pump to obtain maximum fuel pressure.
- Verify the fuel pressure remains within 34 kPa (5 psi) of the maximum pressure for 1 minute after turning the pump off.

Does the fuel pressure remain within 34 kPa (5 psi) of the highest reading after 1 minute?

Yes	No
GO to **HD11**.	REPAIR as necessary. REFER to **FUEL SYSTEM-GENERAL INFORMATION** to determine which area within the fuel system is at fault.

HD11 CHECK THE FUEL INJECTORS ABILITY TO DELIVER FUEL

NOTE: The fuel delivery system is not likely to have caused the misfire DTC if the flow test is within specification.

Refer to the fuel system WARNING information at the beginning of Pinpoint Test HC.

- Verify the flow rate for each injector is within specification. Use the injector flow tester.

Is the flow rate for each injector within specification?

Yes	No
GO to **HD12**.	INSTALL a new fuel injector.

HD12 CHECK THE VACUUM SYSTEM

NOTE: Some vacuum leaks can be heard.

- Visually inspect the vacuum hoses for signs of damage or deterioration. A collapsed vacuum hose may cause a blockage to one of the various actuators or sensors. If a blockage is found remove the

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blockage or install new parts as necessary.

Is the vehicle vacuum system OK?

Yes	No
GO to **HD13**.	REPAIR as necessary.

HD13 CHECK THE CRANKSHAFT PULLEY

- Observe the crankshaft pulley for wobble.
- Examine the pulse wheel on the crankshaft pulley.

Does the crankshaft pulley wobble or is the pulse wheel damaged?

Yes	No
INSTALL a new crankshaft pulley.	GO to **HD14**.

HD14 CHECK THE EVAPORATIVE EMISSION SYSTEM

NOTE: The misfire monitor can be influenced by the evaporative emission system. The next 5 pinpoint test steps diagnose the evaporative emission system.

- Check the EVAP canister for fuel saturation.

Is there an excess amount of liquid fuel present in the canister?

Yes	No
INSTALL a new EVAP canister.	GO to **HD15**.

HD15 PRESSURE TEST THE EVAPORATIVE EMISSION SYSTEM

- Install the Rotunda Evaporative Emission System Tester, or equivalent, at the EVAP test port, then at the fuel filler cap.
- Follow the test instructions from the tester kit.

Is the evaporative emission system holding pressure?

Yes	No
GO to **HD16**.	REPAIR as necessary.

HD16 CHECK FOR VACUUM IN THE EVAPORATIVE EMISSION SYSTEM

- Check the vacuum system between the engine vacuum port and the EVAP canister.
- Check the EVAP system lines/hoses (check for proper connections, damage or blockage).
- Check for blockage in the fuel tank vent system.

Is there a fault indicated?

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Yes	No
INSTALL a new vacuum hose, or REMOVE the blockage/restrictions.	GO to **HD17**.

HD17 CHECK THE EVAP CANISTER PURGE VALVE HOUSING FOR LEAKS

NOTE: The EVAP canister purge valve is electrically connected.

- Install a hand vacuum pump to the fuel vapor port from the EVAP canister on the EVAP canister purge vacuum valve at the line.
- Apply 53 kPa (16 in-Hg) of vacuum with the vacuum pump.

Does the EVAP canister purge valve hold vacuum at room temperature?

Yes	No
GO to **HD18**.	REMOVE the vacuum pump. INSTALL a new EVAP canister purge valve.

HD18 CHECK FOR FILTER CONTAMINATION ON THE EVAP CANISTER PURGE VALVE

- Remove the vacuum line from the input vacuum port to the intake manifold on the EVAP canister purge valve (the control vacuum solenoid part of the valve).
- Install a hand vacuum to the open vacuum port on the EVAP canister purge valve.
- Apply 48 - 52 kPa (14 - 15 in-Hg) of vacuum to the canister purge valve.

Does the EVAP canister purge valve hold vacuum, or is the valve very slow to release vacuum to the atmosphere?

Yes	No
REPAIR the EVAP canister purge valve filter. If unable to clean the filter or remove blockage to the filter, INSTALL a new EVAP canister purge valve.	GO to **HD19**.

HD19 CHECK FOR BASE ENGINE CONCERNS

NOTE: This step determines if there are any base engine concerns that may have caused the Misfire DTC or drive concern.

NOTE: The engine temperature may affect the results.

- Carry out the following tests in order to evaluate base engine integrity:
  - Carry out the engine compression and cylinder leakage detection tests. Refer to **ENGINE SYSTEM-GENERAL INFORMATION** .
  - Carry out valve train analysis. Refer to **ENGINE SYSTEM-GENERAL INFORMATION** .

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- Check the oil consumption. Refer to **ENGINE SYSTEM-GENERAL INFORMATION** .
- Check possible leakage points. Refer to **ENGINE SYSTEM-GENERAL INFORMATION** .

Is any repair required?

Yes	No
REPAIR as necessary. REFER to **ENGINE SYSTEM-GENERAL INFORMATION** .	GO to Pinpoint Test **Z**. If unable to identify the fault in Pinpoint Test Z, GO to **HD20**.

HD20 CHECK Z1 TO IDENTIFY A FAULT

Did Pinpoint Test Z find a fault?

Yes	No
REPAIR as necessary.	GO to **HD21**.

HD21 CHECK FOR ADDITIONAL MISFIRE DTCS

NOTE: Diagnostic trouble code P0300 indicates multiple cylinders are misfiring or the PCM cannot identify which cylinder is misfiring.

Are any other misfire DTCs present?

Yes	No
GO to **HD2**.	GO to **HD22**.

HD22 CHECK FOR OTHER NON-MISFIRE CONTINUOUS MEMORY DTCS

Are other continuous memory DTCs present?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **HD23**.

HD23 CHECK THE CMP SENSOR OUTPUT

- Key in OFF position.
- PCM connector connected.
- CMP Sensor connector disconnected.
- Crank the engine using the engine cranking diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Digital multimeter on low voltage AC scale.
- Measure the voltage between:

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(+) CMP Sensor Connector, Component Side	(-) CMP Sensor Connector, Component Side
CMP	SIGRTN

Is the voltage greater than 0.25 V?

Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	INSTALL a new CMP sensor.

HD24 CHECK THE PHYSICAL CONDITION OF THE CRANKSHAFT PULSE WHEEL

NOTE: DTC P0315 is set when the PCM is unable to learn and correct for the mechanical variations in the crankshaft pulse wheel tooth spacing (the allowable correction tolerances are exceeded).

- Inspect the pulse wheel on the crankshaft pulley for damaged teeth.
- Inspect the crankshaft pulley for wobble.
- Check the CKP sensor for damage.

Are the CKP sensor and crankshaft pulley OK?

Yes	No
INSPECT the crankshaft pulse wheel. REFER to **ENGINE SYSTEM-GENERAL INFORMATION** to check for correct crankshaft position (CKP) sensor installation.	REPAIR as necessary. GO to Pinpoint Test **Z**.

PINPOINT TEST HF: CATALYST EFFICIENCY MONITOR AND EXHAUST SYSTEMS

INTRODUCTION

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DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE

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CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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This pinpoint test is intended to diagnose the following:

- Catalytic converter.
- Exhaust system.

Catalyst Efficiency Monitor Overview

The catalyst efficiency monitor uses precatalyst and post catalyst heated oxygen sensors (HO2S) to infer the hydrocarbon (HC) efficiency based on the oxygen storage capacity of the catalyst. Under normal, closed-loop fuel conditions, high efficiency catalysts have significant oxygen storage. This makes the switching frequency of the post catalyst HO2S (B) very slow and reduces the amplitude of those switches as compared to the switching frequency and amplitude of the precatalyst HO2S (A). As catalyst efficiency deteriorates due to thermal and chemical deterioration, its ability to store oxygen declines. The post catalyst HO2S (B) signal begins to switch more rapidly with increasing amplitude, approaching the switching frequency and amplitude of the precatalyst HO2S (A).

For additional information on the catalyst efficiency monitor and exhaust systems, refer to **CATALYST AND EXHAUST SYSTEMS** .

Fig. 56: Identifying High Catalyst Efficiency
Courtesy of FORD MOTOR CO.

Fig. 57: Identifying Low Efficiency Catalyst
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

HF1 DTC P0420: CHECK FOR MISFIRE DETECTION MONITOR DTCS

NOTE: Be sure the customer has not:

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- **Fueled the vehicle with leaded gasoline.**
- **Noticed a high vehicle oil consumption. (An engine that consumes oil at a high rate deposits high levels of phosphorus on the catalyst and reduces the catalyst efficiency).**

NOTE: Internal deterioration of a catalytic converter is usually caused by abnormal engine operation upstream of the catalyst. Events that can produce higher than normal temperatures in the catalyst are particularly suspect. For example, misfiring can cause higher than normal catalyst operating temperatures.

- Check for self-test DTCs.

Are DTCs P0300, P0301, P0302, P0303 or P0304 present?

Yes	No
DISREGARD the DTC P0420 at this time. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** and REPAIR misfire DTCs.	GO to **HF2**.

HF2 CHECK FOR HO2S DTCS

NOTE: Incorrect HO2S signal input can cause an abnormal temperature in the catalyst.

- Check for self-test DTCs.
- If DTCs P0053, P0054, P0132, P0133, P0135, P0138, P0141, P1127, P2195, P2196, P2270 or P2271 are present, diagnose those DTCs first.

Are there any HO2S DTCs?

Yes	No
DISREGARD the DTC P0420 at this time. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** and REPAIR HO2S DTCs.	GO to **HF3**.

HF3 CHECK FOR CHT SENSOR DTCS

NOTE: Temperature sensor DTCs can indicate the thermostat is not operating correctly or the engine coolant level is not filled to specification, producing above normal operation temperatures.

- Check for self-test DTCs.

Are DTCs P0128, P1285, P1288, P1289, P1290 or P1299 present?

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Yes	No
DISREGARD the DTC P0420 at this time. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** and REPAIR CHT DTCs.	GO to **HF4**.

HF4 CHECK FOR FRP SENSOR DTCS

WARNING: THE FUEL SYSTEM REMAINS PRESSURIZED WHEN THE ENGINE IS NOT RUNNING. TO PREVENT INJURY OR FIRE, USE CAUTION WHEN WORKING ON THE FUEL SYSTEM.

NOTE: Fuel pressure above specification can produce an abnormally rich air/fuel mixture. This rich air/fuel mixture can cause higher than normal catalyst operating temperatures.

- Check for self-test DTCs.

Are DTCs P0190, P0191, P0192 or P0193 present?

Yes	No
DISREGARD the DTC P0420 at this time. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** and REPAIR FRP DTCs.	GO to **HF5**.

HF5 CHECK FOR ANY OTHER DTCS

Are there any other DTCs recorded in HF1 (not including the initial P0420)?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **HF6**.

HF6 CHECK FOR LEAKS IN THE EXHAUST SYSTEM

NOTE: If a catalyst is in series with a leaking exhaust system, it can fail the Catalyst Efficiency Monitor test.

- Inspect the exhaust system for leaks, cracks, loose connections, punctures, or non-factory modifications.

Are any concerns present?

Yes	No
REPAIR as necessary.	GO to **HF7**.

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HF7 CHECK FOR RESTRICTIONS IN THE EXHAUST SYSTEM

NOTE: A slight pressure in the exhaust system is normal, but excessive exhaust back pressure seriously affects engine operation.

- Inspect the following for damage or restrictions:
  - Front and rear exhaust pipes.
  - Catalytic converter.
  - Muffler and tailpipe assembly.

Are any concerns present?

Yes	No
REPAIR as necessary.	GO to **HF8**.

HF8 CHECK THE HO2S ACTIVITY

- Access the freeze frame data (if available) and record the DTC malfunction conditions.
- Clear the PCM DTCs.
- Access the PCM and monitor the O2S11 and O2S12 PIDs.
- Observe the sensor waveform using a diagnostic tool. If waveform mode is not available on the diagnostic tool, use an oscilloscope.
- Start the engine and warm it until engine temperature is stable.
- Test drive using the freeze frame data conditions.
- If the freeze frame data is not available, drive at 64 - 80 km/h (40 - 50 mph) for 5 minutes.
- Observe sensor operation and the waveform of each sensor. Refer to **CATALYST EFFICIENCY MONITOR** for monitor operation.

Does the catalyst monitor sensor O2S12 oscillate/switch at the same rate as O2S11?

Yes	No
INSTALL a new catalyst between the monitored HO2Ss (O2S11 and O2S12). CARRY OUT the catalyst monitor drive cycle and VERIFY the repairs. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .	GO to **HF9**.

HF9 CARRY OUT THE CATALYST MONITOR DRIVE CYCLE

- Carry out the catalyst monitor drive cycle. Refer to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .
- Carry out the self-test.

Is DTC P0420 present?

Yes	No

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GO to **HF10**.	Test is complete and no faults were found.

HF10 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HG: POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

Important Safety Notice

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This pinpoint test is intended to diagnose the following:

- Positive crankcase ventilation (PCV) valve (6A666).
- PCV system related vacuum lines.

TEST PROCEDURE

HG1 VISUAL INSPECTION OF THE PCV VALVE

- Check the PCV valve, hoses and connections for leaks or restrictions.
- Verify the proper PCV valve part number.
- Verify the PCV valve is clean.
- Verify the fresh air tube and related hoses are clean and routed correctly.

Are there any concerns found during the visual inspection?

Yes	No
REPAIR as necessary.	GO to **HG2**.

HG2 STUCK PCV VALVE CHECK

- Disconnect the PCV valve from the valve cover.
- Shake the PCV valve.

Does the PCV valve rattle when shaken?

Yes	No
GO to **HG3**.	INSTALL a new PCV valve.

HG3 PCV SYSTEM CHECK

- Install the PCV valve.
- Start the engine and warm it until engine temperature is stable.
- Disconnect the closure (fresh air) hose from the remote air cleaner or air outlet tube (the tube connecting the mass air flow sensor and the throttle body).
- Place a stiff piece of paper over the hose end. Wait 1 minute.

Does vacuum hold the paper in place?

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Yes	No
The PCV system is OK. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.	CHECK for vacuum leaks/obstruction in the PCV system (such as oil cap, PCV valve, hoses, cut grommets, valve cover bolt torque/gasket leak). REPAIR as necessary.

PINPOINT TEST HH: DC/DC CONVERTER

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
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This pinpoint test is intended to diagnose the following:

- Harness circuits: DC/DC enable (DCE) and DC/DC fault (DCF).
- DC/DC converter (14B227).
- Powertrain control module (PCM) (12A650).

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Fig. 58: Identifying DC/DC Converter-A (DDC-A) Connector
Courtesy of FORD MOTOR CO.

Fig. 59: Identifying DC/DC Converter-High Voltage (DDC-HV) Connector
Courtesy of FORD MOTOR CO.

Fig. 60: Identifying Transaxle Assembly-DC/DC High Voltage (DDHV) Connector
Courtesy of FORD MOTOR CO.

Fig. 61: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

HH1 DTCS P0A08, P0A10, P0A11, P0A12 AND P0A13: CHECK FOR SELF-TEST DTCS

NOTE: **Repair any DTCs related to the MECT or contactors before entering this pinpoint test.**

NOTE: **The 12-volt battery must be sufficiently charged for DC/DC diagnostics.**

NOTE: **The traction battery (TB) must be at a minimum of 35% state of charge for the PCM to activate the DCE circuit with the KOER position.**

Are any of the following DTCs present during PCM or TCM self-test: P0A08, P0A10, P0A11, P0A12, P0A13?

Yes	No
For KOEO and KOER DTC P0A08, GO to **HH2**. For KOEO and KOER DTC P0A10, GO to **HH17**. For KOEO and KOER DTCs P0A11, P0A12 and P0A13, GO to **HH11**. For continuous memory DTCs P0A08, P0A10, P0A11, P0A12 and P0A13, GO to **HH23**.	Unable to duplicate or identify the fault at this time. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

HH2 KOEO AND KOER DTC P0A08: CHECK IF THE VEHICLE ENGINE STARTS

Does the engine start?

Yes	No
GO to **HH5**.	GO to **HH3**.

HH3 CHECK THE HIGH VOLTAGE BATTERY CONTACTOR STATUS

- Key ON, engine OFF.
- Access the TCM and monitor the CONTACT PID.

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Does the PID indicate the contactors are closed?

Yes	No
GO to **HH4**.	Key in OFF position. Unable to close the traction battery contactors. REFER to **HIGH VOLTAGE TRACTION BATTERY** .

HH4 CHECK THE TRANSAXLE ASSEMBLY HIGH VOLTAGE

- Access the TCM and monitor the HVBAT_V PID.

Is the voltage between 216 V - 400 V?

Yes	No
GO to **HH5**.	Key in OFF position. DIAGNOSE the high voltage supply concern. GO to **TT8**.

HH5 VERIFY THE MOTOR ELECTRONICS COOLANT TEMP (MECT)

NOTE: High MECT limits DC/DC converter performance.

- Access the PCM and monitor the MECT_V PID.
- Reference the voltage transfer function table in Pinpoint Test DN.

Is the temperature less than 65°C (149°F)?

Yes	No
Key in OFF position. GO to **HH6**.	Key in OFF position. DIAGNOSE the MECT sensor concern. GO to **DN2**.

HH6 VERIFY THE LOW VOLTAGE BATTERY CONNECTIONS ON THE DC/DC CONVERTER

- Check the low voltage battery connections on the DC to DC converter for corrosion and the proper connection.
- Measure the voltage at the DC/DC converter low voltage battery connections.

Does the voltage read +/- 0.1 volt of 12-volt battery voltage?

Yes	No
GO to **HH7**.	REPAIR as necessary.

HH7 CHECK THE HIGH VOLTAGE POSITIVE CABLE FOR AN OPEN

- Key in OFF position.

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- Transaxle Assembly-DDHV connector disconnected.
- DDC-HV connector disconnected.
- Measure the resistance between:

(+) Transaxle Assembly-DDHV Connector, Harness Side	**(-) DDC-HV Connector, Harness Side**
HVP - Pin (+)	HVP - Pin (+)

Is the resistance less than 5 ohms?

Yes	No
GO to **HH8**.	INSTALL a new high voltage cable from the transaxle assembly to the DC/DC converter.

HH8 CHECK THE HIGH VOLTAGE NEGATIVE CABLE FOR AN OPEN

- Measure the resistance between:

(+) Transaxle Assembly-DDHV Connector, Harness Side	**(-) DDC-HV Connector, Harness Side**
HVN - Pin (-)	HVN - Pin (-)

Is the resistance less than 5 ohms?

Yes	No
GO to **HH9**.	INSTALL a new high voltage cable from the transaxle assembly to the DC/DC converter.

HH9 CHECK FOR THE DC TO DC CONVERTER OVERCHARGING THE LOW VOLTAGE BATTERY

NOTE: Disconnecting the DCE circuit activates the DC to DC converter with the key in the ON position.

- DDC-HV connector connected.
- Transaxle Assembly-DDHV connector connected.
- Key ON, engine OFF.
- DDC-A connector disconnected.
- Measure the voltage between:

(+) Vehicle Battery	**(-) Vehicle Battery**
Positive terminal	Negative terminal

Is VBAT less than 16 volts when the DC to DC converter is enabled?

Yes	No
Key in OFF position.	

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GO to **HH10**.	INSTALL a new DC/DC converter.

HH10 CHECK FOR DTC P0A11, P0A12, OR P0A13 (DC TO DC ENABLE CIRCUIT FAULTS)

Are DTCs P0A11, P0A12, or P0A13 present?

Yes	No
GO to **HH11**.	GO to **HH18**.

HH11 CHECK THE FUNCTIONALITY OF DC/DC CONVERTER

NOTE: Disconnecting the DCE circuit activates the DC to DC converter with the ignition key in the ON position.

- Key in OFF position.
- DDC-A connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Vehicle Battery	(-) Vehicle Battery
Positive terminal	Negative terminal

- Record the 12-volt battery voltage.
- Key in OFF position.
- Record the 12-volt battery voltage.

Does the 12-volt battery voltage increase when the key is in the ON position?

Yes	No
Key in OFF position. GO to **HH12**.	INSTALL a new DC/DC converter.

HH12 CHECK THE DCE CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) DDC-A Connector, Harness Side	(-) PCM Connector, Harness Side
DCE - 3259 - Pin 1	DCE - Pin T44

Is the resistance less than 5 ohms?

Yes	No
GO to **HH13**.	REPAIR the open circuit.

HH13 CHECK THE DCE CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

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- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
DCE - Pin T44	Negative terminal

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **HH14**.	Key in OFF position. REPAIR the short circuit to PWR.

HH14 CHECK THE DCE CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

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

(+) PCM Connector, Harness Side	(-) Vehicle Battery
DCE - Pin T44	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **HH15**.	REPAIR the short circuit to GND.

HH15 CHECK THE FUNCTIONALITY OF THE DCE CIRCUIT

- Key ON, engine OFF.
- Connect a 5 amp fused jumper wire between the following:

Point A DDC-A Connector, Component Side	Point B Vehicle Battery
DCE - 3259 - Pin 1	Negative terminal

- Measure the voltage between:

(+) Vehicle Battery	(-) Vehicle Battery
Positive terminal	Negative terminal

Does VBAT drop approximately 1 volt when the jumper wire is installed (forcing the DC to DC to disable), and increase approximately 1 volt when the jumper wire is removed (forcing the DC to DC to enable)?

Yes	No
GO to **HH16**.	INSTALL a new DC/DC converter.

HH16 CHECK THE FUNCTIONALITY OF THE PCM DCE CIRCUIT

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- Key in OFF position.
- DDC-A connector connected.
- PCM connector connected.
- Measure the voltage between:

(+) Vehicle Battery	(-) Vehicle Battery
Positive terminal	Negative terminal

- Key ON, engine OFF.
- Access the PCM and control the DCE PID.
- Enable and disable the DCE circuit.

Does VBAT indicate the DC to DC converter is cycling on and off with output state control?

Yes	No
Key in OFF position. CLEAR the DTCs. GO to **HH17**.	Key in OFF position. GO to **HH24**.

HH17 KOEO AND KOER DTC P0A10: CHECK FOR DTC P0A11, P0A12, OR P0A13 (DC TO DC ENABLE CIRCUIT FAULTS)

Are any of the following on-demand DTCs present: P0A11, P0A12, or P0A13 ?

Yes	No
GO to **HH11**.	GO to **HH18**.

HH18 CHECK THE DCF CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- DDC-A connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) DDC-A Connector, Harness Side	(-) PCM Connector, Harness Side
DCF - 3989 - Pin 6	DCF - Pin T34

Is the resistance less than 5 ohms?

Yes	No
GO to **HH19**.	REPAIR the open circuit.

HH19 CHECK THE DCF CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

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(+) PCM Connector, Harness Side	(-) Vehicle Battery
DCF - Pin T34	Negative terminal

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **HH20**.	Key in OFF position. REPAIR the short circuit to PWR.

HH20 CHECK THE DCF CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

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

(+) PCM Connector, Harness Side	(-) Vehicle Battery
DCF - Pin T34	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **HH21**.	REPAIR the short circuit to GND.

HH21 CHECK THE DCF CIRCUIT FOR AN OPEN IN THE PCM

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

(+) PCM Connector, Component Side	(-) PCM Connector, Component Side
VPWR - Pin B35, B36	DCF - Pin T34

Is the resistance between 1K ohms - 2K ohms?

Yes	No
Key in OFF position. GO to **HH22**.	GO to **HH24**.

HH22 CHECK THE DCF CIRCUIT FOR A SHORT TO GND IN THE PCM

- DDC-A connector connected.
- PCM connector connected.
- Disconnect the DCF pin from the DDC-A connector.
- Key ON, engine OFF.
- Measure the voltage between:

(+) DDC-A Connector, Harness Side	(-)
DCF - 3989 - Pin 6	Ground

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Is the voltage less than 10.5 V?

Yes	No
GO to **HH24**.	INSTALL a new DC/DC converter.

HH23 CHECK THE DC TO DC CONVERTER CIRCUITS FOR AN INTERMITTENT CONCERN

NOTE: The continuous memory PCM DTC P0A09 alone indicates the intermittent DC to DC fault (DCF) circuit failure, or the 12 V bus voltage dropped below the calibrated threshold.

- Key ON, engine OFF.
- Access the PCM and monitor the DCE PID.
- Access the PCM and monitor the DCE_F PID.
- Carefully wiggle all accessible wiring and connectors associated with the circuit and look for a change in the PID state.

Does the PID indicate a fault while wiggling the harness or connectors?

Yes	No
Key in OFF position. REPAIR as necessary.	Key in OFF position. Unable to duplicate or identify the fault at this time. Make sure the 12-volt battery is sufficiently charged.

HH24 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HJ: HIGH VOLTAGE INTERLOCK

INTRODUCTION

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WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

WARNING: DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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This pinpoint test is intended to diagnose the following:

- Harness circuit(s): High voltage interlock (HVI) and VPWR to high voltage interlock.
- Front inertia fuel shutoff (IFS) switch (9341)
- Rear inertia fuel shutoff (IFS) switch (9341)
- High voltage cable from the transaxle assembly to the DC/DC converter (14B323)
- High voltage cable from the transaxle assembly to the traction battery (14B322)
- Traction battery (10B759)
- Transaxle assembly (7000)
- DC/DC converter (14B227)

Fig. 62: Identifying Traction Battery-A (TB-A) Connector
Courtesy of FORD MOTOR CO.

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Fig. 63: Identifying Traction Battery-High Voltage (TB-HV) Connector
Courtesy of FORD MOTOR CO.

Fig. 64: Identifying Transaxle Assembly-DC/DC High Voltage (DDHV) Connector
Courtesy of FORD MOTOR CO.

Fig. 65: Identifying Transaxle Assembly-Traction Battery High Voltage (TBHV) Connector
Courtesy of FORD MOTOR CO.

Fig. 66: Identifying DC/DC Converter-High Voltage (DDC-HV) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

HJ1 VISUAL INSPECTION OF THE HIGH VOLTAGE SYSTEM

- Visually inspect all the high voltage cables.
- Make sure all the high voltage connectors are properly and securely connected.
- Examine all the high voltage cables and connectors for damaged, burned, or overheated insulation and loose or broken conditions.
- Verify that the traction battery high voltage service plug is properly connected.
- Make sure the Transaxle Assembly cover is securely closed and was not removed from the vehicle.

Is a concern present?

Yes	No
REPAIR as necessary.	GO to **HJ2**.

HJ2 CHECK THE HVINTLCK PID

- Key ON, engine OFF.
- Access the TCM and monitor the HVINTLCK PID.

Does the PID indicate an open HVINTLCK circuit?

Yes	No
GO to **HJ4**.	GO to **HJ3**.

HJ3 CHECK THE HIGH VOLTAGE INTERLOCK CIRCUIT(S) FOR INTERMITTENT CONCERNS

- Access the TCM and monitor the HVINTLCK PID.
- Carefully wiggle all accessible wiring and connectors associated with the circuit and look for a change in the PID state.

Is a fault indicated during the wiggle test?

Yes	No
Key in OFF position.	Unable to duplicate or identify the concern at this

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REPAIR as necessary.	time. GO to Pinpoint Test **Z**.

HJ4 CHECK THE VPWR VOLTAGE AT THE TRACTION BATTERY HIGH VOLTAGE CONNECTOR

- Key in OFF position.
- TB-HV connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) TB-HV Connector, Component Side	(-)
HVIP - Pin 1	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to **HJ6**.	GO to **HJ5**.

HJ5 CHECK THE VPWR VOLTAGE TO THE HIGH VOLTAGE INTERLOCK CIRCUIT

- Key in OFF position.
- TB-A connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) TB-A Connector, Harness Side	(-) Vehicle Battery
HVIPWR - Pin 14	Negative terminal

Is the voltage greater than 10.5 V?

Yes	No
GO to **HJ14**.	Key in OFF position. High voltage interlock VPWR circuit fault. REPAIR as necessary. CHECK the condition of the traction battery/interlock fuse. If damaged, CHECK the VPWR circuit for a short to ground.

HJ6 CHECK THE CONTINUITY OF THE HIGH VOLTAGE INTERLOCK CIRCUIT

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

(+) TB-HV Connector, Harness Side	(-) TB-HV Connector, Harness Side
HVIN - Pin 2	HVIP - Pin 1

Is the resistance less than 5 ohms?

Yes	No
GO to **HJ7**.	GO to **HJ9**.

HJ7 CHECK THE IFS_PWR INPUT VOLTAGE TO THE TRACTION BATTERY

NOTE: Verify the front and rear IFS switches are not tripped.

- TB-A connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) TB-A Connector, Harness Side	(-) Vehicle Battery
IFS_PWR - Pin 23, 7	Negative terminal

Are the voltages greater than 10.5 volts?

Yes	No
GO to **HJ14**.	GO to **HJ8**.

HJ8 CHECK THE FRONT AND REAR IFS FOR AN OPEN

- Key in OFF position.
- Disconnect the front and rear IFS switches.
- Reset the front and rear inertia switches.
- Measure the resistance across the normally closed contacts of the front and rear IFS switches.

Are the resistances less than 5 ohms?

Yes	No
IFS switch circuit failure. REPAIR as necessary. CHECK the condition of the fuel fuse. If damaged, CHECK the VPWR circuit for a short to ground.	INSTALL a new IFS switch as necessary.

HJ9 CHECK THE HIGH VOLTAGE INTERLOCK CIRCUIT FOR AN OPEN IN THE DDC

- DDC-HV connector disconnected.
- Measure the resistance between:

(+) DDC-HV Connector, Component Side	(-) DDC-HV Connector, Component Side
HVIP - Pin 2	HVIN - Pin 1

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Is the resistance less than 5 ohms?

Yes	No
GO to **HJ10**.	INSTALL a new DC/DC converter.

HJ10 CHECK THE CONTINUITY OF THE HIGH VOLTAGE INTERLOCK CIRCUIT

- Transaxle Assembly-DDHV connector disconnected.
- Measure the resistance between:

(+) DDC-HV Connector, Harness Side	(-) Transaxle Assembly-DDHV Connector, Harness Side
HVIP - Pin 2	HVIP - Pin 2
HVIN - Pin 1	HVIN - Pin 1

Are the resistances less than 5 ohms?

Yes	No
GO to **HJ11**.	INSTALL a new high voltage cable from the transaxle assembly to the DC/DC converter.

HJ11 CHECK THE HIGH VOLTAGE INTERLOCK CIRCUIT FOR AN OPEN IN THE TRANSAXLE ASSEMBLY

- Transaxle Assembly-TBHV connector disconnected.
- Measure the resistance between:

(+) Transaxle Assembly-TBHV Connector, Component Side	(-) Transaxle Assembly-DDHV Connector, Component Side
HVIP - Pin 1	HVIP - Pin 2
HVIN - Pin 2	HVIN - Pin 1

Are the resistances less than 5 ohms?

Yes	No
GO to **HJ12**.	INSTALL a new transaxle assembly.

HJ12 CHECK THE CONTINUITY OF THE HIGH VOLTAGE INTERLOCK CIRCUIT

- Measure the resistance between:

(+) Transaxle Assembly-TBHV Connector, Harness Side	(-) TB-HV Connector, Harness Side
HVIP - Pin 1	HVIP - Pin 1
HVIN - Pin 2	HVIN - Pin 2

Are the resistances less than 5 ohms?

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Yes	No
GO to **HJ13**.	INSTALL a new high voltage cable from the transaxle assembly to the traction battery.

HJ13 CHECK FOR CORRECT TRANSAXLE ASSEMBLY OPERATION

- Key in OFF position.
- Disconnect all the high voltage connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the high voltage connectors and make sure they seat correctly.
- TB-A connector connected.
- Carry out the TCM and TBCM self-test and verify the concern is still present.

Is the concern still present?

Yes	No
INSTALL a new transaxle assembly.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

HJ14 CHECK FOR CORRECT TRACTION BATTERY OPERATION

- Key in OFF position.
- Disconnect all the high voltage connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the high voltage connectors and make sure they seat correctly.
- TB-A connector connected.
- Carry out the TCM and TBCM self-test and verify the concern is still present.

Is the concern still present?

Yes	No
INSTALL a new traction battery.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HU: INTAKE AIR SYSTEM

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES,

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COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

WARNING: DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

Important Safety Notice

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This article provides general directions for repairing vehicles with tested, effective techniques. Following them will help ensure reliability. There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles, as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

This pinpoint test is intended to diagnose the following:

- Air cleaner assembly (including air cleaner element).
- Air inlet tube.
- Clean air tube hose and resonator (9F763).
- Intake manifold runner control (IMRC) sensor (9L492).
- Intake manifold runner control (IMRC) actuator (9J995).
- Harness circuits: IMRC, IMRCM, SIGRTN, PWRGND, VREF, and VPWR.
- Powertrain control module (PCM) (12A650).

Fig. 67: Identifying Intake Manifold Runner Control (IMRC) Actuator Connector
Courtesy of FORD MOTOR CO.

Fig. 68: Identifying Intake Manifold Runner Control Monitor (IMRCM) Sensor Connector
Courtesy of FORD MOTOR CO.

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Fig. 69: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

HU1 DTCS P2004, P2006, P2008 AND P2279: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during the PCM self-test: P2004, P2006, P2008, or P2279?

Yes	No
For DTCs P2004, P2006 or P2008, GO to **HU5**. For DTC P2279, GO to **HU2**.	GO to **HU2**.

HU2 CHECK THE INTAKE AIR SYSTEM FOR LEAKS, OBSTRUCTIONS AND DAMAGE

- Remove the air cleaner element. Check the air cleaner for restrictions.
- Check for restrictions between the air inlet and the throttle body.

Are any restriction concerns present?

Yes	No
REMOVE the restriction. INSTALL a new air cleaner element.	INSTALL the air cleaner element. GO to **HU3**.

HU3 CHECK FOR VACUUM LEAKS

- Listen for vacuum leaks from the following:
  - cracked or punctured inlet air tube.
  - loose connections on the inlet air tube at the air cleaner housing or throttle body.
  - intake manifold assembly or gasket.
  - vacuum supply connectors and hose.

Are any concerns present?

Yes	No
Key in OFF position. REPAIR as necessary.	GO to **HU4**.

HU4 CHECK THE THROTTLE BODY FOR EXCESSIVE WEAR

- Key in OFF position.
- Remove the throttle body assembly. Refer to **FUEL CHARGING & CONTROLS - HYBRID** .
- Inspect the throttle body for:
  - excessive wear or grooving in the throttle bore.
  - misaligned or worn throttle plate.
  - excessive gap between the throttle bore and plate.

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Are any concerns present?

Yes	No
INSTALL a new throttle body assembly.	The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

HU5 DTCS P2004, P2006 AND P2008: VISUAL INSPECTION

- Visually inspect the IMRC linkage for binding or obstructions. Check the IMRC lever/linkage for movement. There may be some tension in one direction but there should be full travel.
- Manually open and close the IMRC plates at the intake manifold and check for sticking or binding.

Are any concerns present?

Yes	No
GO to **HU6**.	GO to **HU7**.

HU6 CHECK THE IMRC FOR MECHANICAL OPERATION

NOTE: The IMRC return spring is strong - approximately 0.34 to 0.45 Nm (3 to 4 in-lb).

- Disconnect the IMRC linkage from the manifold.
- Rotate the IMRC plate lever fully open and fully closed, contacting both limits.
- Check for sticking or binding during rotation.

Are any concerns present?

Yes	No
REPAIR as necessary.	INSTALL a new IMRC actuator.

HU7 CHECK THE VACUUM HOSES RELATED TO THE IMRC SYSTEM

- Inspect the vacuum hose between the engine intake manifold and the IMRC actuator.
- Inspect the vacuum hose between the IMRC actuator and the IMRC linkage.

Are any concerns present?

Yes	No
REPAIR as necessary.	GO to **HU8**.

HU8 VERIFY NORMAL OPERATION OF THE IMRC SYSTEM

- Key in OFF position.
- IMRC Actuator connector disconnected.
- Connect a non-powered test lamp between:

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(+) IMRC Actuator Connector, Harness Side	(-) IMRC Actuator Connector, Harness Side
VPWR - Pin 1	IMRC - Pin 2

- Key ON, engine OFF.

Does the test lamp illuminate with the key in the ON position?

Yes	No
GO to **HU17**.	GO to **HU9**.

HU9 CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the voltage between:

(+) IMRC Actuator Connector, Harness Side	(-)
VPWR - Pin 1	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to **HU10**.	REPAIR the open circuit.

HU10 CHECK FOR AN INTERMITTENT OPEN IN THE VPWR CIRCUIT

- Key ON, engine OFF.
- Measure the voltage between:

(+) IMRC Actuator Connector, Harness Side	(-)
VPWR - Pin 1	Ground

- While observing the DMM shake, wiggle, and bend the VPWR circuit. Note that voltage will suddenly change when the fault is detected.

Is a concern present?

Yes	No
REPAIR as necessary.	GO to **HU11**.

HU11 CHECK THE IMRC CIRCUIT FOR AN OPEN IN THE HARNESS

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

(+) IMRC Actuator Connector, Harness Side	(-) PCM Connector, Harness Side
IMRC - Pin 2	IMRC - Pin E28

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Is the resistance less than 5 ohms?

Yes	No
GO to **HU12**.	REPAIR the open circuit.

HU12 CHECK FOR AN INTERMITTENT OPEN IN THE IMRC CIRCUIT

- Measure the resistance between:

(+) IMRC Actuator Connector, Harness Side	(-) PCM Connector, Harness Side
IMRC - Pin 2	IMRC - Pin E28

- While observing the DMM shake, wiggle, and bend the IMRC circuit. Note that resistance will suddenly change when the fault is detected.

Is a concern present?

Yes	No
REPAIR as necessary.	GO to **HU13**.

HU13 CHECK THE IMRC CIRCUIT FOR A SHORT TO PWR IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) IMRC Actuator Connector, Harness Side	(-)
IMRC - Pin 2	Ground

Is any voltage present?

Yes	No
Key in OFF position. REPAIR the short circuit to PWR.	GO to **HU14**.

HU14 CHECK FOR AN INTERMITTENT SHORT TO PWR IN THE IMRC CIRCUIT

- Key ON, engine OFF.
- Measure the voltage between:

(+) IMRC Actuator Connector, Harness Side	(-)
IMRC - Pin 2	Ground

- While observing the DMM shake, wiggle, and bend the IMRC circuit. Note that voltage will suddenly change when the fault is detected.

Is a concern present?

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Yes	No
Key in OFF position. REPAIR as necessary.	GO to **HU15**.

HU15 CHECK THE IMRC DRIVER CIRCUIT FOR A SHORT TO THE IMRCM CIRCUIT

- Key in OFF position.
- IMRCM Sensor connector disconnected.
- Measure the resistance between:

(+) IMRC Actuator Connector, Harness Side	(-) IMRCM Sensor Connector, Harness Side
IMRC - Pin 2	IMRCM - Pin 1

Is the resistance greater than 10K ohms?

Yes	No
GO to **HU16**.	REPAIR the short circuit.

HU16 CHECK THE IMRC DRIVER CIRCUIT FOR AN INTERMITTENT SHORT TO THE IMRCM CIRCUIT

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

(+) IMRC Actuator Connector, Harness Side	(-) IMRCM Sensor Connector, Harness Side
IMRC - Pin 2	IMRCM - Pin 1

- While observing the DMM shake, wiggle, and bend the IMRC and IMRCM circuits. Note that resistance will suddenly change when the fault is detected.

Is a concern present?

Yes	No
REPAIR as necessary.	GO to **HU30**.

HU17 CHECK THE IMRC ACTUATOR RESISTANCE

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

(+) IMRC Actuator Connector, Component Side	(-) IMRC Actuator Connector, Component Side
IMRC - Pin 2	VPWR - Pin 1

Is the resistance between 32 ohms - 40 ohms?

Yes	No

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GO to **HU18**.	INSTALL a new IMRC actuator.

HU18 CHECK THE IMRC CIRCUIT FOR A SHORT TO GROUND

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

(+) IMRC Actuator Connector, Harness Side	(-)
IMRC - Pin 2	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to **HU19**.	REPAIR the short circuit to GND.

HU19 CHECK FOR AN INTERMITTENT SHORT TO GROUND IN THE IMRC CIRCUIT

- Measure the resistance between:

(+) IMRC Actuator Connector, Harness Side	(-)
IMRC - Pin 2	Ground

- While observing the DMM shake, wiggle, and bend the IMRC circuit. Note that resistance will suddenly change when the fault is detected.

Is a concern present?

Yes	No
REPAIR as necessary.	GO to **HU20**.

HU20 CHECK THE VREF VOLTAGE TO THE IMRCM SENSOR

- IMRCM Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) IMRCM Sensor Connector, Harness Side	(-) IMRCM Sensor Connector, Harness Side
SIGRTN - Pin 2	VREF - Pin 3

Is the voltage between 4.5 V - 5.5 V?

Yes	No
GO to **HU21**.	Key in OFF position. GO to Pinpoint Test **C**.

HU21 CHECK THE IMRCM CIRCUIT FOR AN OPEN IN THE HARNESS

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

(+) IMRCM Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IMRCM - Pin 1	IMRCM - Pin E29

Is the resistance less than 5 ohms?

Yes	No
GO to **HU22**.	REPAIR the open circuit.

HU22 CHECK FOR AN INTERMITTENT OPEN IN THE IMRCM CIRCUIT

- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IMRCM - Pin 1	IMRCM - Pin E29

- While observing the DMM shake, wiggle, and bend the IMRCM circuit. Note that resistance will suddenly change when the fault is detected.

Is a concern present?

Yes	No
REPAIR as necessary.	GO to **HU23**.

HU23 CHECK THE IMRCM CIRCUIT FOR A SHORT TO PWR IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) IMRCM Sensor Connector, Harness Side	(-)
IMRCM - Pin 1	Ground

Is any voltage present?

Yes	No
Key in OFF position. REPAIR the short circuit to PWR.	GO to **HU24**.

HU24 CHECK FOR AN INTERMITTENT SHORT TO POWER IN THE IMRCM CIRCUIT

- Key ON, engine OFF.
- Measure the voltage between:

(+) IMRCM Sensor Connector, Harness Side	(-)

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IMRCM - Pin 1	Ground

- While observing the DMM shake, wiggle, and bend the IMRCM circuit. Note that voltage will suddenly change when the fault is detected.

Is a concern present?

Yes	No
Key in OFF position. REPAIR as necessary.	GO to **HU25**.

HU25 CHECK THE IMRCM CIRCUIT FOR A SHORT TO GROUND

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

(+) IMRCM Sensor Connector, Harness Side	(-)
IMRCM - Pin 1	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to **HU26**.	REPAIR the short circuit to GND.

HU26 CHECK FOR AN INTERMITTENT SHORT TO GROUND IN THE IMRCM CIRCUIT

- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-)
IMRCM - Pin 1	Ground

- While observing the DMM shake, wiggle, and bend the IMRCM circuit. Note that resistance will suddenly change when the fault is detected.

Is a concern present?

Yes	No
REPAIR as necessary.	GO to **HU27**.

HU27 CHECK THE IMRC DRIVER CIRCUIT FOR A SHORT TO THE IMRCM CIRCUIT

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

(+) IMRC Actuator Connector, Harness Side	(-) IMRCM Sensor Connector, Harness Side
IMRC - Pin 2	MRCM - Pin 1

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Is the resistance greater than 10K ohms?

Yes	No
GO to **HU28**.	REPAIR the short circuit.

HU28 CHECK THE IMRC DRIVER CIRCUIT FOR AN INTERMITTENT SHORT TO THE IMRCM CIRCUIT

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

(+) IMRC Actuator Connector, Harness Side	(-) IMRCM Sensor Connector, Harness Side
IMRC - Pin 2	IMRCM - Pin 1

- While observing the DMM shake, wiggle, and bend the IMRC and IMRCM circuits. Note that resistance will suddenly change when the fault is detected.

Is a concern present?

Yes	No
REPAIR as necessary.	GO to **HU29**.

HU29 CHECK THE IMRCM CIRCUIT FOR A SHORT TO VREF AND SIGRTN IN THE HARNESS

- Measure the resistance between:

(+) IMRCM Sensor Connector, Harness Side	(-) IMRCM Sensor Connector, Harness Side
IMRCM - Pin 1	VREF - Pin 3
IMRCM - Pin 1	SIGRTN - Pin 2

Are the resistances greater than 10K ohms?

Yes	No
INSTALL a new IMRC actuator. REPAIR as necessary.	REPAIR the short circuit.

HU30 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?

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Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST HX: EVAPORATIVE EMISSION (EVAP) MONITOR AND SYSTEM

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

WARNING: DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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NOTE: Enter this pinpoint test only when directed here.

The use of a soap solution around the fuel filler cap or the use of the hydrocarbon emission analyzer to

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determine an evaporative emission system leak is not recommended. The mandatory Rotunda Evaporative Emission System Leak Tester for OBD II (including the ultra-sonic tester) and the Rotunda Vacutec 522 Leak Detector Smoke Machine are the only devices to be used at this time for evaporative emission system leak detection.

This pinpoint test is intended to diagnose the following:

- Canister vent (CV) solenoid (9F945).
- Fuel filler cap (9030).
- Fuel tank pressure (FTP) sensor (9C052).
- EVAP canister purge (EVAPCP) valve (9C915). Also known as the vapor management valve (VMV).
- Fuel tank isolation valve (FTIV) (9G712).
- EVAP system leaks using the Rotunda Vacutec Leak Detector Smoke Machine.
- Harness circuits: CV, EVAPCP, FTP, FTIV, SIGRTN, VPWR, VREF, and PWRGND.
- Powertrain control module (PCM) (12A650).

Fig. 70: Identifying Canister Vent Solenoid (CANV) Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 71: EVAP Canister Purge (EVAPCP) Valve Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 72: Identifying EVAP Canister Purge (EVAPCP) Valve Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 73: Identifying Fuel Tank Isolation Valve (FTIV) Solenoid Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 74: Identifying Powertrain Control Module (PCM) Connector Terminal
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

HX1 DTCS P0442, P0443, P0446, P0452, P0453, P0454, P0455, P0456, P0457, P1450, P2418 AND P2450: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during PCM or TCM self-test: P0442, P0443, P0446, P0452, P0453, P0454, P0455, P0456, P0457, P1450, P2418, or P2450?

Yes	No
For continuous memory DTCs P0442 and P0456, GO to **HX44**. For DTC P0443, GO to **HX2**. For DTC P0446, GO to **HX33**. For DTC P0452, GO to **HX18**. For DTC P0453, GO to **HX23**. For continuous memory DTCs P0455 and P0457, GO to **HX39**. For continuous memory DTC P1450, GO to	Unable to duplicate or identify the fault at this time. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

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HX8. For DTC P2418, GO to **HX47**. For continuous memory DTC P2450, GO to **HX53**.	

HX2 DTC P0443: CHECK THE PCM OUTPUT TO EVAPCP VALVE

- Key in OFF position.
- EVAPCP Valve connector disconnected.
- Connect a non-powered test lamp between the EVAPCP and VPWR circuits at the EVAP canister purge valve harness connector.
- Key ON, engine OFF.
- Enter output test mode. Refer to **OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Command the outputs OFF.
- Exit output test mode.

Does the test lamp turn on and off when the output(s) is commanded on and off?

Yes	No
Key in OFF position. GO to **HX3**.	GO to **HX4**.

HX3 CHECK THE EVAPCP VALVE SOLENOID RESISTANCE

NOTE: The EVAPCP valve resistance reading must be taken with the engine cooled down.

- EVAPCP Valve connector disconnected.
- Measure the resistance between:

(+) EVAPCP Valve Connector, Component Side	(-) EVAPCP Valve Connector, Component Side
EVAPCP - Pin 2	VPWR - Pin 1

Is the resistance between 2.5 ohms - 6 ohms?

Yes	No
Unable to identify the fault at this time. GO to Pinpoint Test **Z**.	INSTALL a new EVAPCP valve.

HX4 CHECK THE VPWR VOLTAGE TO EVAPCP VALVE

- Measure the voltage between:

(+) EVAPCP Valve Connector, Harness Side	(-) Vehicle Battery

VPWR - Pin 1	Negative terminal

Is the voltage greater than 10.5 V?

Yes	No
Key in OFF position. GO to **HX5**.	REPAIR the open circuit.

HX5 CHECK THE EVAPCP VALVE CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) EVAPCP Valve Connector, Harness Side
EVAPCP - Pin B34	EVAPCP - Pin 2

Is the resistance less than 5 ohms?

Yes	No
GO to **HX6**.	REPAIR the open circuit.

HX6 CHECK THE EVAPCP VALVE CIRCUIT FOR A SHORT TO PWRGND IN THE HARNESS

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

(+) PCM Connector, Harness Side	(-)
EVAPCP - Pin B34	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to **HX7**.	REPAIR the short circuit to GND.

HX7 CHECK THE EVAPCP VALVE CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) EVAPCP Valve Connector, Harness Side	(-)
EVAPCP - Pin 2	Ground

Is the voltage less than 1 V?

Yes	No
GO to **HX54**.	REPAIR the short circuit to PWR.

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HX8 DTC P1450: CHECK FOR VISUAL CAUSES OF EXCESSIVE FUEL TANK VACUUM

- Check for kinks or bends in the fuel vapor hoses/tubes (EVAPCP outlet tube and EVAP canister tube).
- Visually inspect the EVAP canister inlet port, CV solenoid filter, and canister vent hose assembly for contamination or debris.
- Check the CV solenoid filter for blockage or contamination.

Is a concern present?

Yes	No
REMOVE any contamination or debris around the fuel vapor hose/tubes and CV solenoid assembly. REMOVE kinks or bends in the EVAPCP outlet tube, EVAP canister tube, and canister vent hose assembly. CLEAR the DTCs. For repair verification, CARRY OUT the evaporative emission leak check monitor repair verification drive cycle. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .	GO to **HX9**.

HX9 CHECK THE FTP SENSOR VOLTAGE WITH THE FUEL FILLER CAP REMOVED

- Remove the fuel filler cap.
- Key ON, engine OFF.
- Access the PCM and monitor the FTP V PID.

Is the voltage between 2.4 V - 2.8 V?

Yes	No
GO to **HX13**.	Key in OFF position. GO to **HX10**.

HX10 CHECK FOR ANY OTHER DTCS

- Check for other 3-wire sensor DTCs (KOEO, KOER, or continuous memory) present with the DTC P1450.

Are any other DTCs present?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	Key in OFF position. GO to **HX11**.

HX11 CHECK THE VREF VOLTAGE TO THE FTP SENSOR

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- FTP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FTP Sensor Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF - Pin 1	SIGRTN - Pin 2

Is the voltage between 4 V - 6 V?

Yes	No
Key in OFF position. INSTALL a new FTP sensor. CLEAR the DTCs. For repair verification, CARRY OUT the evaporative emission leak check monitor repair verification drive cycle. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .	Key in OFF position. GO to **HX12**.

HX12 CHECK THE VREF AND SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF - Pin B40	VREF - Pin 1
SIGRTN - Pin B41	SIGRTN - Pin 2

Are the resistances less than 5 ohms?

Yes	No
GO to **HX54**.	REPAIR the open circuit.

HX13 CHECK IF THE ENGINE WILL IDLE

- Key ON, engine running.

Does the engine stall or cannot maintain idle?

Yes	No
Key in OFF position. GO to **HX14**.	GO to **HX15**.

HX14 CHECK THE EVAP SYSTEM FOR A STUCK OPEN VALVE

- Disconnect the larger of 2 manifold lines at the EVAPCP and cap it at the EVAPCP.
- Key ON, engine running.

Does the engine stall or cannot maintain idle?

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Yes	No
Key in OFF position. The EVAP system is not the cause of the symptom. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.	Key in OFF position. INSTALL a new EVAPCP valve.

HX15 CHECK FOR BLOCKAGE IN THE FUEL TANK VENT SYSTEM

NOTE: The EVAPCV is normally open and venting to the atmosphere.

- Key ON, engine running.
- Access the PCM and monitor the EVAPCV, EVMV and FTP V PIDs.
- While monitoring the FTP PID, open the EVAPCP by commanding the EVMV PID to a 100% duty cycle (1,000 mA). Ramp the EVAP canister purge valve open in increments.

Does the FTP sensor voltage drop below 2 volts when the EVAPCP valve is commanded fully open?

Yes	No
CHECK for blockage in the vapor line to the EVAPCV solenoid. CHECK the CV solenoid filter for blockage or contamination. CHECK the carbon canister for blockage. If OK, INSTALL a new EVAPCV.	GO to **HX16**.

HX16 CHECK THE EVAP SYSTEM FOR A VALVE THAT IS STUCK OPEN

- Key ON, engine running.
- Close the EVAPCP by commanding the EVMV PID to 0 % duty cycle (0 mA).
- Close the EVAPCV by commanding the EVAPCV PID to ON (100% duty cycle).

Does the FTPV PID decrease, engine RPM change, or engine stall as an indication that the EVAPCP is stuck open?

Yes	No
Key in OFF position. INSTALL a new EVAPCP valve.	GO to **HX17**.

HX17 EVAPCP VALVE TEST

- Key ON, engine running.
- Close the EVAPCV by commanding the EVAPCV PID to ON (100% duty cycle).
- While monitoring the FTP PID, open the EVAPCP by commanding the EVMV PID to a 100% duty cycle (1,000 mA).

Does the FTPV PID decrease, engine RPM change, or engine stall as an indication that the EVAPCP

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is opening?

Yes	No
Key in OFF position. For DTC P1450, CHECK for the FTIV stuck closed. REPAIR as necessary. For all others, CHECK the EVAP system for leaks, GO to **HX39**.	Key in OFF position. CHECK for blockages between the fuel tank, the EVAPCP valve, and the engine intake manifold. CHECK for obstructions in the EVAPCP valve diaphragm and ports. If OK, INSTALL a new EVAPCP valve.

HX18 DTC P0452: CHECK FOR FTP SENSOR CONNECTOR CONTAMINATION

- Key in OFF position.
- Visually check for liquid fuel contamination of the FTP sensor and electrical connector.

Does the FTP sensor and its connector show any signs of fuel contamination?

Yes	No
REPAIR as necessary. ADJUST the fuel tank overfill.	GO to **HX19**.

HX19 CHECK FOR LOW FTP SENSOR VOLTAGE

NOTE: The FTP sensor voltage with no pressure/vacuum on the fuel tank is between 2.4 and 2.8 volts.

- Key ON, engine OFF.
- Access the PCM and monitor the FTP V PID.

Is the voltage less than 0.22 V?

Yes	No
Key in OFF position. GO to **HX20**.	The fault that produced DTC P0452 is intermittent. GO to Pinpoint Test **Z**.

HX20 CHECK THE OPPOSITE INDUCED HIGH FTP SENSOR SIGNAL

- FTP Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A FTP Sensor Connector, Harness Side	Point B FTP Sensor Connector, Harness Side
VREF - Pin 1	FTP - Pin 3

- Key ON, engine OFF.
- Access the PCM and monitor the FTP V PID.

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Is the voltage between 4 V - 6 V?

Yes	No
INSTALL a new FTP sensor.	REMOVE the jumper. GO to **HX21**.

HX21 CHECK THE VREF VOLTAGE TO THE FTP SENSOR

- Key ON, engine OFF.
- Measure the voltage between:

(+) FTP Sensor Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF - Pin 1	SIGRTN - Pin 2

Is the voltage between 4 V - 6 V?

Yes	No
Key in OFF position. GO to **HX22**.	GO to Pinpoint Test **C**.

HX22 CHECK THE FTP CIRCUIT(S) FOR A SHORT TO SIGRTN OR GND IN THE HARNESS

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

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FTP - Pin B9	SIGRTN - Pin B41

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
FTP - Pin B9	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **HX54**.	REPAIR the short circuit.

HX23 DTC P0453: CHECK FOR A HIGH FTP SENSOR VOLTAGE

NOTE: The FTP sensor voltage with no pressure/vacuum on the fuel tank is between 2.4 and 2.8 volts.

- Key ON, engine OFF.
- Access the PCM and monitor the FTP V PID.

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Is the voltage greater than 4.5 V?

Yes	No
Key in OFF position. GO to **HX24**.	The fault that produced DTC P0453 is intermittent. GO to Pinpoint Test **Z**.

HX24 CHECK THE FTP CIRCUIT FOR A SHORT TO POWER

- FTP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FTP Sensor Connector, Harness Side	(-) Vehicle Battery
FTP - Pin 3	Negative terminal

Is the voltage greater than 10.5 V?

Yes	No
Key in OFF position. GO to **HX25**.	Key in OFF position. GO to **HX26**.

HX25 CHECK THE FTP CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
FTP - Pin B9	Negative terminal

Is the voltage greater than 10.5 V?

Yes	No
REPAIR the short circuit to PWR.	GO to **HX54**.

HX26 INSTALL A JUMPER BETWEEN THE FTP SIGNAL AND THE SIGRTN CIRCUITS

- Connect a 5 amp fused jumper wire between the following:

Point A FTP Sensor Connector, Harness Side	Point B FTP Sensor Connector, Harness Side
FTP - Pin 3	SIGRTN - Pin 2

- Key ON, engine OFF.
- Access the PCM and monitor the FTP V PID.

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Is the voltage between 4 V - 6 V?

Yes	No
REMOVE the jumper. GO to **HX32**.	GO to **HX27**.

HX27 CHECK THE OPPOSITE INDUCED LOW FTP SIGNAL

- Access the PCM and monitor the FTP V PID.

Is the voltage less than 0.1 V?

Yes	No
REMOVE the jumper. GO to **HX28**.	Key in OFF position. REMOVE the jumper. GO to **HX30**.

HX28 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS AT THE FTP SENSOR VEHICLE HARNESS CONNECTOR

- Key ON, engine OFF.
- Measure the voltage between:

(+) FTP Sensor Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
VREF - Pin 1	SIGRTN - Pin 2

Is the voltage between 4 V - 6 V?

Yes	No
Key in OFF position. GO to **HX29**.	GO to Pinpoint Test **C**.

HX29 CHECK THE FTP CIRCUIT FOR A SHORT TO VREF

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF - Pin B40	FTP - Pin B9

Is the resistance greater than 10K ohms?

Yes	No
INSTALL a new FTP sensor.	REPAIR the short circuit to VREF.

HX30 CHECK THE FTP CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.

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- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
FTP - Pin B9	FTP - Pin 3

Is the resistance less than 5 ohms?

Yes	No
GO to **HX31**.	REPAIR the open circuit.

HX31 CHECK THE SIGRTN CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FTP Sensor Connector, Harness Side
SIGRTN - Pin B41	SIGRTN - Pin 2

Is the resistance less than 5 ohms?

Yes	No
GO to **HX32**.	REPAIR the open circuit.

HX32 CHECK THE FTP CIRCUIT FOR A SHORT TO VREF

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
FTP - Pin B9	VREF - Pin B40

Is the resistance greater than 10K ohms?

Yes	No
GO to **HX54**.	REPAIR the short circuit to VREF.

HX33 DTC P0446: CHECK THE PCM OUTPUT TO EVAP CANISTER VENT SOLENOID

- Key in OFF position.
- CANV connector disconnected.
- Connect a non-powered test lamp between the CANV and VPWR circuits at the CANV solenoid harness connector.
- Key ON, engine OFF.
- Enter output test mode. Refer to **OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Command the outputs OFF.

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- Exit output test mode.

Does the test lamp turn on and off when the output(s) is commanded on and off?

Yes	No
Key in OFF position. GO to **HX34**.	GO to **HX35**.

HX34 CHECK THE CANV SOLENOID RESISTANCE

- Measure the resistance between:

(+) CANV Connector, Component Side	(-) CANV Connector, Component Side
VPWR - Pin 1	CANV - Pin 2

Is the resistance between 48 ohms - 65 ohms?

Yes	No
Unable to identify the fault at this time. GO to Pinpoint Test **Z**.	INSTALL a new EVAPCV.

HX35 CHECK THE VPWR VOLTAGE TO CANV SOLENOID

- Measure the voltage between:

(+) CANV Connector, Harness Side	(-)
VPWR - Pin 1	Ground

Is the voltage greater than 10.5 V?

Yes	No
Key in OFF position. GO to **HX36**.	REPAIR the open circuit.

HX36 CHECK THE CANV CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CANV Connector, Harness Side
CANV - Pin B13	CANV - Pin 2

Is the resistance less than 5 ohms?

Yes	No
GO to **HX37**.	REPAIR the open circuit.

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HX37 CHECK THE CANV CIRCUIT FOR A SHORT TO PWRGND IN THE HARNESS

- Measure the resistance between:

(+) CANV Connector, Harness Side	(-) Vehicle Battery
CANV - Pin 2	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **HX38**.	REPAIR the short circuit to GND.

HX38 CHECK THE CANV CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) CANV Connector, Harness Side	(-)
CANV - Pin 2	Ground

Is the voltage less than 1 V?

Yes	No
GO to **HX54**.	REPAIR the short circuit to PWR.

HX39 DTCS P0455 OR P0457: CHECK THE FUEL FILLER CAP

NOTE: **Many EVAP leaks are caused by a loose or damaged fuel filler cap. If the fuel filler cap is suspect during visual inspection, do not disturb the fuel filler cap until the repair verification method is complete. If the repair verification method fails, reposition or install a new fuel filler cap and repeat the test. This action isolates the fuel filler cap from the rest of the EVAP system as a potential concern.**

- Visually inspect the fuel filler cap without initially disturbing it.
- Check for a missing or loose fuel filler cap.
- Check the fuel filler cap for damage.

Is a concern present with the proper installation of the fuel filler cap?

Yes	No
For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. CONNECT or INSTALL a new fuel filler cap. GO to **HX44**.	GO to **HX40**.

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HX40 CHECK THE OPERATION OF THE FUEL GAUGE

NOTE: A fuel gauge that always indicates a fuel level below a half tank or always a full tank, may be caused by an FLI fault.

- Check the operation of the fuel gauge.

Is the fuel gauge functioning properly?

Yes	No
Key in OFF position. GO to **HX41**.	Key in OFF position. CHECK the functionality of the FLI circuit. REFER to **INSTRUMENT CLUSTER** to diagnose the fuel level indicator.

HX41 EVAPORATIVE EMISSION SYSTEM VISUAL INSPECTION

- Visually inspect for:
  - EVAP system lines/hoses (check for proper connections, damage or blockage).
  - Loose fuel vapor hose/tube connections to the EVAP system components.
  - The vacuum line from the input vacuum port to the intake manifold on the EVAP canister purge valve (the control vacuum solenoid part of the valve) is removed.
  - A blocked vacuum hose between the EVAPCP valve solenoid and the engine intake manifold.
  - A damaged fuel tank or fuel filler pipe.

Are any concerns present during the visual inspection?

Yes	No
REPAIR as necessary. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to **HX44**.	GO to **HX42**.

HX42 CHECK THE FTP SENSOR VOLTAGE WITH THE FUEL FILLER CAP REMOVED

- Remove the fuel filler cap.
- Key ON, engine OFF.
- Access the PCM and monitor the FTP V PID.

Is the voltage between 2.4 V - 2.8 V?

Yes	No
CONNECT the fuel filler cap. GO to **HX43**.	Key in OFF position. INSTALL a new FTP sensor. REPEAT the test and VERIFY the results. For repair verification, CARRY OUT the Smoke

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	Machine PHASE 1 - Leak Verification Pressure Test. GO to **HX44**.

HX43 EVAPCP VALVE TEST

NOTE: Access the fuel tank isolation valve and verify that it is not stuck closed before continuing.

- Key ON, engine running.
- Access the PCM and monitor the EVAPCV, FTP V and EVMV PIDs.
- Close the EVAPCV by commanding the EVAPCV PID to ON (100% duty cycle).
- While monitoring the FTP PID, open the EVAPCP by commanding the EVMV PID to a 100% duty cycle (1,000 mA).

Does the FTPV PID decrease, engine RPM change, or engine stall as an indication that the EVAPCP is opening?

Yes	No
Key in OFF position. GO to **HX44**.	Key in OFF position. INSTALL a new EVAPCP valve. REPEAT the test and VERIFY the results. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to **HX44**.

HX44 DTCS P0442 OR P0456: HOOK UP THE SMOKE MACHINE

CAUTION: Removing the Schrader valve from the test port will permanently damage the valve.

- Disconnect the larger of 2 manifold lines at the EVAPCP and cap it at the EVAPCP.
- Connect the smoke machine power cables to the vehicle battery. Check to see that the smoke machine power indicator lamp is on, indicating a good battery contact.
- Locate the evaporative emissions test port and remove the green cap. It is located on the EVAPCP.
- Install the evaporative emissions port adapter (provided with the smoke machine) to the test port.
- Diagnostic tool connected.

Is the smoke machine hook up complete?

Yes	No
For leak detection, GO to **HX45**. For leak repair verification, GO to **HX46**.	Key in OFF position. REFER to the smoke machine operator manual for additional instructions and for helpful tips.

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HX45 CARRY OUT SMOKE MACHINE PHASE 2 - LEAK DETECTION SMOKE TEST

NOTE: If the leak is not detected from the top, check the EVAP system for leaks from under the vehicle. Check the EVAP hoses, EVAPCP, EVAPCV, carbon canister, fuel tank, the components around the fuel tank area, and at the fuel filler cap. Wiggle the components and connections to simulate road bumps while looking for signs of leaking smoke. If the leak is in the fuel filler neck between the check valve and the fuel filler cap, smoke under pressure may not reach the leak. If leaking smoke is not found, a thorough visual inspection of the fuel filler neck and fuel filler cap should be carried out.

- Position the control lever located on the smoke machine to SMOKE.
- Remove the fuel filler cap.
- Connect the smoke supply hose (black hose) nozzle tip into the evaporative emission test port.
- Key ON, engine OFF.
- Close the EVAPCV by commanding the EVAPCV PID to ON (100% duty cycle). Note: The EVAPCV reopens after 9 minutes of continuous operation.
- Press the remote starter button on the smoke machine. Smoke will be introduced into the EVAP system.
- Secure the fuel cap once smoke is observed exiting the fuel tank neck area.
- If smoke does not exit the fuel filler neck after the system is pressurized, command the EVAPCV open to allow air to purge the canister vent solenoid. Once smoke is seen at the canister vent solenoid, close the EVAPCV.
    - Continue to introduce smoke into the system for 60 seconds to obtain pressure.
    - Press and release the remote starter button in intervals of approximately 15 seconds on and 15 seconds off while checking for exiting smoke.
    - Use the halogen spotlight provided with the smoke machine to follow the EVAP system path and look for smoke exiting at the source of the leak.

Is the source of the EVAP leak located?

Yes	No
Key in OFF position. REPAIR as necessary. CONNECT all the disconnected components. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to **HX46**.	Key in OFF position. Test passed. CONNECT all the disconnected components. CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to **HX46**.

HX46 CARRY OUT SMOKE MACHINE PHASE 1 - LEAK VERIFICATION PRESSURE TEST

- Position the control lever located on the smoke machine to METER.
- Calibrate the smoke machine flow meter using the 0.020 standard as follows:
    - Insert the air supply hose (transparent hose) nozzle tip into the 0.020 EVAP system standard located on the front of the smoke machine.

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- Press the remote starter button on the smoke machine. Observe the position of the flow meter indicator ball.
- Position the flow meter red pointer flag so that it aligns with the measurement of the indicator ball.
- Release the button and remove the air supply hose nozzle tip from the EVAP system standard.

- Connect the air supply hose (tranparent hose) nozzle tip into the evaporative emission test port adapter.
- Key ON, engine OFF.
- Close the EVAPCV by commanding the EVAPCV PID to ON (100% duty cycle).
- Press the remote starter button on the smoke machine. Notice that the ball in the flowmeter is all the way at the top. This indicates the system is being pressurized.
- Continue to press the remote starter button until the ball stops descending. Once the ball stops descending, observe if it is above or below the red pointer flag. If the measurement is below the indicator flag, the system has passed the pressure test. If the measurement is above the indicator flag, the EVAP system has an unacceptable leak.

Does the EVAP system pass the smoke machine leak verification pressure test?

Yes	No
Key in OFF position. Test passed, no faults found.	GO to **HX45**.

HX47 DTC P2418: CHECK THE PCM OUTPUT TO FTIV

- Key in OFF position.
- FTIV Solenoid connector disconnected.
- Connect a non-powered test lamp between the FTIV and VPWR circuits at the FTIV connector.
- Key ON, engine OFF.
- Enter output test mode. Refer to **OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Command the outputs OFF.
- Exit output test mode.

Does the test lamp turn on and off when the output(s) is commanded on and off?

Yes	No
Key in OFF position. GO to **HX48**.	GO to **HX49**.

HX48 CHECK THE FTIV SOLENOID RESISTANCE

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

(+) FTIV Solenoid Connector, Component	(-) FTIV Solenoid Connector, Component

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Side	Side
FTIV - Pin 2	VPWR - Pin 1

Is the resistance between 17 ohms - 21 ohms?

Yes	No
Unable to identify the fault at this time. GO to Pinpoint Test **Z**.	INSTALL a new FTIV solenoid.

HX49 CHECK THE VPWR VOLTAGE TO FUEL TANK ISOLATION VALVE

- Measure the voltage between:

(+) FTIV Solenoid Connector, Harness Side	(-)
VPWR - Pin 1	Ground

Is the voltage greater than 10.5 V?

Yes	No
Key in OFF position. GO to **HX50**.	REPAIR the open circuit.

HX50 CHECK THE FTIV CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FTIV Solenoid Connector, Harness Side
FTIV - Pin B29	FTIV - Pin 2

Is the resistance less than 5 ohms?

Yes	No
GO to **HX51**.	REPAIR the open circuit.

HX51 CHECK THE FTIV CIRCUIT FOR A SHORT TO PWRGND IN THE HARNESS

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

(+) PCM Connector, Harness Side	(-)
FTIV - Pin B29	Ground

Is the resistance greater than 10K ohms?

Yes	No

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GO to **HX52**.	REPAIR the short circuit to GND.

HX52 CHECK THE FTIV CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) FTIV Solenoid Connector, Harness Side	(-)
FTIV - Pin 2	Ground

Is the voltage less than 1 V?

Yes	No
GO to **HX52**.	REPAIR the short circuit to PWR.

HX53 CONTINUOUS MEMORY DTC P2450: CHECK FOR A STUCK OPEN FTIV

- Disconnect the FTIV and inspect for damaged or pushed out pins, corrosion, and loose wires.
- Check for kinks or bends in the fuel vapor hoses/tubes (FTIV to the fuel tank tube).

Are there any concerns with the wiring or the FTIV connection?

Yes	No
REPAIR as necessary. CARRY OUT an evaporative emission leak check monitor repair verification drive cycle. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .	INSTALL a new FTIV solenoid. CARRY OUT an evaporative emission leak check monitor repair verification drive cycle. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .

HX54 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

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PINPOINT TEST JB: SECONDARY IGNITION

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

CAUTION: A malfunctioning ignition system may cause high catalyst temperatures. Check components next to the catalyst and muffler for heat damage.

Important Safety Notice

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This article provides general directions for repairing vehicles with tested, effective techniques. Following them will help ensure reliability. There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles, as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

This pinpoint test is intended to diagnose the following:

- Spark plugs (12405).
- Secondary side of the coil.

The firing order for the coil-on-plug ignition system is 1, 3, 4, 2.

TEST PROCEDURE

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JB1 VISUAL INSPECTION OF IGNITION SYSTEM

- Visually inspect the engine compartment to make sure all the coils are properly and securely connected.
- Examine all the wiring harnesses and connectors for damaged, burned, or overheated insulation, and loose or broken conditions.
- Make sure the vehicle battery is in good condition and all accessories are turned off.

Is a problem indicated?

Yes	No
REPAIR as necessary.	GO to **JB2**.

JB2 DTC P0301 THROUGH P0304: MISFIRE ON CYLINDERS 1 THROUGH 4

Are any of the above listed DTCs present?

Yes	No
GO to **JB3**.	GO to **JB4**.

JB3 CHECK FOR SPARK AT CYLINDER(S) INDICATED BY THE DTC(S)

- Key in OFF position.
- Disconnect the ignition coil(s) from the spark plug(s).
- Connect air gap spark tester 303-D037 (D81P-6666-A) or equivalent to a coil.
- Crank the engine using the engine cranking diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Observe the spark tester while cranking the engine.

Is a bluish-white spark present?

Yes	No
Key in OFF position. GO to **JB5**.	Key in OFF position. INSPECT the coil boot on the missing cylinder. INSTALL a new coil as necessary. INSPECT the spark plug on the missing cylinder. MEASURE the resistance of the spark plug. INSTALL a new spark plug if the resistance is lower than 2,000 ohms or higher than 20,000 ohms. GO to Pinpoint Test **JF**.

JB4 CHECK FOR SPARK AT ALL CYLINDERS

- Key in OFF position.
- Disconnect the ignition coil(s) from the spark plug(s).
- Connect the Air Gap spark tester 303-D037 (D81P-6666-A) or its equivalent to the suspect coil.
- Crank the engine using the engine cranking diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Observe the spark tester at each cylinder while cranking the engine.

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Is a bluish-white spark consistent between all cylinders?

Yes	No
Key in OFF position. GO to **JB5**.	Key in OFF position. INSPECT the coil boot on the missing cylinder. INSTALL a new coil as necessary. INSPECT the spark plug on the missing cylinder. MEASURE the resistance of the spark plug. INSTALL a new spark plug if the resistance is lower than 2,000 ohms or higher than 20,000 ohms. RECORD cylinder(s) with inconsistent spark. GO to Pinpoint Test **JF**.

JB5 CHECK THE SPARK PLUGS

- Remove and inspect the plugs for damage, wear, carbon deposits, and proper plug gap.

Are the plugs OK?

Yes	No
GO to **JB6**.	ADJUST the gap or INSTALL a new spark plug as necessary.

JB6 CHECK THE SPARK PLUG RESISTANCE

- Measure the spark plug resistance.

Is the resistance between 2,000 and 20,000 ohms?

Yes	No
GO to **JB7**.	INSTALL a new spark plug.

JB7 TEST DIRECTION

Were you directed to this pinpoint test from the SYMPTOM CHARTS article?

Yes	No
The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.	GO to **JB8**.

JB8 TEST DIRECTION

Were you directed to this pinpoint test from Pinpoint Test Step A6?

Yes	No
GO to **A7**.	The concern is intermittent. GO to Pinpoint Test **Z**.

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PINPOINT TEST JD: CRANKSHAFT POSITION (CKP) SENSOR

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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This pinpoint test is intended to diagnose the following:

- Crankshaft position (CKP) sensor (6C135).
- Harness circuits: CKP(+) and CKP(-).
- Powertrain control module (PCM) (12A650).

Fig. 75: Identifying Crankshaft Position (CKP) Sensor Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 76: Identifying Powertrain Control Module (PCM) Connector Terminal
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

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JD1 CHECK THE CKP SENSOR SIGNAL TO THE PCM

NOTE: With electronic throttle control (ETC), erroneous ignition and ETC-related DTCs may be set due to salt water intrusion into the crankshaft position (CKP) sensor harness connector. These DTCs are set in the following combination:

- **P0320 and P0351.**

Thoroughly clean the connector, pack with di-electric grease and retest. If the problem returns, continue the CKP sensor diagnosis.

- Battery fully charged and starting system functioning properly.
- Key ON, engine OFF.
- Access the PCM and monitor the RPM PID.
- Crank the engine using the engine cranking diagnostic mode. Refer to **DIAGNOSTIC MODES** .

Is the engine speed between 900 - 1,200 RPM?

Yes	No
The CKP, PCM, and harness are working properly. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.	Key in OFF position. GO to **JD2**.

JD2 CHECK THE TIMING COVER, CKP SENSOR, AND CRANKSHAFT PULSE WHEEL FOR OBVIOUS PHYSICAL DAMAGE

- Visually check the timing cover, CKP sensor, and crankshaft pulse wheel (outside the timing cover) for obvious physical damage.

Do any parts appear physically damaged?

Yes	No
REPAIR or INSTALL a new component as necessary.	GO to **JD3**.

JD3 CHECK FOR PROPER CKP BIAS VOLTAGES IN THE PCM

- CKP Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) CKP Sensor Connector, Harness Side	(-) Vehicle Battery
CKP+ - Pin 1	Negative terminal
CKP- - Pin 2	Negative terminal

Are the voltages between 1 V - 3 V?

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Yes	No
Key in OFF position. GO to **JD4**.	Key in OFF position. GO to **JD6**.

JD4 CHECK THE CKP SENSOR RESISTANCE

NOTE: The CKP sensor resistance values change significantly with temperature rise.

- Measure the resistance between:

(+) CKP Sensor Connector, Component Side	(-) CKP Sensor Connector, Component Side
CKP+ - Pin 1	CKP- - Pin 2

Is the resistance between 250 ohms - 1K ohms?

Yes	No
GO to **JD5**.	INSTALL a new CKP sensor.

JD5 CHECK THE CKP HARNESS SHIELD GROUND

NOTE: The harness shield protects the CKP signal from electrical noise and is grounded at one end, typically near the PCM.

NOTE: Carry out the following resistance measurement between the CKP shield and the chassis ground.

- Measure the resistance between:

(+) CKP_SHLD Assembly Connector, Harness Side	(-)
CKP_SHLD	Ground

Is the resistance less than 5 ohms?

Yes	No
GO to **JD6**.	REPAIR the open circuit. CHECK for a poor ground connection.

JD6 CHECK FOR A SHORT BETWEEN THE CKP(+) AND CKP(-) IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) CKP Sensor Connector, Harness Side	(-) CKP Sensor Connector, Harness Side
CKP+ - Pin 1	CKP- - Pin 2

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Is the resistance greater than 10K ohms?

Yes	No
GO to **JD7**.	REPAIR the short circuit.

JD7 CHECK THE CKP CIRCUIT(S) FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) CKP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
CKP- - Pin 2	CKP- - Pin E45
CKP+ - Pin 1	CKP+ - Pin E34

Are the resistances less than 5 ohms?

Yes	No
GO to **JD8**.	REPAIR the open circuit.

JD8 CHECK THE CKP CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
CKP+ - Pin E34	Negative terminal
CKP- - Pin E45	Negative terminal

Is any voltage present?

Yes	No
Key in OFF position. REPAIR the short circuit to PWR.	Key in OFF position. GO to **JD9**.

JD9 CHECK THE CKP CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) CKP Sensor Connector, Harness Side	(-) Vehicle Battery
CKP+ - Pin 1	Negative terminal
CKP- - Pin 2	Negative terminal

Are the resistances less than 10K ohms?

Yes	No
REPAIR the short circuit.	INSTALL a new PCM. REFER to **FLASH**

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	ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM) .

PINPOINT TEST JF: INTEGRATED IGNITION COIL ON PLUG COIL A THROUGH D FAILURE

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
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This pinpoint test is intended to diagnose the following:

- Ignition coils (12A366).
- Harness circuits CD1, CD2, CD3, CD4, and IGN START/RUN.
- Powertrain control module (PCM) (12A650).

IGNITION COIL TO CYLINDER CORRELATION

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Related DTC	Cylinder Number	Ignition Coil	Coil Driver (CD)	PCM Pin
P0351	1	A	A	E1
P0353	3	C	B	E12
P0354	4	D	C	E24
P0352	2	B	D	E35

Fig. 77: Identifying Coil On Plug (COP) Connector Terminal
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

JF1 CHECK FOR THE PRESENCE OF PCM DTCS P0351, P0352, P0353, AND P0354 TOGETHER

NOTE: DTCs P0351, P0352, P0353 and P0354 together indicate that all 4 ignition coils lost IGN START/RUN power while the PCM sustained VPWR.

Possible causes:

- IGN START/RUN circuit open.
- ISP-R shorted to PWR.

Are PCM continuous DTCs P0351, P0352, P0353, and P0354 present together during the self-test?

Yes	No
GO to **JF2**.	GO to **JF3**.

JF2 CHECK THE IGNITION SWITCH RUN POSITION CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Check the condition of the IGN START/RUN circuit related fuses.
- Key in OFF position.
- PCM connector disconnected.
- Measure the voltage between:

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

Is the voltage less than 1 V?

Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	CHECK for a damaged ignition switch. REFER to **COMPONENT TESTING** . If the ignition switch is OK, REPAIR the short to PWR circuit in the harness.

JF3 DETERMINE WHICH COIL IS NOT FIRING PROPERLY

NOTE: Electronic ignition engine timing is entirely controlled by the PCM. Electronic

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ignition timing is NOT adjustable. Do not attempt to check base timing. You will receive false readings.

- Determine which coil is not firing properly using the information from Pinpoint Test JB or a DTC and the table at the beginning of this pinpoint test.
- Record the suspect cylinder, coil, and PCM pin number from the table.

Have the suspect cylinder number, coil driver, and PCM pin number been recorded?

Yes	No
GO to **JF4**.	REPEAT the test step to obtain the required information.

JF4 CHECK THE FUNCTIONALITY OF THE SUSPECT COIL DRIVER CIRCUIT

- Suspect coil connector disconnected.
- PCM connector connected.
- Connect a non-powered test lamp between the IGN START/RUN and suspect coil driver, harness side.
- Crank the engine using the engine cranking diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Observe the test lamp while cranking the engine.

Is the test lamp blinking consistently?

Yes	No
Key in OFF position. GO to **JF5**.	GO to **JF6**.

JF5 CHECK THE FUNCTIONALITY OF THE SUSPECT COIL

- Carry out a visual inspection. Closely inspect the coil case and boot for carbon tracking, cracks and torn or improperly installed boots.
- Remove the suspect COP from the spark plug.
- Connect air gap spark tester 303-D037 (D81P-6666-A) or equivalent to the suspect coil.
- Suspect coil connector connected.
- Crank the engine using the engine cranking diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Observe the spark tester while cranking the engine.

Is a bluish-white spark present?

Yes	No
Key in OFF position. GO to Pinpoint Test **Z**.	Key in OFF position. INSTALL a new coil as necessary. INSPECT the spark plug, INSTALL a new spark plug as necessary.

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JF6 CHECK IGN START/RUN VOLTAGE TO SUSPECT COIL

- Measure the voltage between:

(+) COP Connector, Harness Side	(-) Vehicle Battery
IGN START/RUN - Pin 2	Negative terminal

Is the voltage greater than 10.5 V?

Yes	No
Key in OFF position. GO to **JF7**.	Key in OFF position. REPAIR the open circuit.

JF7 CHECK THE SUSPECT COIL DRIVER CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) COP Connector, Harness Side
Suspect coil driver	COP - Pin 1

Is the resistance less than 5 ohms?

Yes	No
GO to **JF8**.	REPAIR the open circuit.

JF8 CHECK THE SUSPECT COIL DRIVER CIRCUIT FOR A SHORT TO VPWR IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
Suspect coil driver	Negative terminal

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **JF9**.	Key in OFF position. REPAIR the short circuit to PWR.

JF9 CHECK THE SUSPECT CD CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
Suspect coil driver	Negative terminal

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Is the resistance greater than 10K ohms?

Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** . If the concern or DTC is still present, REPAIR the short circuit to GND.	GO to **JF10**. If the concern or DTC is still present, GO to **JF10**.

JF10 CHECK THE SUSPECT COIL FOR DAMAGE

- Carry out a visual inspection. Closely inspect the coil case and boot for carbon tracking, cracks, and torn or improperly installed boots.
- Remove the suspect COP from the spark plug.
- Connect air gap spark tester 303-D037 (D81P-6666-A) or equivalent to the suspect coil.
- Suspect coil connector connected.
- Crank the engine using the engine cranking diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Observe the spark tester while cranking the engine.

Is a bluish-white spark present?

Yes	No
Key in OFF position. INSPECT the spark plug. INSTALL a new spark plug as necessary.	Key in OFF position. INSTALL a new COP. INSPECT the spark plug. INSTALL a new spark plug as necessary.

PINPOINT TEST JH: ENGINE SPEED SIGNAL

INTRODUCTION

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HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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This pinpoint test is intended to diagnose the following:

- Harness circuit(s) clean tachometer output (CTO).
- Powertrain control module (PCM) (12A650).
- Transaxle Assembly (7000).

Fig. 78: Identifying Transaxle Assembly-B Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 79: Identifying Powertrain Control Module (PCM) Connector Terminal
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

JH1 CONTINUOUS MEMORY DTCS P0726 AND P0727: CLEAR AND RETRIEVE TCM CONTINUOUS DTCS

NOTE: Repair the PCM continuous memory DTC P0320 before proceeding any further.

NOTE: Clearing the TCM DTCs will erase any TCM recorded freeze frame data. Make sure to record any TCM freeze frame information before proceeding any further. Refer to the diagnostic tool instruction manual for freeze frame PID menu.

- Clear and retrieve TCM continuous DTCs.

Are the TCM DTCs P0726 or P0727 present during self-test?

Yes	No
A hard fault is present. GO to **JH2**.	CHECK the CTO circuit for an intermittent fault. GO to **JH8**.

JH2 COMPARE TCM CALCULATED AND RECEIVED ENGINE RPM TO THE ACTUAL ENGINE RPM

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NOTE: The RPM PID indicates the engine speed the TCM calculated using generator speed. The ENG CTO PID indicates the engine speed the TCM receives from the PCM through the CTO circuit.

NOTE: If the engine cranks but does not start, refer to SYMPTOM CHARTS , and Diagnose the No Start, Normal Crank symptom.

- Start the engine using the engine running diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Allow the engine to idle at the normal operating temperature.
- Access the TCM and monitor the RPM and ENG CTO PIDs.

Are both RPM PID readings within 1,000 RPM range of engine idle RPM?

Yes	No
INSTALL a new transaxle assembly.	GO to **JH3**.

JH3 CHECK THE CTO FOR A SHORT TO POWER IN THE HARNESS

- Transaxle Assembly-B connector disconnected.
- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Transaxle Assembly-B Connector, Harness Side	(-) Vehicle Battery
CTO - Pin 1	Negative terminal

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **JH4**.	Key in OFF position. REPAIR the short circuit to PWR.

JH4 CHECK THE CTO CIRCUIT FOR A SHORT TO GND IN THE HARNESS

- Measure the resistance between:

(+) Transaxle Assembly-B Connector, Harness Side	(-) Vehicle Battery
CTO - Pin 1	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **JH5**.	REPAIR the short circuit to GND.

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JH5 CHECK THE CTO CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) Transaxle Assembly-B Connector, Harness Side	(-) PCM Connector, Harness Side
CTO - Pin 1	CTO - Pin T46

Is the resistance less than 5 ohms?

Yes	No
GO to **JH6**.	REPAIR the open circuit.

JH6 CHECK FOR THE CTO CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

- Measure the resistance between:

(+) Transaxle Assembly-B Connector, Harness Side	(-) Transaxle Assembly-B Connector, Harness Side
CTO - Pin 1	GSDN - Pin 10
CTO - Pin 1	ISDN2 - Pin 7
CTO - Pin 1	MSDN - Pin 5
CTO - Pin 1	TGAC - Pin 9
CTO - Pin 1	TMAC - Pin 4

Are the resistances greater than 10K ohms?

Yes	No
GO to **JH7**.	REPAIR the short circuit. ISOLATE the fault and REPAIR as necessary.

JH7 CHECK THE CTO SIGNAL FROM THE PCM

CAUTION: While conducting checks with a running engine make sure adequate safety precautions are observed to prevent contact with moving engine parts. For example make sure ties or loose clothing do not come into contact with the cooling fan or drive belts.

- PCM connector connected.
- Transaxle Assembly-B connector connected.
- Isolate the CTO pin from the transaxle-B connector.
- Start the engine using the engine running diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Measure the frequency between:

(+) Transaxle Assembly-B Connector, Harness Side	(-) Vehicle Battery

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CTO - Pin 1	Negative terminal

Is the frequency between 15 Hz - 155 Hz?

Yes	No
Key in OFF position. INSTALL a new transaxle assembly.	Key in OFF position. GO to **JH9**.

JH8 CHECK THE CTO CIRCUIT FOR INTERMITTENT FAULTS

CAUTION: While conducting checks with a running engine ensure adequate safety precautions are observed to prevent contact with moving engine parts. For example ensure ties or loose clothing do not come into contact with the cooling fan or drive belts.

- Start the engine using the engine running diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Access the TCM and monitor the ENG CTO PID.
- Carefully wiggle all accessible wiring and connectors associated with the circuit and look for a change in the PID state.

Is a fault indicated during the wiggle test?

Yes	No
Key in OFF position. REPAIR as necessary.	Key in OFF position. GO to Pinpoint Test **Z**.

JH9 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KB: FUEL PUMP DRIVER MODULE (FPDM)

INTRODUCTION

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This pinpoint test is intended to diagnose the following:

- Fuel pump driver module (FPDM) (9D370).
- Harness circuits associated with the FPDM.
- FPDM power supply relay.
- Powertrain control module (PCM) (12A650).

Fig. 80: Identifying Fuel Pump Driver Module (FPDM) Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 81: Identifying Inertia Fuel Shutoff (IFS) Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 82: Identifying Powertrain Control Module (PCM) Connector Terminal
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

KB1 DTCS P1233, P1235 AND P1237: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during PCM or TCM self-test: P1233, P1235, or P1237?

Yes	No
For DTC P1233, GO to **KB2**. For DTC P1235, GO to **KB17**. For DTC P1237, GO to **KB25**.	The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

KB2 DTC P1233: IS DTC P1233 PRESENT IN THE KOEO SELF-TEST?

Is DTC P1233 present in the KOEO or KOER self-test?

Yes	No
A hard fault is present. GO to **KB4**.	The PCM is now receiving a signal from the FPDM. One possible cause of DTC P1233 is that the IFS switch was tripped, then reset. GO to **KB3**.

KB3 DOES THE ENGINE START?

Does the engine start?

Yes	No
Intermittent concern. GO to **KB13**.	DISREGARD the DTC at this time. RETURN to **SYMPTOM CHARTS** and continue as directed. After repairing the no start, to diagnose intermittent causes of P1233, GO to **KB13**.

KB4 KOEO DTC P1233: DOES THE ENGINE START?

Does the engine start?

Yes	No
The FPM circuit will be checked. GO to **KB9**.	VERIFY the IFS switch is set (button pressed). GO to **KB5**.

KB5 CHECK THE POWER AND GROUND CIRCUITS TO THE FPDM

- FPDM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-) FPDM Connector, Harness Side
VPWR - Pin 5	GND - Pin 3

Is the voltage greater than 10.5 V?

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Yes	No
Key in OFF position. INSTALL a new FPDM.	GO to **KB6**.

KB6 CHECK POWER TO FPDM

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
VPWR - Pin 5	Ground

Is the voltage greater than 10.5 V?

Yes	No
REPAIR the open ground circuit to the FPDM.	Key in OFF position. GO to **KB7**.

KB7 CHECK THE VOLTAGE TO FRONT IFS SWITCH

- IFS Switch connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) IFS Switch Connector, Harness Side	(-)
VPWR - Pin 2	Ground

Is the voltage greater than 10.5 V?

Yes	No
Key in OFF position. GO to **KB8**.	PWR_TO_IFS circuit fault. CHECK the condition of the related fuse/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for a short to ground before installing a new fuse/fuse link.

KB8 CHECK THE RESISTANCE OF FRONT IFS SWITCH

- Measure the resistance between:

(+) IFS Switch Connector, Component Side	(-) IFS Switch Connector, Component Side
VPWR - Pin 2	FPDMPWR-A - Pin 1

Is the resistance less than 5 ohms?

Yes	No
REPAIR the open FPDM PWR circuit.	INSTALL a new IFS switch.

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KB9 CHECK THE FPM CIRCUIT FOR AN OPEN IN THE HARNESS

- FPDM connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-) PCM Connector, Harness Side
FPM - Pin 1	FPM - Pin B46

Is the resistance less than 5 ohms?

Yes	No
GO to **KB10**.	REPAIR the open circuit.

KB10 CHECK THE FPM CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
FPM - Pin 1	Ground

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **KB11**.	REPAIR the short circuit to PWR.

KB11 CHECK THE FPM CIRCUITE FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-)
FPM - Pin 1	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to **KB12**.	REPAIR the short circuit to GND.

KB12 CHECK FOR FPM OUTPUT FROM THE PCM

NOTE: It is OK for the voltage to cycle below this range and then return within range.

- FPDM connector connected.

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- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
FPM - Pin B46	Ground

Is the voltage between 0.02 V - 1 V?

Yes	No
GO to **KB37**.	INSTALL a new FPDM.

KB13 CHECK THE FPDM PWR AND GND CIRCUITS FOR AN INTERMITTENT CONCERN

NOTE: Be aware that P1233 could be set if the IFS switch is tripped then reset.

- Key in OFF position.
- FPDM connector disconnected.
- Connect a non-powered test lamp between:

(+) FPDM Connector, Harness Side	(-) FPDM Connector, Harness Side
FPDM PWR	GND - Pin 3

- Key ON, engine OFF.
- Observe the test lamp for an indication of a fault while carrying out the following. Note that the lamp turns OFF when a fault is detected.
- Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module.

Is a fault indicated?

Yes	No
ISOLATE the fault and REPAIR as necessary.	GO to **KB14**.

KB14 CHECK FOR AN INTERMITTENT OPEN IN THE FPM CIRCUIT

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

(+) FPDM Connector, Harness Side	(-) PCM Connector, Harness Side
FPM - Pin 1	FPM - Pin B46

- Observe the DMM for an indication of a fault while completing the following. (Note that resistance changes suddenly when a fault is detected).
- Wiggle, shake, and bend small sections of the wiring harness while working from the component to

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the module.

Is a fault indicated?

Yes	No
ISOLATE the fault and REPAIR as necessary.	GO to **KB15**.

KB15 CHECK FOR AN INTERMITTENT SHORT TO POWER IN THE FPM CIRCUIT

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-) Vehicle Battery
FPM - Pin 1	Negative terminal

- Observe the DMM for an indication of a fault while completing the following. (Note that voltage changes suddenly when a fault is detected).
- Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module.

Is a fault indicated?

Yes	No
ISOLATE the fault and REPAIR as necessary.	GO to **KB16**.

KB16 CHECK FOR AN INTERMITTENT SHORT TO GROUND IN THE FPM CIRCUIT

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

(+) FPDM Connector, Harness Side	(-)
FPM - Pin 1	Ground

- Observe the DMM for an indication of a fault while completing the following. (Note that resistance changes suddenly when a fault is detected).
- Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module.

Is a fault indicated?

Yes	No
ISOLATE the fault and REPAIR as necessary.	Unable to duplicate or identify the fault at this time. GO to Pinpoint Test **Z**.

KB17 KOEO AND KOER DTC P1235: IS DTC P1235 PRESENT IN THE KOEO OR KOER SELF-TEST?

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Is DTC P1235 present in the KOEO or KOER self-test?

Yes	No
A hard fault is present. GO to **KB18**.	DTC P1235 is possibly intermittent. GO to **KB22**.

KB18 CHECK THE FP CIRCUIT FOR AN OPEN IN THE HARNESS

- FPDM connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) FPDM Connector, Harness Side
FP - Pin B12	FP - Pin 6

Is the resistance less than 5 ohms?

Yes	No
GO to **KB19**.	REPAIR the open circuit.

KB19 CHECK THE FP CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
FP - Pin 6	Ground

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **KB20**.	REPAIR the short circuit to PWR.

KB20 CHECK THE FP CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-)
FP - Pin 6	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to **KB21**.	REPAIR the short circuit to GND.

KB21 CHECK THE FP CIRCUIT IN THE FPDM

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- FPDM connector connected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
FP - Pin B12	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to **KB37**.	INSTALL a new FPDM.

KB22 CHECK FOR AN INTERMITTENT OPEN IN THE FP CIRCUIT

- Key in OFF position.
- FPDM connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-) PCM Connector, Harness Side
FP - Pin 6	FP - Pin B12

- Observe the DMM for an indication of a fault while completing the following. (Note that resistance changes suddenly when a fault is detected).
- Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module.

Is a fault indicated?

Yes	No
ISOLATE the fault and REPAIR as necessary.	GO to **KB23**.

KB23 CHECK FOR AN INTERMITTENT SHORT TO POWER IN THE FP CIRCUIT

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-) Vehicle Battery
FP - Pin 6	Negative terminal

- Observe the DMM for an indication of a fault while completing the following. (Note that voltage changes suddenly when a fault is detected).
- Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module.

Is a fault indicated?

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Yes	No
ISOLATE the fault and REPAIR as necessary.	GO to **KB24**.

KB24 CHECK FOR AN INTERMITTENT SHORT TO GROUND IN THE FP CIRCUIT

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

(+) FPDM Connector, Harness Side	(-)
FP - Pin 6	Ground

- Observe the DMM for an indication of a fault while completing the following. (Note that resistance changes suddenly when a fault is detected).
- Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module.

Is a fault indicated?

Yes	No
ISOLATE the fault and REPAIR as necessary.	Unable to duplicate or identify the fault at this time. GO to Pinpoint Test **Z**.

KB25 DTC P1237: IS DTC P1237 PRESENT IN THE KOEO OR KOER SELF-TEST?

Is DTC P1237 present in the KOEO or KOER self-test?

Yes	No
A hard fault is present. GO to **KB26**.	DTC P1237 is possibly intermittent. GO to **KB35**.

KB26 DOES THE ENGINE START?

Does the engine start?

Yes	No
GO to **KB33**.	GO to **KB27**.

KB27 CHECK FPPWR, FPRTN, AND INTERNAL FUEL PUMP CIRCUIT RESISTANCE

- FPDM connector disconnected.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-) FPDM Connector, Harness Side
FPPWR - Pin 4	FPRTN - Pin 2

Is the resistance less than 10 ohms?

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Yes	No
GO to **KB28**.	An open secondary circuit exists. GO to **KB31**.

KB28 CHECK THE FPRTN CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
FPRTN - Pin 2	Ground

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **KB29**.	REPAIR the short circuit to PWR.

KB29 CHECK THE FPPWR CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-)
FPPWR - Pin 4	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to **KB30**.	REPAIR the short circuit to GND.

KB30 CHECK FOR VOLTAGE TO THE FP

NOTE: During Output Test Mode, the fuel pump stays commanded on for only about 5 seconds.

- FP connector disconnected.
- FPDM connector connected.
- Key ON, engine OFF.
- Enter output test mode. Refer to **OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Measure the voltage between:

(+) FP Connector, Harness Side	(-) FP Connector, Harness Side
FPPWR	FPRTN

Is the voltage greater than 10 V?

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Yes	No
INSTALL a new FP.	VERIFY the vehicle battery was at a proper charge during the test. VERIFY the pump ON command did not time out before the voltage check was made. If OK, INSTALL a new FPDM.

KB31 ISOLATE THE OPEN IN THE FP CIRCUIT

- FP connector disconnected.
- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-) FP Connector, Harness Side
FPPWR - Pin 4	FPPWR
FPRTN - Pin 2	FPRTN

Are the resistances less than 5 ohms?

Yes	No
GO to **KB32**.	REPAIR the open circuit.

KB32 CHECK THE FUEL PUMP

- Measure the resistance between:

(+) FP Connector, Harness Side	(-) FP Connector, Harness Side
FPPWR	FPRTN

Is the resistance less than 10 ohms?

Yes	No
Unable to duplicate or identify the fault at this time. VERIFY the results of the previous test steps.	INSTALL a new FP.

KB33 CHECK THE FPPWR CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- FPDM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-)
FPPWR - Pin 4	Ground

Is the voltage less than 1 V?

Yes	No

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Key in OFF position. GO to **KB34**.	REPAIR the short circuit to PWR.

KB34 CHECK THE FPRTN CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) FPDM Connector, Harness Side	(-)
FPRTN - Pin 2	Ground

Is the resistance greater than 10K ohms?

Yes	No
INSTALL a new FPDM.	REPAIR the short circuit to GND.

KB35 CHECK FOR AN INTERMITTENT OPEN OR SHORT IN THE FPPWR AND FPRTN CIRCUITS

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

(+) FPDM Connector, Harness Side	(-) FPDM Connector, Harness Side
FPPWR - Pin 4	FPRTN - Pin 2

- Observe the DMM for an indication of a fault while completing the following. (Note that resistance changes suddenly when a fault is detected).
- Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module.

Is a fault indicated?

Yes	No
ISOLATE the fault and REPAIR as necessary.	GO to **KB36**.

KB36 CHECK FOR AN INTERMITTENT SHORT TO POWER IN THE FPRTN CIRCUIT

- Key ON, engine OFF.
- Measure the voltage between:

(+) FPDM Connector, Harness Side	(-) Vehicle Battery
FPRTN - Pin 2	Negative terminal

- Observe the DMM for an indication of a fault while completing the following. (Note that voltage changes suddenly when a fault is detected).
- Wiggle, shake, and bend small sections of the wiring harness while working from the component to the module.

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Is a fault indicated?

Yes	No
ISOLATE the fault and REPAIR as necessary.	Unable to duplicate or identify the fault at this time. GO to Pinpoint Test **Z**.

KB37 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KD: ELECTRIC EXHAUST GAS RECIRCULATION (EEGR) SYSTEM

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE

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IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

Important Safety Notice

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This pinpoint test is intended to diagnose the following:

- Electric exhaust gas recirculation (EEGR) system.
- EEGR stepper motor (9D475).
- Harness circuit: EEGR.
- Powertrain control module (PCM) (12A650).

Fig. 83: Electric Exhaust Gas Recirculation (EEGR) Assembly Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 84: Identifying Manifold Absolute Pressure (MAP) Sensor Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 85: Identifying Powertrain Control Module (PCM) Connector Terminal
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

KD1 DTCS P0400, P0403 AND P1408: EGR CONTROL CIRCUIT - CHECK THE CONNECTION OF THE EEGR HARNESS CONNECTOR TO THE EEGR

NOTE: If the DTC is intermittent, wiggle the harness and connectors when taking measurements.

- Check the connection of the EEGR harness connector to the EEGR.

Are the connector contacts clean and correctly seated?

Yes	No
GO to **KD2**.	REPAIR as necessary.

KD2 CHECK FOR VPWR AT THE EEGR HARNESS CONNECTOR

- Key ON, engine OFF.
- EEGR Assembly connector disconnected.

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- Measure the voltage between:

(+) EEGR Assembly Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 2, 5	Negative terminal

Are the voltages greater than 10.5 volts?

Yes	No
GO to **KD3**.	Key in OFF position. REPAIR the open circuit.

KD3 CHECK THE EEGR CIRCUIT(S) FOR AN OPEN IN THE HARNESS

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

(+) EEGR Assembly Connector, Harness Side	(-) PCM Connector, Harness Side
EGRMC1 - Pin 1	EGRMC1 - Pin E4
EGRMC2 - Pin 3	EGRMC2 - Pin E15
EGRMC3 - Pin 4	EGRMC3 - Pin E5
EGRMC4 - Pin 6	EGRMC4 - Pin E16

Are the resistances less than 5 ohms?

Yes	No
GO to **KD4**.	REPAIR the open circuit.

KD4 CHECK THE EEGR CIRCUIT(S) FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) EEGR Assembly Connector, Harness Side	(-) Vehicle Battery
EGRMC1 - Pin 1	Negative terminal
EGRMC2 - Pin 3	Negative terminal
EGRMC3 - Pin 4	Negative terminal
EGRMC4 - Pin 6	Negative terminal

Are the resistances greater than 10K ohms?

Yes	No
GO to **KD5**.	REPAIR the short circuit to GND.

KD5 CHECK FOR SHORTS BETWEEN CIRCUITS IN THE EEGR HARNESS

- Measure the resistance between:

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(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
EGRMC3 - Pin E5	EGRMC1 - Pin E4
EGRMC3 - Pin E5	EGRMC2 - Pin E15
EGRMC3 - Pin E5	EGRMC4 - Pin E16
EGRMC1 - Pin E4	EGRMC2 - Pin E15
EGRMC1 - Pin E4	EGRMC4 - Pin E16
EGRMC2 - Pin E15	EGRMC4 - Pin E16

Are the resistances greater than 10K ohms?

Yes	No
GO to **KD6**.	REPAIR the short circuit.

KD6 CHECK THE EEGR CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) EEGR Assembly Connector, Harness Side	(-) Vehicle Battery
EGRMC1 - Pin 1	Negative terminal
EGRMC2 - Pin 3	Negative terminal
EGRMC3 - Pin 4	Negative terminal
EGRMC4 - Pin 6	Negative terminal

Are the voltages less than 1 V?

Yes	No
GO to **KD7**.	REPAIR the short circuit to PWR.

KD7 CHECK THE EEGR COILS FOR AN OPEN

- Key in OFF position.
- EEGR Assembly connector connected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
EGRMC1 - Pin E4	VPWR - Pin B35, B36
EGRMC2 - Pin E15	VPWR - Pin B35, B36
EGRMC3 - Pin E5	VPWR - Pin B35, B36
EGRMC4 - Pin E16	VPWR - Pin B35, B36

Are the resistances between 15 ohms - 24 ohms?

Yes	No
GO to **KD8**.	INSTALL a new EEGR assembly.

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KD8 CHECK THE EEGR FOR SHORTS TO GROUND

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
EGRMC1 - Pin E4	Negative terminal
EGRMC2 - Pin E15	Negative terminal
EGRMC3 - Pin E5	Negative terminal
EGRMC4 - Pin E16	Negative terminal

Are the resistances greater than 1K ohms?

Yes	No
For DTCs P0400 or P1408, GO to **KD9**.	INSTALL a new EEGR assembly.

KD9 CHECK FOR STUCK OR STICKY EGR VALVE OPERATION BY COMPARING ACTUAL MAP VOLTAGE TO MAP_V PID VOLTAGE

NOTE: Repair DTCs P0102, P0103, P0107, P0108, P1100, and P1101 first, if present.

- Key in OFF position.
- MAP Sensor connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A MAP Sensor Connector, Harness Side	Point B MAP Sensor Connector, Component Side
VREF - Pin 2	VREF - Pin 2
SIGRTN	SIGRTN

- Key ON, engine running.
- Measure the voltage between:

(+) MAP Sensor Connector, Component Side	(-) Vehicle Battery
MAP - Pin 1	Negative terminal

Is the voltage between 1 V - 2 V?

Yes	No
Note the actual MAP voltage values at KOEO, idle, 1,000 and 2,000 RPM. You will use the values for comparison in the following test step. GO to **KD10**.	Key in OFF position. CHECK the MAP harness for open and short circuits.

KD10 COMPARE THE ACTUAL MAP VOLTAGE TO THE MAP_V PID VOLTAGE EGR

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- Key ON, engine OFF.
- Access the PCM and monitor the MAP_V PID.
- Note the MAP_V PID voltage.
- Start the engine using the engine running diagnostic mode. Refer to **DIAGNOSTIC MODES** .
- Note the MAP_V PID voltage.
- Increase engine speed to 1,000 RPM.
- Note the MAP_V PID voltage.
- Increase engine speed to 2,000 RPM.
- Note the MAP_V PID voltage.

Does the MAP_V PID voltage stay within 0.5 volt of the actual MAP voltage?

Yes	No
Key in OFF position. The concern is not present at this time. VERIFY the MAP is correctly seated and the vacuum source is not blocked.	Key in OFF position. GO to **KD11**.

KD11 CARRY OUT THE KOER ON DEMAND SELF-TEST

Does DTC P1408 reappear?

Yes	No
INSTALL a new EEGR assembly.	The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

PINPOINT TEST KF: FAN CONTROL (FC)

INTRODUCTION

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HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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This pinpoint test is intended to diagnose the following:

- Low fan control (LFC), medium fan control (MFC), high fan control (HFC) relays.
- Harness circuits: HFC, LFC, MFC, VPWR.
- Powertrain control module (PCM) (12A650).

Three Speed Fan Operation

Although the PCM output circuits are called low, medium, and high fan control (FC), cooling fan operation is controlled by a combination of these outputs.

Refer to **POWERTRAIN CONTROL MODULE (PCM) OUTPUTS** .

Fig. 86: Identifying Low Fan Control (LFC) Relay Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 87: Identifying Medium Fan Control (MFC) Relay Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 88: Identifying High Fan Control (HFC) Relay Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 89: Identifying Left Fan Motor Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 90: Identifying Right Fan Motor Connector
Courtesy of FORD MOTOR CO.

Fig. 91: Identifying Powertrain Control Module (PCM) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

KF1 DTCS P0480, P0481 AND P0482: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during PCM or TCM self-test: P0480, P0481, or P0482?

Yes	No
For KOEO and KOER DTC P0480, GO to **KF2**. For KOEO and KOER DTC P0481, GO to **KF12**. For KOEO and KOER DTC P0482, GO to **KF7**. For continuous memory DTC P0480, GO to **KF17**. For continuous memory DTC P0481, GO to **KF19**. For continuous memory DTC P0482, GO to **KF21**.	Symptom diagnostics are required. For cooling fan always runs: GO to **KF23**. For cooling fan does not operate: GO to **KF26**.

KF2 KOEO AND KOER DTC P0480: CHECK THE VPWR VOLTAGE TO LOW SPEED FC RELAY

- LFC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) LFC Relay Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 2	Negative terminal

Is the voltage greater than 10.5 V?

Yes	No
GO to **KF3**.	REPAIR the open circuit.

KF3 CHECK FOR LFC CIRCUIT CYCLING

NOTE: During KOEO on demand self-test, the LFC circuit will be cycled on and off.

- Connect a non-powered test lamp between:

(+) LFC Relay Connector, Harness Side	(-) LFC Relay Connector, Harness Side
VPWR - Pin 2	LFC - Pin 1

- Carry out the PCM KOEO on demand self-test.

Does the test lamp illuminate on and off during the KOEO on demand self-test?

Yes	No
INSTALL a new LFC relay.	Key in OFF position. REMOVE the test lamp. GO to **KF4**.

KF4 CHECK THE LFC CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

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- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) LFC Relay Connector, Harness Side	(-) Vehicle Battery
LFC - Pin 1	Negative terminal

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **KF5**.	REPAIR the short circuit.

KF5 CHECK THE LFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) LFC Relay Connector, Harness Side	(-) Vehicle Battery
LFC - Pin 1	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **KF6**.	REPAIR the short circuit.

KF6 CHECK THE LFC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) LFC Relay Connector, Harness Side	(-) PCM Connector, Harness Side
LFC - Pin 1	LFC - Pin B38

Is the resistance less than 5 ohms?

Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	REPAIR the open circuit.

KF7 KOEO AND KOER DTC P0482: CHECK THE VPWR VOLTAGE TO MEDIUM SPEED FC RELAY

- MFC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

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(+) MFC Relay Connector, Harness Side	(-)
VPWR - Pin 2	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to **KF8**.	REPAIR the open circuit.

KF8 CHECK FOR MFC CIRCUIT CYCLING

NOTE: During KOEO on demand self-test, the MFC circuit will be cycled on and off.

- Connect a non-powered test lamp between:

(+) MFC Relay Connector, Harness Side	(-) MFC Relay Connector, Harness Side
VPWR - Pin 2	MFC - Pin 1

- Carry out the PCM KOEO on demand self-test.

Does the test lamp illuminate on and off during the KOEO on demand self-test?

Yes	No
INSTALL a new MFC relay.	Key in OFF position. REMOVE the test lamp. GO to **KF9**.

KF9 CHECK THE MFC CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MFC Relay Connector, Harness Side	(-)
MFC - Pin 1	Ground

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **KF10**.	REPAIR the short circuit.

KF10 CHECK THE MFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) MFC Relay Connector, Harness Side	(-)

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MFC - Pin 1	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to **KF11**.	REPAIR the short circuit.

KF11 CHECK THE MFC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) MFC Relay Connector, Harness Side	(-) PCM Connector, Harness Side
MFC - Pin 1	MFC - Pin B33

Is the resistance less than 5 ohms?

Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	REPAIR the open circuit.

KF12 KOEO AND KOER DTC P0481: CHECK THE VPWR VOLTAGE TO THE HIGH SPEED FC RELAY

- HFC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HFC Relay Connector, Harness Side	(-)
VPWR - Pin 2	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to **KF13**.	REPAIR the open circuit.

KF13 CHECK FOR HFC CIRCUIT CYCLING

NOTE: During KOEO on demand self-test, the HFC circuit will be cycled on and off.

- Connect a non-powered test lamp between:

(+) HFC Relay Connector, Harness Side	(-) HFC Relay Connector, Harness Side
VPWR - Pin 2	HFC - Pin 1

- Carry out the KOEO on demand self-test.

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Does the test lamp illuminate on and off during the KOEO on demand self-test?

Yes	No
INSTALL a new HFC relay.	REMOVE the test lamp. GO to **KF14**.

KF14 CHECK THE HFC CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HFC Relay Connector, Harness Side	(-) Vehicle Battery
HFC - Pin 1	Negative terminal

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **KF15**.	REPAIR the short circuit.

KF15 CHECK THE HFC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) HFC Relay Connector, Harness Side	(-) Vehicle Battery
HFC - Pin 1	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **KF16**.	REPAIR the short circuit.

KF16 CHECK THE HFC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) HFC Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC - Pin 1	HFC - Pin B37

Is the resistance less than 5 ohms?

Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	REPAIR the open circuit.

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KF17 CONTINUOUS MEMORY DTC P0480: CHECK THE LFC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO POWER

- A/C and defrost off.
- Left Fan Motor connector disconnected.
- Right Fan Motor connector disconnected.
- Connect a non-powered test lamp between:

(+) Left Fan Motor Connector, Harness Side	(-) Left Fan Motor Connector, Harness Side
LSFAN PWR - Pin 2	GND - Pin 3

- Key ON, engine OFF.
- Enter output test mode. Refer to **OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Observe the test lamp for an indication of a fault while carrying out the following. Note that the lamp turns off when a fault is detected.
  - Shake, wiggle, and bend the LFC circuit(s).
  - Shake, wiggle, and bend the VPWR circuit to the LFC relay.
  - Lightly tap on the low speed FC relay to simulate road shock.

Is a fault indicated?

Yes	No
ISOLATE the fault and REPAIR as necessary.	GO to **KF18**.

KF18 CHECK THE LFC CIRCUIT FOR AN INTERMITTENT SHORT TO GROUND

- Key ON, engine OFF.
- Command the outputs OFF.
- Observe the test lamp for an indication of a fault while completing the following. Note that the lamp turns on when a fault is detected.
  - Shake, wiggle, and bend the LFC circuit(s).
  - Lightly tap on the LFC RLY to simulate road shock.

Is a fault indicated?

Yes	No
ISOLATE the fault and REPAIR as necessary.	Key in OFF position. Unable to duplicate or identify the fault at this time. GO to Pinpoint Test **Z**.

KF19 CONTINUOUS MEMORY DTC P0481: CHECK THE HFC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO POWER

- A/C and defrost off.

- Left Fan Motor connector disconnected.
- Right Fan Motor connector disconnected.
- Connect a non-powered test lamp between:

(+) Right Fan Motor Connector, Harness Side	(-) Right Fan Motor Connector, Harness Side
HSFAN PWR - Pin 1	GND - Pin 3

- Key ON, engine OFF.
- Enter output test mode. Refer to **OUTPUT TEST MODE (OTM)** .
- Command the high speed fan ON.
- Observe the test lamp for an indication of a fault while completing the following. Note that the lamp turns when a fault is detected.
  - Shake, wiggle, and bend the HFC circuit(s).
  - Shake, wiggle, and bend the VPWR circuit to the HFC relay.
  - Lightly tap on the High Speed FC relay to simulate road shock.

Is a fault indicated?

Yes	No
ISOLATE the fault and REPAIR as necessary.	GO to **KF20**.

KF20 CHECK THE HFC CIRCUIT FOR AN INTERMITTENT SHORT TO GROUND

- Key ON, engine OFF.
- Command the outputs OFF.
- Observe the test lamp for an indication of a fault while completing the following. Note that the lamp turns on when a fault is detected.
- Shake, wiggle, and bend the HFC circuit(s).

Is a fault indicated?

Yes	No
ISOLATE the fault and REPAIR as necessary.	Key in OFF position. Unable to duplicate or identify the fault at this time. GO to Pinpoint Test **Z**.

KF21 CONTINUOUS MEMORY DTC P0482: CHECK THE MFC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO POWER

- A/C and defrost off.
- Left Fan Motor connector disconnected.
- Right Fan Motor connector disconnected.
- Connect a non-powered test lamp between:

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(+) Right Fan Motor Connector, Harness Side	(-) Right Fan Motor Connector, Harness Side
MSFAN PWR - Pin 2	GND - Pin 3

- Key ON, engine OFF.
- Enter output test mode. Refer to **OUTPUT TEST MODE (OTM)** .
- Command the low speed fan ON.
- Observe the test lamp for an indication of a fault while carrying out the following. Note that the lamp turns off when a fault is detected.
  - Shake, wiggle, and bend the MFC circuit(s).
  - Shake, wiggle, and bend the VPWR circuit to the MFC relay.
  - Medium Speed FC relay Low Speed FC relay.

Is a fault indicated?

Yes	No
ISOLATE the fault and REPAIR as necessary.	GO to **KF22**.

KF22 CHECK THE MFC CIRCUIT FOR AN INTERMITTENT SHORT TO GROUND

- Key ON, engine OFF.
- Command the outputs OFF.
- Observe the test lamp for an indication of a fault while completing the following. Note that the lamp turns off when a fault is detected.
- Shake, wiggle, and bend the MFC circuit(s).

Is a fault indicated?

Yes	No
ISOLATE the fault and REPAIR as necessary.	Key in OFF position. Unable to duplicate or identify the fault at this time. GO to Pinpoint Test **Z**.

KF23 COOLING FAN ALWAYS RUNS (NO DTCS): VERIFY THE FAN IS NOT ON BECAUSE OF A/C HIGH PRESSURE SWITCH INPUT TO THE PCM

- Key ON, engine running.
- Access the PCM and monitor the ACP PID.

Is the PID state CLOSED?

Yes	No
Key in OFF position. The PCM will turn the fan on when the medium pressure, normally open contacts of the ACHP	Input OK GO to **KF26**.

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switch are closed. GO to **KF24**.	

KF24 CHECK THE A/CHPSW (MEDIUM PRESSURE, NORMALLY OPEN CONTACTS)

- A/CHPSW connector disconnected.
- Key ON, engine OFF.
- Access the PCM and monitor the ACP PID.

Is the PID state CLOSED?

Yes	No
Key in OFF position. GO to **KF25**.	Key in OFF position. RECONNECT A/CHPSW. REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS - HYBRID** to diagnose the over pressurized A/C system. If OK, INSTALL a new A/CHPSW.

KF25 CHECK THE A/CPSW CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) A/CHPSW Connector, Harness Side	(-)
A/CPSW	Ground

Is the resistance greater than 10K ohms?

Yes	No
Verify the results of the previous test steps. RETURN to **SYMPTOM CHARTS** to continue diagnosis. If OK, INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	REPAIR the short circuit to GND.

KF26 CHECK THE VPWR VOLTAGE TO LOW SPEED FC RELAY

- LFC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) LFC Relay Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 2	Negative terminal

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Is the voltage greater than 10.5 V?

Yes	No
GO to **KF27**.	REPAIR the open circuit.

KF27 CHECK FOR LFC CIRCUIT CYCLING

NOTE: During KOEO on demand self-test, the LFC circuit will be cycled on and off.

- Connect a non-powered test lamp between:

(+) LFC Relay Connector, Harness Side	(-) LFC Relay Connector, Harness Side
VPWR - Pin 2	LFC - Pin 1

- Carry out the PCM KOEO on demand self-test.

Does the test lamp illuminate on and off during the KOEO on demand self-test?

Yes	No
GO to **KF28**.	Key in OFF position. REMOVE the test lamp. GO to **KF4**.

KF28 CHECK THE VPWR VOLTAGE TO MEDIUM SPEED FC RELAY

- Key in OFF position.
- MFC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) MFC Relay Connector, Harness Side	(-)
VPWR - Pin 2	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to **KF29**.	REPAIR the open circuit.

KF29 CHECK FOR MFC CIRCUIT CYCLING

NOTE: During KOEO on demand self-test, the MFC circuit will be cycled on and off.

- Connect a non-powered test lamp between:

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(+) MFC Relay Connector, Harness Side	(-) MFC Relay Connector, Harness Side
VPWR - Pin 2	MFC - Pin 1

- Carry out the PCM KOEO on demand self-test.

Does the test lamp illuminate on and off during the KOEO on demand self-test?

Yes	No
GO to **KF30**.	Key in OFF position. REMOVE the test lamp. GO to **KF9**.

KF30 CHECK THE VPWR VOLTAGE TO HIGH SPEED FC RELAY

- Key in OFF position.
- HFC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) HFC Relay Connector, Harness Side	(-)
VPWR - Pin 2	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to **KF31**.	REPAIR the open circuit.

KF31 CHECK FOR HFC CIRCUIT CYCLING

NOTE: During KOEO on demand self-test, the HFC circuit will be cycled on and off.

- Connect a non-powered test lamp between:

(+) HFC Relay Connector, Harness Side	(-) HFC Relay Connector, Harness Side
VPWR - Pin 2	HFC - Pin 1

- Carry out the KOEO on demand self-test.

Does the test lamp illuminate on and off during the KOEO on demand self-test?

Yes	No
The PCM primary FC circuits are OK. REFER to **COMPONENT TESTING** to check the relay(s). INSTALL a new FC relay if necessary. To check the secondary FC circuits,	REMOVE the test lamp. GO to **KF14**.

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REFER to **ENGINE COOLING - HYBRID** .

PINPOINT TEST KG: FUEL INJECTOR

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

Important Safety Notice

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This article provides general directions for repairing vehicles with tested, effective techniques. Following them will help ensure reliability. There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles, as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

This pinpoint test is intended to diagnose the following:

- fuel injector(s) (9F593).
- harness circuits: VPWR and INJ 1 - 4.
- powertrain control module (PCM) (12A650).

Fig. 92: Identifying Fuel Injector Connector Terminal
Courtesy of FORD MOTOR CO.

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

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Fig. 93: Identifying Powertrain Control Module (PCM) Connector Terminal
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

KG1 DTCS P0201 THROUGH P0204: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during the PCM self-test: P0201 through P0204?

Yes	No
For DTCs P0201 through P0204, GO to **KG2**.	For all others, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

KG2 CHECK THE VPWR CIRCUIT FOR AN OPEN IN THE HARNESS

NOTE: Disconnect the suspect fuel injector harness connector. Only the suspect injector needs to be diagnosed.

- Key in OFF position.
- Fuel Injector connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) Fuel Injector Connector, Harness Side	(-)
VPWR - Pin 2	Ground

Is the voltage greater than 10 V?

Yes	No
GO to **KG3**.	REPAIR the open circuit.

KG3 CHECK THE SUSPECT INJ CIRCUIT FOR AN OPEN IN THE HARNESS

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

(+) PCM Connector, Harness Side	(-) Fuel Injector Connector, Harness Side
Suspect INJ	INJ - Pin 1

Is the resistance less than 5 ohms?

Yes	No
GO to **KG4**.	REPAIR the open circuit.

KG4 CHECK THE SUSPECT INJ CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

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- Measure the resistance between:

(+) Fuel Injector Connector, Harness Side	(-)
INJ - Pin 1	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to **KG5**.	REPAIR the short circuit.

KG5 CHECK THE SUSPECT INJ CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) Fuel Injector Connector, Harness Side	(-)
INJ - Pin 1	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit.	GO to **KG6**.

KG6 CHECK THE RESISTANCE OF THE SUSPECT FUEL INJECTOR

- Measure the resistance between:

(+) Fuel Injector Connector, Component Side	(-) Fuel Injector Connector, Component Side
VPWR - Pin 2	INJ - Pin 1

Is the resistance between 11 ohms - 18 ohms?

Yes	No
GO to **KG7**.	INSTALL a new fuel injector. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .

KG7 CHECK THE FUNCTIONALITY OF THE SUSPECT INJ CIRCUIT

- Key in OFF position.
- PCM connector connected.
- Key ON, engine OFF.
- Connect a non-powered test lamp between:

(+) Fuel Injector Connector, Harness Side	(-) Fuel Injector Connector, Harness Side

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VPWR - Pin 2	INJ - Pin 1

- Key ON, engine running.

Is the test lamp blinking?

Yes	No
GO to **KG8**.	GO to **KG9**.

KG8 CARRY OUT A THOROUGH WIGGLE TEST ON THE SUSPECT FUEL INJECTOR HARNESS

- Key in OFF position.
- Fuel Injector connector connected.
- Key ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the INJ PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the fuel injector to the PCM.

Are any injector values fluctuating in and out of range?

Yes	No
ISOLATE the fault and REPAIR as necessary.	Unable to duplicate or identify the fault at this time. GO to Pinpoint Test **Z**.

KG9 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KM: A/C CIRCUITS

INTRODUCTION

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WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
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Important Safety Notice

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This article provides general directions for repairing vehicles with tested, effective techniques. Following them will help ensure reliability. There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles, as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

This pinpoint test is intended to diagnose the following:

- Harness circuits: battery positive voltage (B+), vehicle power (VPWR), air conditioning clutch (A/CC), air conditioning clutch power (A/CC PWR), A/CLPCS, A/CHPSW, air conditioning cycling switch (A/CCS).
- Powertrain control module (PCM) (12A650).

Fig. 94: Identifying Air Conditioning Clutch (A/CC) Relay Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 95: Identifying Air Conditioning High Pressure Switch (A/CHPSW) Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 96: Identifying Air Conditioning Refrigerant Distribution Valve (A/CRDV) Solenoid Connector Terminal
Courtesy of FORD MOTOR CO.

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Fig. 97: Identifying Powertrain Control Module (PCM) Connector Terminal
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

KM1 VERIFY THE A/C AND DEFROST WERE OFF DURING THE SELF-TEST

- Verify the A/C and defrost were off during the self-test.

Was the A/C and defrost off during the self-test?

Yes	No
GO to **KM2**.	TURN off the A/C and DEFROST, then REPEAT the self-test.

KM2 DTCS P0645, P1459, P1464, P2515, P2521, P2524 AND P2611: CHECK FOR SELFTEST DTCS

Are any of the following DTCs present during PCM or TCM self-test: P0645, P1459, P1464, P2515, P2521, P2524, or P2611?

Yes	No
For KOEO and KOER DTC P0645, GO to **KM3**. For continuous memory DTC P0645, GO to **KM8**. For KOEO and KOER DTC P1459, GO to **KM10**. For KOEO and KOER DTC P1464, GO to **KM14**. For KOEO and KOER DTC P2515, GO to **KM17**. For KOEO and KOER DTCs P2521 and P2524, GO to **KM19**. For KOEO and KOER DTC P2611, GO to **KM21**. For continuous memory DTC P2611, GO to **KM26**. For continuous memory DTCs P2521 and P2524, GO to **KM28**.	The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

KM3 KOEO AND KOER DTC P0645: CHECK THE VPWR VOLTAGE TO CLUTCH RELAY

- A/CC Relay connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) A/CC Relay Connector, Harness Side	(-)
VPWR - Pin 2	Ground

Is the voltage greater than 10.5 V?

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Yes	No
Key in OFF position. GO to **KM4**.	REPAIR the open circuit.

KM4 CHECK THE A/CC RELAY

- Measure the resistance between either pin 1 or pin 85 and all the other pins of the relay. One measurement must be between 40 and 120 ohms, with the other measurements being greater than 10,000 ohms.

Are all resistance checks OK?

Yes	No
GO to **KM5**.	INSTALL a new A/CC relay.

KM5 CHECK THE A/CC CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) A/CC Relay Connector, Harness Side	(-)
A/CC - Pin 1	Ground

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **KM6**.	REPAIR the short circuit.

KM6 CHECK THE A/CC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) A/CC Relay Connector, Harness Side	(-)
A/CC - Pin 1	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to **KM7**.	REPAIR the short circuit.

KM7 CHECK THE A/CC CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) A/CC Relay Connector, Harness Side	(-) PCM Connector, Harness Side

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A/CC - Pin 1	A/CC - Pin B25

Is the resistance less than 5 ohms?

Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	REPAIR the open circuit.

KM8 CONTINUOUS MEMORY DTC P0645: CHECK THE A/CC CIRCUIT FOR AN INTERMITTENT SHORT TO GROUND

NOTE: The air conditioning clutch clicks on when a fault is detected.

- Key ON, engine OFF.
- Check the A/CC circuit for short to ground while carrying out the following:
  - Shake, wiggle, and bend the A/CC circuit(s).
  - Lightly tap on the Air Conditioning Clutch to simulate road shock.

Is a fault indicated?

Yes	No
Key in OFF position. REPAIR as necessary. CLEAR the DTCs. START the engine. TURN on the A/C. WAIT 15 seconds. TURN off the A/C. REPEAT the self-test. REFER to **SYMPTOM CHARTS** .	GO to **KM9**.

KM9 CHECK THE A/CC CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO POWER

NOTE: The air conditioning clutch clicks off when a fault is detected.

- Key ON, engine OFF.
- Enter output test mode. Refer to **OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Check the A/CC circuit for an open or short to power while carrying out the following:
  - Shake, wiggle, and bend the A/CC circuit(s).
  - Shake, wiggle, and bend the VPWR circuit to the Air Conditioning Clutch relay.
  - Lightly tap on the Clutch relay to simulate road shock.

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Is a fault indicated?

Yes	No
Key in OFF position. REPAIR as necessary. CLEAR the DTCs. START the engine. TURN on the A/C. WAIT 15 seconds. TURN off the A/C. REPEAT the self-test. REFER to **SYMPTOM CHARTS** .	Key in OFF position. Unable to duplicate or identify the fault at this time. GO to Pinpoint Test **Z**.

KM10 KOEO AND KOER DTC P1459: CHECK IGN START/RUN VOLTAGE TO A/C HEATER MODE SWITCH

- A/C Heater Mode Switch connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) A/C Heater Mode Switch Connector, Harness Side	(-)
IGN START/RUN	Ground

Is the voltage greater than 10.5 V?

Yes	No
Key in OFF position. GO to **KM11**.	Key in OFF position. IGN START/RUN circuit fault. CHECK the condition of the related fuse/fuse links. If OK, REPAIR the open circuit. If the fuse/fuse link is damaged, CHECK the circuit for short to ground before replacing.

KM11 CHECK THE A/C HEATER MODE SWITCH

- Carry out the following resistance measurement with the A/C heater mode switch in the OFF, MAX A/C, and A/C RECIRC position.
- Measure the resistance between:

(+) A/C Heater Mode Switch Connector, Component Side	(-) A/C Heater Mode Switch Connector, Component Side
IGN START/RUN	A/CRSW

Is the resistance less than 5 ohms?

Yes	No
GO to **KM12**.	INSTALL a new A/C Heater Mode Switch.

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KM12 CHECK A/CRSW CIRCUIT CONTINUITY

- PCM connector disconnected.
- Measure the resistance between:

(+) A/C Heater Mode Switch Connector, Harness Side	(-) PCM Connector, Harness Side
A/CRSW	A/CRSW - Pin B2

Is the resistance less than 5 ohms?

Yes	No
GO to **KM13**.	REPAIR the open circuit.

KM13 CHECK THE A/CRSW CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) A/C Heater Mode Switch Connector, Harness Side	(-)
A/CRSW	Ground

Is the resistance greater than 10K ohms?

Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	REPAIR the short circuit to GND.

KM14 KOEO AND KOER DTC P1464: VERIFY THE A/C AND DEFROST WERE OFF DURING THE SELF-TEST

- Verify the A/C and defrost were off during the self-test.

Was the A/C and defrost off during the self-test?

Yes	No
GO to **KM15**.	TURN OFF the A/C and DEFROST, then REPEAT the self-test.

KM15 CHECK THE A/C HEATER MODE SWITCH

- A/C Heater Mode Switch connector disconnected.
- Check for self-test DTCs.

Is DTC P1464 present?

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Yes	No
GO to **KM16**.	REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS - HYBRID** to check the operation of the climate control mode switch.

KM16 CHECK THE A/CCS CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
A/CCS - Pin B15	Ground

Is the voltage less than 1 V?

Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	REPAIR the short circuit to PWR.

KM17 KOEO AND KOER DTC P2515: CHECK THE ACP PID WITH THE SWITCH DISCONNECTED

- A/CHPSW connector disconnected.
- Access the PCM and monitor the ACP PID.

Is the PID state CLOSED?

Yes	No
Key in OFF position. GO to **KM18**.	Key in OFF position. REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS - HYBRID** to check A/C refrigerant pressure.

KM18 CHECK THE A/CPSW CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) A/CHPSW Connector, Harness Side	(-)
A/CPSW - Pin 1	Ground

Is the resistance less than 10K ohms?

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Yes	No
REPAIR the short circuit to GND.	INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .

KM19 KOEO AND KOER DTCS P2521 AND P2524: CHECK THE A/C HEATER MODE SWITCH

- A/C Heater Mode Switch connector disconnected.
- Check for self-test DTCs.

Is DTC P2524 present?

Yes	No
GO to **KM20**.	REFER to **CLIMATE CONTROL SYSTEM - GENERAL INFORMATION AND DIAGNOSTICS - HYBRID** to check the operation of the climate control mode switch.

KM20 CHECK THE A/CFDS CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
A/CFDS - Pin B3	Ground

Is the voltage less than 1 V?

Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	REPAIR the short circuit to PWR.

KM21 KOEO AND KOER DTC P2611: CHECK THE VOLTAGE TO A/CRDV

- A/CRDV Solenoid connector disconnected. (also referred to as Passenger A/C Zone Valve)
- Key ON, engine OFF.
- Measure the voltage between:

(+) A/CRDV Solenoid Connector, Harness Side	(-)
VPWR - Pin 1	Ground

Is the voltage greater than 10.5 V?

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Yes	No
Key in OFF position. GO to **KM22**.	REPAIR the open circuit.

KM22 CHECK FOR A/CRDV CIRCUIT CYCLING

- Connect a non-powered test lamp between:

(+) A/CRDV Solenoid Connector, Harness Side	(-) A/CRDV Solenoid Connector, Harness Side
VPWR - Pin 1	A/CRDV - Pin 2

- Enter output test mode. Refer to **OUTPUT TEST MODE (OTM)** .
- Command the outputs ON.
- Enter output test mode. Refer to **OUTPUT TEST MODE (OTM)** .
- Command the outputs OFF.

Does the test lamp illuminate on and off when the output(s) is commanded on and off?

Yes	No
INSTALL a new A/CRDV solenoid.	Key in OFF position. GO to **KM23**.

KM23 CHECK THE A/CRDV CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- PCM connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) A/CRDV Solenoid Connector, Harness Side	(-)
A/CRDV - Pin 2	Ground

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **KM24**.	REPAIR the short circuit to PWR.

KM24 CHECK THE A/CRDV CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) A/CRDV Solenoid Connector, Harness Side	(-)
A/CRDV - Pin 2	Ground

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Is the resistance greater than 10K ohms?

Yes	No
GO to **KM25**.	REPAIR the short circuit to GND.

KM25 CHECK THE A/CRDV CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) A/CRDV Solenoid Connector, Harness Side	(-) PCM Connector, Harness Side
A/CRDV - Pin 2	A/CRDV - Pin T22

Is the resistance less than 5 ohms?

Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	REPAIR the open circuit.

KM26 CONTINUOUS MEMORY DTC P2611: CHECK THE A/CRDV CIRCUIT FOR AN INTERMITTENT OPEN OR SHORT TO GROUND

- Access the PCM and monitor the ACRDV_F PID.
- Check the A/CRDV and VPWR circuit for concern while carrying out the following. Note that a fault is indicated by a sudden change in the ACRDVF PID.
- Shake, wiggle, and bend the ACRDV circuit(s).
- Shake, wiggle, and bend the VPWR circuit(s).

Is a fault indicated?

Yes	No
Key in OFF position. ISOLATE the fault and REPAIR as necessary.	GO to **KM27**.

KM27 CHECK THE A/CRDV CIRCUIT FOR A SHORT TO POWER

- A/CRDV Solenoid connector disconnected.
- Connect a non-powered test lamp between the A/CRDV circuit and ground.
- Key ON, engine OFF.
- Observe the test lamp for an indication of a fault while completing the following. Note that the lamp turns on when a fault is detected.
- Shake, wiggle, and bend the ACRDV circuit(s).

Is a fault indicated?

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Yes	No
ISOLATE the fault and REPAIR as necessary.	Key in OFF position. Unable to duplicate or identify the fault at this time. GO to Pinpoint Test **Z**.

KM28 CONTINUOUS MEMORY DTCS P2521 AND P2524: CHECK THE A/CCS AND A/CFDS CIRCUITS FOR INTERMITTENT FAULTS

- Key ON, engine OFF.
- Access the PCM and monitor the ACCS and ACFDS_P PIDs.
- Check for intermittent circuit failures while carrying out the following (a fault will be indicated by a sudden change in the ACCS and ACFDS_P PID):
- Shake, wiggle, and bend the ACCS and ACFDS_P circuit(s).

Is a fault indicated?

Yes	No
Key in OFF position. ISOLATE the fault and REPAIR as necessary.	Key in OFF position. GO to Pinpoint Test **Z**.

PINPOINT TEST KT: MOTOR ELECTRONICS COOLING PUMP (MECP)

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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CAUTION: When using Output State Control for the MECP, do not leave the pump off for more than 2 minutes with the key ON.

This pinpoint test is intended to diagnose the following:

- MECP relay (14B192)
- Harness circuits: MECP, vehicle power (VPWR)
- Powertrain control module (PCM) (12A650)

Fig. 98: Identifying Motor Electronics Cooling Pump (MECP) Relay Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 99: Identifying Powertrain Control Module (PCM) Connector Terminal
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

KT1 DTC P0A05: VERIFY THE FAULT IS MECP RELATED

NOTE: The DTC P0A05 may be set as the result of the PCM taking a LOS action.

The PCM DTCs P1A0C, P1A0D, and P2105, or P1145 and P2279 present along with P0A05 indicate that actual fault is not MECP related.

Are the PCM DTCs P1A0C, P1A0D, and P2105, or P1145 and P2279 present during self-test?

Yes	No
DTC P0A05 was not set because of MECP related failure. DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	DTC P0A05 was set because of MECP related failure. GO to **KT2**.

KT2 DTC P0A05: VERIFY THAT THE HARD FAULT IS PRESENT

Is DTC P0A05 present in the KOEO or KOER self-test?

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Yes	No
GO to **KT3**.	GO to **KT9**.

KT3 CHECK THE FUNCTIONALITY OF THE MECP CIRCUIT AT THE RELAY

- Key in OFF position.
- MECP Relay connector disconnected.
- Connect a non-powered test lamp between:

(+) Vehicle Battery	(-) MECP Relay Connector, Harness Side
Positive terminal	MECPR - Pin 1

- Key ON, engine OFF.
- Access the PCM and control the MECP PID.
- Cycle the MECP PID on and off.

Does the test lamp turn on and off when output state control is commanded on and off?

Yes	No
GO to **KT4**.	Key in OFF position. GO to **KT6**.

KT4 CHECK THE VPWR VOLTAGE TO THE MECP RELAY

- Measure the voltage between:

(+) MECP Relay Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 2	Negative terminal

Is the voltage greater than 10.5 V?

Yes	No
Key in OFF position. GO to **KT5**.	Key in OFF position. REPAIR the open circuit. CHECK the condition of related fuses/fuse links. If damaged, CHECK the VPWR circuit for a short to ground.

KT5 CHECK THE MECP RELAY RESISTANCE

- Measure the resistance between:

(+) MECP Relay Connector, Component Side	(-) MECP Relay Connector, Component Side
VPWR - Pin 2	MECPR - Pin 1

Is the resistance between 40 - 90 ohms?

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Yes	No
Unable to duplicate or identify the fault at this time. GO to **KT9**.	INSTALL a new MECP relay.

KT6 CHECK THE MECP CIRCUIT FOR A SHORT TO VOLTAGE IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
MECPR - Pin T4	Negative terminal

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **KT7**.	Key in OFF position. REPAIR the short circuit to PWR.

KT7 CHECK THE MECP CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

(+) MECP Relay Connector, Harness Side	(-) PCM Connector, Harness Side
MECPR - Pin 1	MECPR - Pin T4

Is the resistance less than 5 ohms?

Yes	No
GO to **KT8**.	REPAIR the open circuit.

KT8 CHECK THE MECP CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
MECPR - Pin T4	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **KT10**.	REPAIR the short circuit to GND.

KT9 CHECK THE MECP CIRCUIT FOR AN INTERMITTENT CONCERN

- PCM connector connected.

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- MECP Relay connector connected.
- Key ON, engine OFF.
- Access the PCM and control the MECP PID.
- Command the MECP ON.
- Access the PCM and monitor the MECP_F PID.
- Carefully wiggle all accessible wiring and connectors associated with the circuit and look for a change in the PID state.

Is a concern present during the wiggle test?

Yes	No
Key in OFF position. REPAIR as necessary.	Key in OFF position. GO to Pinpoint Test **Z**.

KT10 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST KU: HEATER PUMP CONTROL

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE

TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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This pinpoint test is intended to diagnose the following:

- Heater pump control relay (HPCR) (14B192).
- Harness circuits: HPCR, vehicle power (VPWR).
- Powertrain control module (PCM) (12A650).

Fig. 100: Identifying Heater Pump Control Relay (HPCR) Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 101: Identifying Powertrain Control Module (PCM) Connector Terminal
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

KU1 DTC P2600: VERIFY THAT THE HARD FAULT IS PRESENT

Is DTC P2600 present in the KOEO or KOER self-test?

Yes	No
GO to **KU2**.	GO to **KU8**.

KU2 CHECK THE FUNCTIONALITY OF THE HPCR CIRCUIT AT THE RELAY

- Key in OFF position.
- HPCR connector disconnected.
- Connect a non-powered test lamp between:

(+) Vehicle Battery	(-) HPCR Connector, Harness Side
Positive terminal	HPCR - Pin 2

- Key ON, engine OFF.
- Access the PCM and control the HPCR PID.
- Cycle the HPCR PID on and off.

Does the test lamp illuminate on and off when the HPCR output is commanded on and off?

Yes	No
GO to **KU3**.	Key in OFF position. GO to **KU5**.

KU3 CHECK THE VPWR VOLTAGE TO THE HPCR RELAY

- Measure the voltage between:

(+) HPCR Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 1	Negative terminal

Is the voltage greater than 10.5 V?

Yes	No
Key in OFF position. GO to **KU4**.	Key in OFF position. REPAIR the open circuit. CHECK the condition of related fuses/fuse links. If damaged, CHECK the VPWR circuit for a short to ground.

KU4 CHECK THE HPCR RELAY RESISTANCE

- Measure the resistance between:

(+) HPCR Connector, Component Side	(-) HPCR Connector, Component Side
VPWR - Pin 1	HPCR - Pin 2

Is the resistance between 40 ohms - 90 ohms?

Yes	No
Unable to duplicate or identify the fault at this time. GO to **KU8**.	INSTALL a new HPCR.

KU5 CHECK THE HPCR CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Measure the resistance between:

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(+) PCM Connector, Harness Side	(-) HPCR Connector, Harness Side
HPCR - Pin T23	HPCR - Pin 2

Is the resistance less than 5 ohms?

Yes	No
GO to **KU6**.	REPAIR the open circuit.

KU6 CHECK THE HPCR CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
HPCR - Pin T23	Negative terminal

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **KU7**.	Key in OFF position. REPAIR the short circuit to PWR.

KU7 CHECK THE HPCR CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
HPCR - Pin T23	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **KU9**.	REPAIR the short circuit to GND.

KU8 CHECK THE HPCR CIRCUIT FOR AN INTERMITTENT CONCERN

- PCM connector connected.
- HPCR connector connected.
- Key ON, engine OFF.
- Access the PCM and control the HPCR PID.
- Command the HPCR ON.
- Access the PCM and monitor the HPUMP_F PID.
- Carefully wiggle all accessible wiring and connectors associated with the circuit and look for a change in the PID state.

Is a concern present during the wiggle test?

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Yes	No
Key in OFF position. REPAIR as necessary.	Key in OFF position. GO to Pinpoint Test **Z**.

KU9 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST NC: IGNITION ENGINE SPEED INPUT CIRCUIT

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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This pinpoint test is intended to diagnose the powertrain control module (PCM) (12A650).

TEST PROCEDURE

NC1 CONTINUOUS MEMORY DTC P0320: ERRATIC IGNITION

NOTE: Verify all 2-way radio installations. Carefully follow the manufacturer's installation instructions regarding the routing of the antenna and power leads.

Are any concerns present?

Yes	No
REPAIR as necessary.	GO to **NC2**.

NC2 NO START CONCERN

Is the customer complaint a no start concern?

Yes	No
GO to Pinpoint Test **A**.	GO to **NC3**.

NC3 INTERMITTENT FAULTS

Is this an intermittent concern?

Yes	No
GO to Pinpoint Test **Z**.	GO to Pinpoint Test **JD**.

PINPOINT TEST QA: UNABLE TO ACTIVATE SELF-TEST/NETWORK COMMUNICATION ERROR/DTC P1001

INTRODUCTION

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AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
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This pinpoint test is intended to diagnose the following:

- Harness circuits: high speed CAN(+) High, high speed CAN(-) Low, between the data link connector DLC and Powertrain Control Module (PCM) or (TCM).
- DLC harness circuits: chassis GND, signal GND, 12-volt battery positive B+.
- Open VREF or GND to PCM.
- Open VPWR or GND to TCM.
- KOER DTC P1001.

NOTE: Network connection to other modules depends on vehicle configuration. Refer to SYSTEM WIRING DIAGRAMS for details of this circuit. For complete description and operation information for the entire vehicle module communications network, refer to MODULE COMMUNICATIONS NETWORK .

Fig. 102: Identifying Data Link Connector (DLC)
Courtesy of FORD MOTOR CO.

Fig. 103: Identifying Fuel Rail Pressure/Temperature (FRPT) Sensor Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 104: Identifying Transaxle Assembly-A Connector

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Courtesy of FORD MOTOR CO.

TEST PROCEDURE

QA1 CHECK FOR SELF-TEST DTC P1001

Is PCM DTC P1001 present during self test?

Yes	No
GO to **QA14**.	GO to **QA2**.

QA2 VEHICLE INSPECTION AND VERIFY THE SELF-TEST PROCEDURE

NOTE: This pinpoint test addresses the following concerns:

- **Unable to communicate with the PCM.**
- **Unable to communicate with the TCM.**
- **Unable to activate the PCM self-test.**
- **Unable to activate the TCM self-test.**
- **Diagnostic tool communication concern.**

Possible causes:

- Damaged DLC.
- Incorrect self-test procedure.
- Open DLC harness circuit.
- Short in the DLC harness circuit or associated modules.
- Damaged power or ground circuits to the PCM or TCM.
- Damaged PCM.
- Damaged TCM.

If the self-test or communication concern only occurred after a failed or aborted module reprogram, the module may be blank. If this is the case, try reprogramming the module again before continuing with this pinpoint test.

Visually inspect the following for obvious signs of electrical damage:

- Power distribution box fuses.
- Smart junction box fuses.
- Harness wiring.
- Electrical connections.

Repair/Install a new component as necessary.

Verify the correct procedure is used to activate the self-test for the diagnostic tool. Refer to **DIAGNOSTIC**

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METHODS .

Was the correct self-test procedure used?

Yes	No
Key in OFF position. GO to **QA3**.	Key in OFF position. Correct procedure was not used for activating the Self-Test. RETURN to **STEP 1: POWERTRAIN CONTROL MODULE (PCM) / TRANSAXLE CONTROL MODULE (TCM) QUICK TEST** , and CARRY OUT the self-test using the correct procedure.

QA3 INSPECT THE VEHICLE AND DIAGNOSTIC TOOL DLC FOR DAMAGE

- Disconnect the diagnostic tool.
- Inspect the vehicle and diagnostic tool DLC for damage.

Are there any concerns with the wiring or the DLC connection?

Yes	No
REPAIR as necessary.	GO to **QA4**.

QA4 CHECK THE B+ VOLTAGE TO THE DATA LINK CONNECTOR (DLC)

- Measure the voltage between:

(+) DLC, Harness Side	(-) Vehicle Battery
B+ - Pin 16	Negative terminal

Is the voltage greater than 10.5 volts?

Yes	No
GO to **QA5**.	REPAIR the open circuit.

QA5 CHECK THE DLC CHASSIS GROUND CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the voltage between:

(+) DLC, Harness Side	(-) DLC, Harness Side
B+ - Pin 16	CHGND - Pin 4

Is the voltage greater than 10.5 volts?

Yes	No
GO to **QA6**.	REPAIR the open circuit.

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QA6 CHECK THE DLC SIGNAL GROUND CIRCUIT FOR AN OPEN IN THE HARNESS

- Measure the voltage between:

(+) DLC, Harness Side	(-) DLC, Harness Side
B+ - Pin 16	SIGGND - Pin 5

Is the voltage greater than 10.5 volts?

Yes	No
GO to **QA7**.	REPAIR the open circuit.

QA7 CARRY OUT THE DATA LINK DIAGNOSTICS TEST

NOTE: The purpose of this test step is to determine if the diagnostic tool can communicate to the PCM by using the data link diagnostic function on the diagnostic tool. The data link diagnostic pings each module on the network and looks for a reply. If a PCM communication error message is encountered possible causes are:

- **Loss or intermittent loss of power or ground to the PCM.**
- **PCM to network communication problems (open or shorted data link (+) or (-) circuit from the PCM to the rest of the network modules or DLC).**

NOTE: A typical PCM communication error message is No response/Not equipped.

- Key ON, engine OFF.
- Carry out the data link diagnostics test.

Are there any PCM network error messages?

Yes	No
Key in OFF position. GO to **QA8**.	PCM test passed. GO to **QA9**.

QA8 CHECK THE VREF VOLTAGE TO THE FRPT SENSOR

NOTE: This test step determines if the PCM has power and ground.

- FRPT Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) FRPT Sensor Connector, Harness Side	(-) FRPT Sensor Connector, Harness Side
VREF - Pin 2	SIGRTN - Pin 4

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Is the voltage reading between 4 and 6 volts?

Yes	No
PCM has power and ground. REFER to **MODULE COMMUNICATIONS NETWORK** to diagnose the module communications network.	GO to Pinpoint Test **C**.

QA9 CHECK FOR TCM NETWORK ERROR MESSAGES

NOTE: A typical TCM communication error message is No response/Not equipped.

- Using the previous data link diagnostic results. Check for TCM communication error messages.

Are there any TCM network error messages?

Yes	No
GO to **QA10**.	TCM test passed. GO to **QA13**.

QA10 CHECK THE TCM MODULE FOR POWER

- Key in OFF position.
- Transaxle Assembly-A connector disconnected.
- Measure the voltage between:

(+) Transaxle Assembly-A Connector, Harness Side	(-) Vehicle Battery
B+ - Pin 12	Negative terminal

Is the voltage greater then 10.5 volts?

Yes	No
GO to **QA11**.	REPAIR the open circuit.

QA11 CHECK THE TCM FOR GROUND

- Measure the resistance between:

(+) Transaxle Assembly-A Connector, Harness Side	(-) Vehicle Battery
GND - Pin 2, 8	Negative terminal
GND - Pin 2, 8	Negative terminal

Is the resistance less then 5 ohms?

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Yes	No
GO to **QA12**.	REPAIR the open circuit.

QA12 CHECK THE VPWR FROM THE POWER SUSTAIN RELAY

- Key ON, engine OFF.
- Measure the voltage between:

(+) Transaxle Assembly-A Connector, Harness Side	(-) Vehicle Battery
PSR - Pin 4, 5	Negative terminal

Is the voltage above 10.5 volts .

Yes	No
TCM has power and ground. REFER to **MODULE COMMUNICATIONS NETWORK** to diagnose the module communications network.	REPAIR the open circuit.

QA13 CHECK THE OTHER MODULES FOR NETWORK ERROR MESSAGES

NOTE: Ignore optional equipment modules communication errors unless the module is related to the symptom being diagnosed.

- Using the previous data link diagnostic results. Check the other ECUs for communication error messages.

Are there any communications network error messages?

Yes	No
REFER to **MODULE COMMUNICATIONS NETWORK** to diagnose the module communications network.	Test complete. RETURN to **SYMPTOM CHARTS** to continue diagnosis.

QA14 KOER DTC P1001: KOER NOT ABLE TO COMPLETE. KOER ABORTED

- Verify the correct procedure is used to activate the self-test for the diagnostic tool. Refer to **DIAGNOSTIC METHODS** .

Is the correct self-test procedure used?

Yes	No
GO to **QA15**.	The correct procedure was not used for activating the Self-Test. RETURN to **STEP 1: POWERTRAIN CONTROL MODULE (PCM) / TRANSAXLE CONTROL MODULE (TCM) QUICK TEST** ,

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	and CARRY OUT the self-test using the correct procedure.

QA15 CHECK FOR ANY OTHER KOER DTCS

Are there any other KOER DTCs present?

Yes	No
If you are here for P1001 and other KOER DTCs are present, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** for pinpoint test direction. REPAIR the other DTCs first.	GO to **QA16**.

QA16 CHECK FOR ANY OTHER PCM DTCS

Are there any other PCM DTCs present?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **STEP 2: NO DIAGNOSTIC TROUBLE CODE (DTC) PRESENT SYMPTOM CHART INDEX** for direction to the proper Step 3 Symptom Chart.

PINPOINT TEST QB: KEEP ALIVE POWER

INTRODUCTION

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This pinpoint test is intended to diagnose the following:

- Battery terminal condition.
- Keep alive power (KAPWR) wire routing.
- Harness circuit: KAPWR.
- Powertrain control module (PCM) (12A650).

Fig. 105: Identifying Powertrain Control Module (PCM) Connector Terminal
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

QB1 DTCS P0603 AND P1633: CHECK THE 12 VOLT BATTERY TERMINALS

NOTE: If KAPWR is interrupted to the PCM because of a battery or PCM disconnect, a DTC can be generated on the first power-up.

- Inspect the 12 volt battery cables for loose connections and for corrosion.

Are the 12 volt battery terminal connections in good condition?

Yes	No
Key in OFF position. GO to **QB2**.	REPAIR as necessary.

QB2 CHECK KAPWR TO THE PCM

- PCM connector disconnected.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
KAPWR - Pin B45	Negative terminal

Is the voltage less than 10.5 V?

Yes	No
REPAIR the circuit.	GO to **QB3**.

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QB3 CHECK FOR A REPEAT OF THE DTC

- PCM connector connected.
- Clear all DTCs that may have been caused by the PCM disconnect.
- Test drive the vehicle and allow the engine to reach normal operating temperature.
- Check for self-test DTCs.

Are DTCs P0603 or P1633 present?

Yes	No
GO to **QB4**.	Unable to duplicate or identify the concern at this time. GO to Pinpoint Test **Z**.

QB4 INSPECT THE ENGINE COMPARTMENT FOR CORRECT WIRE ROUTING

- Inspect the electronic engine control (EEC) system wiring for correct wire routing.
- Check the wiring routing to establish if any of the electrical connectors are being stressed due to poorly routed wiring. If necessary re-route and secure the wiring.
- Visually inspect wiring and connectors.

Are any concerns present?

Yes	No
REPAIR as necessary.	GO to **QB5**.

QB5 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST QC: DTC P1000: ON BOARD DIAGNOSTIC (OBD) SYSTEMS READINESS TEST NOT COMPLETE

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INTRODUCTION

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Diagnostic Trouble Code (DTC) P1000 indicates that all the OBD monitors have not yet been successfully tested. In some areas, this DTC must be cleared to pass an inspection/maintenance test. The customer should be informed that the law specifies additional city and highway driving must be done to complete the check of the OBD system. This additional driving must occur before the vehicle is tested at the inspection/maintenance station. The amount of driving required varies with individual driving patterns. To complete this requirement in the shortest amount of time, refer to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .

It is not necessary to clear DTC P1000 from the PCM by driving the vehicle unless it is requested by the customer to pass an inspection/maintenance test.

The only way a DTC P1000 can be removed from memory is when all the OBD monitors are successfully completed.

DTC P1000 is set by the PCM under any of the following conditions:

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- The vehicle is new from the factory and has not yet completed an OBD drive cycle.
- The battery or PCM has been disconnected.
- An OBD monitor failure had occurred before completion of an OBD drive cycle.
- The PCM DTCs have been cleared with a diagnostic tool as part of a repair process.
- The PCM has been flashed and the vehicle has not yet completed an OBD drive cycle.

TEST PROCEDURE

QC1 CONTINUOUS MEMORY DTC P1000: CHECK FOR ANY OTHER DTCS

NOTE: Carry out this pinpoint test only if a Diagnostic Trouble Code DTC P1000 was received from Continuous Memory. Ignore any DTC P1000s in KOEO or KOER.

- DTC P1000 indicates all of the OBD monitors have not yet been successfully tested.

Are any other DTCs received with P1000?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **QC2**.

QC2 REQUEST TO CLEAR DTC P1000

NOTE: An entire OBD drive cycle has not yet been completed to clear DTC P1000 from the PCM.

Has the customer requested DTC P1000 be cleared from the PCM memory?

Yes	No
CARRY OUT an OBD drive cycle. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** .	Key in OFF position. INFORM the customer that if the law in your area requires additional driving in order to clear DTC P1000 from the PCM memory, it must be completed before an inspection/maintenance test.

PINPOINT TEST QE: HYBRID-ELECTRIC SYSTEM

INTRODUCTION

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AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
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This pinpoint test is intended to diagnose the informational PCM and TCM DTCs.

The informational DTCs are the result of limited operating strategy (LOS) or failure mode effects management (FMEM) operating strategy that maintains limited vehicle function in the event of the PCM, TCM, or component failure.

The circuit DTCs can be accompanied by the informational DTCs, and should be diagnosed first. An informational DTC without a circuit DTCs may or may not indicate the actual malfunction and should be diagnosed as a symptom.

Fig. 106: Identifying Transaxle Assembly-B Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

QE1 CHECK FOR THE PRESENCE OF ANY DTCS OTHER THAN THE INFORMATIONAL DTCS

Are any DTCs present other than the following: P0606, P0613, P0726, P0727, P0A09, P0A27, P0A28, P1A03, P1A04, P1A0C, PA10D, P1A0E, P1A0F, P1A10, P1A13, P1A14, P2104, P2105, P2110?

Yes	No
DTCs other than informational DTCs should be	

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diagnosed in the following order: PCM KOEO, PCM KOER, TCM On Demand, PCM CONT and TCM CONT. DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **QE2**.

QE2 CHECK FOR THE PRESENCE OF TCM DTCS P1A03 OR P1A04

- DTC P1A03 without DTC P1A04 present indicates an MSDN circuit fault.
- DTC P1A04 without DTC P1A03 present indicates a GSDN circuit fault.
- DTCs P1A03 and P1A04 together indicate that PCM requested MSDN and GSDN because of some other malfunction.

Is TCM DTC P1A03 or P1A04 present during the self-test?

Yes	No
DTC P1A03 without DTC P1A04 present: GO to Pinpoint Test **TE**. DTC P1A04 without DTC P1A03 present: GO to Pinpoint Test **TF**. DTCs P1A03 and P1A04 together: GO to **QE3**.	GO to **QE4**.

QE3 CHECK MSDN AND GSDN PIDS

- Access the TCM and monitor the M_SDN_A, M_SDN_C, G_SDN_A and G_SDN_C PIDs.

Do any of the PIDs indicate ON?

Yes	No
For M_SDN_A indicating ON: GO to **QE4**. For M_SDN_C indicating ON: GO to **TE4**. For G_SDN_A indicating ON: GO to **QE4**. For G_SDN_C indicating ON: GO to **TF4**.	GO to **QE4**.

QE4 CHECK FOR THE PRESENCE OF TCM DTC P0726 OR P0727

- TCM DTC P0726 or P0727 with an engine that does not start indicates a missing CKP signal to the PCM.
- TCM DTC P0726 or P0727 with an engine that starts and runs indicates a missing CTO signal to the TCM.

Are the TCM DTCs P0726 or P0727 present during self-test?

Yes	No
For DTC P0726 or P0727 and engine does not start: GO to Pinpoint Test **JD**.	GO to **QE5**.

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For DTC P0726 or P0727 and engine starts and continues running: GO to Pinpoint Test **JH**.	

QE5 CHECK FOR THE PRESENCE OF PCM DTC P0A27 OR P0A28

- PCM DTCs P0A27 or P0A28 indicate a BPO circuit failure or that the Traction Battery Control Module (TBCM) sent the Battery Power Off (BPO) request to the PCM.

Are the PCM DTCs P0A27 or P0A28 present during self-test?

Yes	No
For DTCs P0A27 and P0A28, GO to **FC2**.	GO to **QE6**.

QE6 CHECK FOR THE PRESENCE OF PCM DTC P0A09

NOTE: The PCM DTC P0A09 indicates the DC to DC Fault (DCF) circuit is shorted to ground, there is internal DC to DC damage, or the 12 V bus voltage dropped below calibrated threshold.

Is PCM DTC P0A09 present during the self-test?

Yes	No
For KOEO or KOER DTC P0A09: GO to **HH17**. For continuous memory DTC P0A09: GO to **HH23**.	GO to **QE7**.

QE7 CHECK FOR TGAC AND TMAC CIRCUITS SHORTED TO SIGNALS IN THE SAME HARNESS

- PCM connector disconnected.
- Transaxle Assembly-B connector disconnected.
- Measure the resistance between:

(+) Transaxle Assembly-B Connector, Harness Side	(-) Transaxle Assembly-B Connector, Harness Side
TGAC - Pin 9	TMAC - Pin 4
TGAC - Pin 9	MSDN - Pin 5
TGAC - Pin 9	GSDN - Pin 10
TGAC - Pin 9	CTO - Pin 1
TMAC - Pin 4	MSDN - Pin 5
TMAC - Pin 4	GSDN - Pin 10
TMAC - Pin 4	CTO - Pin 1

Are the resistances greater than 10K ohms?

Yes	No
For DTCs P2104, P2105 and P2110, GO to **QE8**. For all others, GO to **STEP 2: NO DIAGNOSTIC**	

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TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX . for further direction. If symptom is not listed, REFER to appropriate service repair article or GO TO Pinpoint Test **Z**, for intermittent PCM/TCM diagnostics.	REPAIR the short circuit.

QE8 CHECK FOR THE PRESENCE OF ANY MODULE COMMUNICATION CONCERNS

- Check for self-test DTCs in all of the vehicle modules.

Are any communication concerns or communication DTCs present?

Yes	No
For communication concerns in the PCM, DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** . For communication concerns in other modules, REFER to the appropriate service repair article to diagnose the communication DTC.	GO to **QE9**.

QE9 CHECK FOR THE PRESENCE OF ANY ABS CONCERNS

- Check for self-test DTCs in all of the vehicle modules.

Are any DTCs present?

Yes	No
REFER to the appropriate service repair article to diagnose the DTC.	GO to **QE10**.

QE10 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY**	The system is operating correctly at this time. The concern may have been caused by a loose

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MEMORY (EEPROM) .	or corroded connector.

PINPOINT TEST TA: TRANSMISSION RANGE (TR) SENSOR

INTRODUCTION

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This pinpoint test is intended to diagnose the following:

- Transmission range (TR) sensor (7K004).
- Harness circuits: TR-A, VREF, and SIGRTN.
- Powertrain control module (PCM) (12A650).

Fig. 107: Identifying Transmission Range (TR) Sensor Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 108: Identifying Powertrain Control Module (PCM) Connector Terminal

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Courtesy of FORD MOTOR CO.

TEST PROCEDURE

TA1 VERIFY THAT THE HARD FAULT IS PRESENT

- Carry out the PCM On Demand Self-test.

Are any of the following DTCs present during the PCM self-test: P2800, P2801, P2802, P2803, P2805, or 2806?

Yes	No
A hard fault is present. GO to **TA2**.	GO to **TA26**.

TA2 CHECK THE TRANSMISSION RANGE (TR) SENSOR FOR PROPER MECHANICAL CONNECTION

NOTE: Verify that gear selector is not stuck between the gears.

- Key ON, engine OFF.
- Move the gear selector from PARK to REVERSE, NEUTRAL, DRIVE and LOW gears.
- Observe the instrument cluster PRNDL display.

Does the PRNDL indicate PARK in all gear selector positions?

Yes	No
Key in OFF position. INSTALL a new TR sensor.	GO to **TA3**.

TA3 CHECK THE FUNCTIONALITY OF THE TRANSMISSION RANGE (TR) SENSOR

- Access the PCM and monitor the TR_A1, TR_A2 and TR_A3 PIDs.
- Record the TR-A1, TR-A2 and TR-A3 voltage values in PARK, REVERSE, NEUTRAL, DRIVE and LOW gears.
- Compare the recorded voltages to the voltages in the table below.

TRANSMISSION RANGE (TR) SENSOR SPECIFICATION

TR SENSOR	PARK	REVERSE	NEUTRAL	DRIVE	LOW
TR-A1 (VOLTS)	4.25 - 4.80	2.95 - 3.50	2.30 - 2.85	1.60 - 2.15	0.90 - 1.45
TR-A2 (VOLTS)	0.50 - 1.10	1.75 - 2.25	2.35 - 2.80	3.25 - 3.75	3.40 - 4.00
TR-A3 (VOLTS)	0.25 - 0.75	1.40 - 1.90	2.00 - 2.55	2.65 - 3.15	3.25 - 3.80

Are all 3 TR-A signals in range in each gear?

Yes	No

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Key in OFF position. GO to **TA24**.	Key in OFF position. GO to **TA4**.

TA4 CHECK THE VREF VOLTAGE TO THE TR SENSOR

- TR Sensor connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) TR Sensor Connector, Harness Side	(-) TR Sensor Connector, Harness Side
TR-VREF1 - Pin 7	TR-RTN1 - Pin 3
TR-VREF2 - Pin 6	TR-RTN2 - Pin 1

Are the voltages between 4.5 V - 5.5 V?

Yes	No
GO to **TA5**.	For VREF voltage above 5.5 volts: GO to **TA27**. For VREF voltage below 4.5 volts: GO to **TA29**.

TA5 CHECK THE FUNCTIONALITY OF THE TR-A1 CIRCUIT

NOTE: Use the voltage measurements recorded in Pinpoint Test Step TA3.

Is TR-A1 out of range in any gear?

Yes	No
GO to **TA8**.	GO to **TA6**.

TA6 CHECK THE FUNCTIONALITY OF THE TR-A2 CIRCUIT

NOTE: Use the voltage measurements recorded in Pinpoint Test Step TA3.

Is TR-A2 out of range in any gear?

Yes	No
GO to **TA13**.	GO to **TA7**.

TA7 CHECK THE FUNCTIONALITY OF THE TR-A3 CIRCUIT

NOTE: Use the voltage measurements recorded in Pinpoint Test Step TA3.

Is TR-A3 out of range in any gear?

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Yes	No
GO to **TA18**.	GO to **TA26**.

TA8 CHECK THE TR-A1 CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- TR Sensor connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) TR Sensor Connector, Harness Side
TR-A1 - Pin T16	TR-A1 - Pin 8

Is the resistance less than 5 ohms?

Yes	No
GO to **TA9**.	REPAIR the open circuit.

TA9 CHECK THE TR-A1 CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
TR-A1 - Pin T16	Negative terminal

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **TA10**.	Key in OFF position. REPAIR the short circuit to PWR.

TA10 CHECK THE TR-A1 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
TR-A1 - Pin T16	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **TA11**.	REPAIR the short circuit to GND.

TA11 CHECK FOR THE TR-A1 CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

- Measure the resistance between:

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(+) TR Sensor Connector, Harness Side	(-) TR Sensor Connector, Harness Side
TR-A1 - Pin 8	TR-A2 - Pin 5
TR-A1 - Pin 8	TR-A3 - Pin 2
TR-A1 - Pin 8	TR-VREF1 - Pin 7
TR-A1 - Pin 8	TR-VREF2 - Pin 6
TR-A1 - Pin 8	TR-RTN1 - Pin 3
TR-A1 - Pin 8	TR-RTN2 - Pin 1

Are the resistances greater than 10K ohms?

Yes	No
GO to **TA12**.	REPAIR the short circuit.

TA12 CHECK THE FUNCTIONALITY OF THE TR SENSOR

- Gear selector lever in PARK.
- Measure the resistance between:

(+) TR Sensor Connector, Component Side	(-) TR Sensor Connector, Component Side
TR-VREF1 - Pin 7	TR-A1 - Pin 8

Is the resistance between 900 ohms - 1K ohms?

Yes	No
GO to **TA23**.	INSTALL a new TR sensor.

TA13 CHECK THE TR-A2 CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- TR Sensor connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) TR Sensor Connector, Harness Side
TR-A2 - Pin T28	TR-A2 - Pin 5

Is the resistance less than 5 ohms?

Yes	No
GO to **TA14**.	REPAIR the open circuit.

TA14 CHECK THE TR-A2 CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery

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TR-A2 - Pin T28	Negative terminal

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **TA15**.	Key in OFF position. REPAIR the short circuit to PWR.

TA15 CHECK THE TR-A2 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
TR-A2 - Pin T28	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **TA16**.	REPAIR the short circuit to GND.

TA16 CHECK FOR THE TR-A2 CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

- Measure the resistance between:

(+) TR Sensor Connector, Harness Side	(-) TR Sensor Connector, Harness Side
TR-A2 - Pin 5	TR-A1 - Pin 8
TR-A2 - Pin 5	TR-A3 - Pin 2
TR-A2 - Pin 5	TR-VREF1 - Pin 7
TR-A2 - Pin 5	TR-VREF2 - Pin 6
TR-A2 - Pin 5	TR-RTN1 - Pin 3
TR-A2 - Pin 5	TR-RTN2 - Pin 1

Are the resistances greater than 10K ohms?

Yes	No
GO to **TA17**.	REPAIR the short circuit.

TA17 CHECK THE FUNCTIONALITY OF THE TR SENSOR

- Gear selector lever in PARK.
- Measure the resistance between:

(+) TR Sensor Connector, Component Side	(-) TR Sensor Connector, Component Side
TR-VREF1 - Pin 7	TR-A2 - Pin 5

Is the resistance between 3K ohms - 3.5K ohms?

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Yes	No
GO to **TA23**.	INSTALL a new TR sensor.

TA18 CHECK THE TR-A3 CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- TR Sensor connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) TR Sensor Connector, Harness Side
TR-A3 - Pin T39	TR-A3 - Pin 2

Is the resistance less than 5 ohms?

Yes	No
GO to **TA19**.	REPAIR the open circuit.

TA19 CHECK THE TR-A3 CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
TR-A3 - Pin T39	Negative terminal

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **TA20**.	Key in OFF position. REPAIR the short circuit to PWR.

TA20 CHECK THE TR-A3 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
TR-A3 - Pin T39	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **TA21**.	REPAIR the short circuit to GND.

TA21 CHECK FOR THE TR-A3 CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

- Measure the resistance between:

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(+) TR Sensor Connector, Harness Side	(-) TR Sensor Connector, Harness Side
TR-A3 - Pin 2	TR-A1 - Pin 8
TR-A3 - Pin 2	TR-A2 - Pin 5
TR-A3 - Pin 2	TR-VREF1 - Pin 7
TR-A3 - Pin 2	TR-VREF2 - Pin 6
TR-A3 - Pin 2	TR-RTN1 - Pin 3
TR-A3 - Pin 2	TR-RTN2 - Pin 1

Are the resistances greater than 10K ohms?

Yes	No
GO to **TA22**.	REPAIR the short circuit.

TA22 CHECK THE FUNCTIONALITY OF THE TR SENSOR

- Gear selector lever in Park.
- Measure the resistance between:

(+) TR Sensor Connector, Component Side	(-) TR Sensor Connector, Component Side
TR-VREF1 - Pin 7	TR-A3 - Pin 2

Is the resistance between 3K ohms - 3.5K ohms?

Yes	No
GO to **TA23**.	INSTALL a new TR sensor.

TA23 CHECK THE TR SENSOR CIRCUIT INTEGRITY

- Measure the resistance between:

(+) TR Sensor Connector, Component Side	(-) TR Sensor Connector, Component Side
TR-VREF1 - Pin 7	TR-RTN1 - Pin 3

Is the resistance between 1K ohms - 1.5K ohms?

Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	INSTALL a new TR sensor.

TA24 CHECK FOR TR-A SIGNALS SHORTED TO EACH OTHER IN THE HARNESS

- PCM connector disconnected.
- TR Sensor connector disconnected.
- Measure the resistance between:

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(+) TR Sensor Connector, Harness Side	(-) TR Sensor Connector, Harness Side
TR-A1 - Pin 8	TR-A2 - Pin 5
TR-A1 - Pin 8	TR-A3 - Pin 2
TR-A2 - Pin 5	TR-A3 - Pin 2

Are the resistances greater than 10K ohms?

Yes	No
GO to **TA25**.	REPAIR the short circuit.

TA25 CHECK THE TR SENSOR CIRCUIT INTEGRITY

- Measure the resistance between:

(+) TR Sensor Connector, Component Side	(-) TR Sensor Connector, Component Side
TR-VREF1 - Pin 7	TR-RTN1 - Pin 3

Is the resistance between 1K ohms - 1.5K ohms?

Yes	No
GO to **TA26**.	INSTALL a new TR sensor.

TA26 CHECK THE TR SENSOR CIRCUIT FOR AN INTERMITTENT CONCERN

- PCM connector connected.
- TR Sensor connector connected.
- Key ON, engine OFF.
- Access the PCM and monitor the TR_A1, TR_A2 and TR_A3 PIDs.
- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM. Monitor the TR-A1, TR-A2, and TR-A3 PIDs. Look for sudden changes in the reading when the harness is wiggled or the sensor is tapped.

Is a concern present during the wiggle test?

Yes	No
Key in OFF position. REPAIR as necessary.	Key in OFF position. Unable to duplicate or identify the fault at this time. GO to **Z1**.

TA27 CHECK THE TR-VREF1 AND TR-VREF2 CIRCUITS FOR A SHORT TO VPWR

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

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(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
TR-VREF1 - Pin T15	VPWR - Pin B35, B36
TR-VREF2 - Pin T27	VPWR - Pin B35, B36

Are the resistances greater than 10K ohms?

Yes	No
GO to **TA28**.	REPAIR the short circuit to PWR.

TA28 CHECK THE TR-VREF1 AND TR-VREF2 CIRCUITS FOR A SHORT TO PWR

- Key ON, engine OFF.
- Measure the voltage between:

(+) TR Sensor Connector, Harness Side	(-)
TR-VREF1 - Pin 7	Ground
TR-VREF2 - Pin 6	Ground

Are the voltages greater than 10.5 V?

Yes	No
REPAIR the short circuit to PWR.	INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .

TA29 CHECK THE TR-VREF1 AND TR-VREF2 CIRCUITS FOR A SHORT TO GND

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

(+) TR Sensor Connector, Harness Side	(-)
TR-VREF1 - Pin 7	Ground
TR-VREF2 - Pin 6	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to **TA30**.	REPAIR the short circuit to GND.

TA30 CHECK THE TR-VREF1 AND TR-VREF2 CIRCUITS FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

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

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TR-VREF1 - Pin 7	TR-VREF1 - Pin T15
TR-VREF2 - Pin 6	TR-VREF2 - Pin T27

Are the resistances less than 5 ohms?

Yes	No
GO to **TA31**.	REPAIR the open circuit.

TA31 CHECK THE TR-RTN1 AND TR-RTN2 CIRCUITS FOR AN OPEN IN THE HARNESS

- Measure the resistance between:

(+) TR Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
TR-RTN1 - Pin 3	TR-RTN1 - Pin T17
TR-RTN2 - Pin 1	TR-RTN2 - Pin T29

Are the resistances less than 5 ohms?

Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	REPAIR the open circuit.

PINPOINT TEST TC: TORQUE OF GENERATOR SIGNAL

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY

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RESULT IN PERSONAL INJURY OR DEATH.

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This pinpoint test is intended to diagnose the following:

- Harness circuits: Torque of generator - AC (TGAC) signal.
- Powertrain control module (PCM) (12A650).
- Transaxle Assembly (7000).

Fig. 109: Identifying Transaxle Assembly-B Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 110: Identifying Powertrain Control Module (PCM) Connector Terminal
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

TC1 DTC P0A23: VERIFY THAT THE HARD FAULT IS PRESENT

- Record and clear all continuous memory DTCs.
- Retrieve the PCM continuous memory DTCs.

Is DTC P0A23 present?

Yes	No
GO to **TC2**.	GO to **TC7**.

TC2 CHECK THE TGAC CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Transaxle Assembly-B connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Transaxle Assembly-B Connector, Harness Side
TGAC - Pin T5	TGAC - Pin 9

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Is the resistance less than 5 ohms?

Yes	No
GO to **TC3**.	REPAIR the open circuit.

TC3 CHECK THE TGAC CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
TGAC - Pin T5	Negative terminal

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **TC4**.	Key in OFF position. REPAIR the short circuit to PWR.

TC4 CHECK THE TGAC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
TGAC - Pin T5	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **TC5**.	REPAIR the short circuit to GND.

TC5 CHECK FOR THE TGAC CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

- Measure the resistance between:

(+) Transaxle Assembly-B Connector, Harness Side	(-) Transaxle Assembly-B Connector, Harness Side
TGAC - Pin 9	ISDN2 - Pin 7
TGAC - Pin 9	GSDN - Pin 10
TGAC - Pin 9	CTO - Pin 1
TGAC - Pin 9	TMAC - Pin 4
TGAC - Pin 9	MSDN - Pin 5

Are the resistances greater than 10K ohms?

Yes	No

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GO to **TC6**.	REPAIR the short circuit.

TC6 TGAC FUNCTIONAL TEST

- PCM connector connected.
- Transaxle Assembly-B connector connected.
- Isolate the TGAC pin from the Transaxle-B connector.
- Connect a 5 amp fused jumper wire between the following:

Point A Transaxle Assembly-B Connector, Harness Side	Point B Transaxle Assembly-B Connector, Harness Side
TGAC - Pin 9	TMAC - Pin 4

- Key ON, engine running.

Does the engine start now?

Yes	No
Key in OFF position. INSTALL a new transaxle assembly.	Key in OFF position. Go to **TC8**.

TC7 CHECK THE TGAC CIRCUIT FOR AN INTERMITTENT CONCERN

- Key ON, engine OFF.
- Access the PCM and monitor the TGAC PID.
- Carefully wiggle all accessible wiring and connectors associated with the circuit and look for a change in the PID state.

Is a concern present during the wiggle test?

Yes	No
Key in OFF position. REPAIR as necessary.	Key in OFF position. GO to Pinpoint Test **Z**.

TC8 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	No

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INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST TD: TORQUE OF MOTOR SIGNAL

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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This pinpoint test is intended to diagnose the following:

- Harness circuits: Torque of Motor AC signal (TMAC).
- Powertrain control module (PCM) (12A650).
- Transaxle Assembly (7000).

Fig. 111: Identifying Transaxle Assembly-B Connector Terminal

Courtesy of FORD MOTOR CO.

Fig. 112: Identifying Powertrain Control Module (PCM) Connector Terminal
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

TD1 DTC P0A18: VERIFY THAT THE HARD FAULT IS PRESENT

- Record and clear all continuous memory DTCs.
- Retrieve the PCM continuous memory DTCs.

Is DTC P0A18 present?

Yes	No
GO to **TD2**.	GO to **TD7**.

TD2 CHECK THE TMAC CIRCUIT FOR AN OPEN IN THE HARNESS

- Key in OFF position.
- PCM connector disconnected.
- Transaxle Assembly-B connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Transaxle Assembly-B Connector, Harness Side
TMAC - Pin T7	TMAC - Pin 4

Is the resistance less than 5 ohms?

Yes	No
GO to **TD3**.	REPAIR the open circuit.

TD3 CHECK THE TMAC CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
TMAC - Pin T7	Negative terminal

Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **TD4**.	Key in OFF position. REPAIR the short circuit to PWR.

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TD4 CHECK THE TMAC CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
TMAC - Pin T7	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **TD5**.	REPAIR the short circuit to GND.

TD5 CHECK FOR THE TMAC CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

- Measure the resistance between:

(+) Transaxle Assembly-B Connector, Harness Side	(-) Transaxle Assembly-B Connector, Harness Side
TMAC - Pin 4	ISDN2 - Pin 7
TMAC - Pin 4	GSDN - Pin 10
TMAC - Pin 4	CTO - Pin 1
TMAC - Pin 4	TGAC - Pin 9
TMAC - Pin 4	MSDN - Pin 5

Are the resistances greater than 10K ohms?

Yes	No
GO to **TD6**.	Key in OFF position. REPAIR the short circuit.

TD6 TMAC FUNCTIONAL TEST

- PCM connector connected.
- Transaxle Assembly-B connector connected.
- Isolate the TMAC pin from the Transaxle-B connector.
- Connect a 5 amp fused jumper wire between the following:

Point A Transaxle Assembly-B Connector, Harness Side	Point B Transaxle Assembly-B Connector, Harness Side
TMAC - Pin 4	TGAC - Pin 9

- Key ON, engine running.

Does the engine start now?

Yes	No
Key in OFF position. INSTALL a new transaxle	Key in OFF position.

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assembly.	GO to **TD8**.

TD7 CHECK THE TMAC CIRCUIT FOR AN INTERMITTENT CONCERN

- Key ON, engine OFF.
- Access the PCM and monitor the TMAC PID.
- Carefully wiggle all accessible wiring and connectors associated with the circuit and look for a change in the PID state.

Is a concern present during the wiggle test?

Yes	No
Key in OFF position. REPAIR as necessary.	Key in OFF position. GO to Pinpoint Test **Z**.

TD8 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST TE: MOTOR SHUTDOWN

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE

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This pinpoint test is intended to diagnose the following:

- Harness circuits: Motor shutdown (MSDN).
- Powertrain control module (PCM) (12A650).
- Transaxle Assembly (7000).

Fig. 113: Identifying Transaxle Assembly-B Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 114: Identifying Powertrain Control Module (PCM) Connector Terminal
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

TE1 KOEO AND CONTINUOUS MEMORY DTC P1A03: VERIFY THAT THE HARD FAULT IS PRESENT

NOTE: Clearing the TCM DTCs will erase any TCM recorded freeze frame data. Make sure to record any TCM freeze frame information before proceeding any further. Refer to the diagnostic tool instruction manual for freeze frame PID menu.

- Clear and retrieve TCM continuous DTCs.

Is DTC P1A03 present?

Yes	No
GO to **TE2**.	GO to **TE9**.

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TE2 CHECK FOR MSDN REQUEST FROM PCM

- Key ON, engine OFF.
- Access the TCM and monitor the M_SDN_A PID.

Is the PID state ON?

Yes	No
DIAGNOSE the motor shutdown request from the E-Quizzer. GO to **QE4**.	Key in OFF position. GO to **TE3**.

TE3 CHECK FOR MSDN REQUEST FROM PCM

- Key ON, engine OFF.
- Access the TCM and monitor the M_SDN_C PID.

Is the PID state ON?

Yes	No
Key in OFF position. GO to **TE4**.	Key in OFF position. GO to **QE4**.

TE4 CHECK THE MSDN CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Transaxle Assembly-B connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Transaxle Assembly-B Connector, Harness Side
MSDN - Pin T11	MSDN - Pin 5

Is the resistance less than 5 ohms?

Yes	No
GO to **TE5**.	REPAIR the open circuit.

TE5 CHECK THE MSDN CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
MSDN - Pin T11	Negative terminal

Is the voltage less than 1 V?

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Yes	No
Key in OFF position. GO to **TE6**.	Key in OFF position. REPAIR the short circuit to PWR.

TE6 CHECK THE MSDN CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
MSDN - Pin T11	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **TE7**.	REPAIR the short circuit to GND.

TE7 CHECK FOR THE MSDN CIRCUIT SHORTED TO CIRCUITS IN THE SAME HARNESS

- Measure the resistance between:

(+) Transaxle Assembly-B Connector, Harness Side	(-) Transaxle Assembly-B Connector, Harness Side
MSDN - Pin 5	CTO - Pin 1
MSDN - Pin 5	TGAC - Pin 9
MSDN - Pin 5	TMAC - Pin 4
MSDN - Pin 5	GSDN - Pin 10
MSDN - Pin 5	ISDN2 - Pin 7

Are the resistances greater than 10K ohms?

Yes	No
GO to **TE8**.	REPAIR the short circuit.

TE8 MSDN FUNCTIONAL TEST

- PCM connector connected.
- Transaxle Assembly-B connector connected.
- Isolate the pin from the PCM connector.
- Connect a 5 amp fused jumper wire between the following:

Point A PCM Connector, Harness Side	Point B PCM Connector, Harness Side
Point B PCM Connector, Harness Side	GSDN - Pin T9

- Key ON, engine OFF.
- Access the TCM and monitor the M_SDN_C PID.

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Is the PID state OFF?

Yes	No
Key in OFF position. GO to **TE13**.	Key in OFF position. INSTALL a new transaxle assembly.

TE9 RECREATE THE SYMPTOM USING ALL AVAILABLE DATA

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- Access the freeze frame data (if available) and record the DTC malfunction conditions.
- Clear the TCM DTCs.
- Obtain information from the customer information worksheet or any other available data from the customer.
- Access the TCM and monitor the M_SDN_A and M_SDN_C PIDs.
- Recreate the symptom using the freeze frame and customer information.
- When the symptom occurs, press the trigger to begin recording. Refer to the diagnostic tool instruction manual for information on the recorder function.

Could the symptom be recreated?

Yes	No
Key in OFF position. GO to **TE10**.	Key in OFF position. GO to Pinpoint Test **Z**.

TE10 CHECK FOR REQUEST FROM PCM

NOTE: Use the data recorded in the Pinpoint Test Step TE9.

Does the M_SDN_A PID display ON when the symptom occurs?

Yes	No
Key in OFF position. DIAGNOSE the motor shutdown request from the PCM.	GO to **TE11**.

TE11 CHECK THE MSDN CIRCUIT FREQUENCY AT THE TCM

NOTE: Use the data recorded in the Pinpoint Test Step TE9.

Does the M_SDN_C PID display ON when the symptom occurs?

Yes	No

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GO to **TE12**.	GO to Pinpoint Test **Z**.

TE12 CHECK THE MSDN CIRCUIT FOR AN INTERMITTENT CONCERN

- Key ON, engine OFF.
- Access the TCM and monitor the M_SDN_C PID.
- Carefully wiggle all accessible wiring and connectors associated with the circuit and look for a change in the PID state.

Is a concern present during the wiggle test?

Yes	No
Key in OFF position. REPAIR as necessary.	Key in OFF position. GO to Pinpoint Test **Z**.

TE13 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST TF: GENERATOR SHUTDOWN

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE

TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

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This pinpoint test is intended to diagnose the following:

- Harness circuit+(s): Generator shutdown (GSDN).
- Powertrain control module (PCM) (12A650).
- Transaxle Assembly (7000).

Fig. 115: Identifying Transaxle Assembly-B Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 116: Identifying Powertrain Control Module (PCM) Connector Terminal
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

TF1 KOEO AND CONTINUOUS MEMORY DTC P1A04: VERIFY THAT THE HARD FAULT IS PRESENT

NOTE: Clearing the TCM DTCs will erase any TCM recorded freeze frame data. Make sure to record any TCM freeze frame information before proceeding any further. Refer to the diagnostic tool instruction manual for freeze frame PID menu.

- Clear and retrieve TCM continuous DTCs.

Is DTC P1A04 present?

Yes	No
GO to **TF2**.	GO to **TF9**.

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TF2 CHECK FOR GSDN REQUEST FROM PCM

- Key ON, engine OFF.
- Access the TCM and monitor the G_SDN_A PID.

Is the PID state ON?

Yes	No
Key in OFF position. DIAGNOSE the generator shutdown request from the PCM. GO to **QE4**.	Key in OFF position. GO to **TF3**.

TF3 CHECK FOR GSDN REQUEST FROM PCM

- Key ON, engine OFF.
- Access the TCM and monitor the G_SDN_C PID.

Is the PID state ON?

Yes	No
GO to **TF4**.	Key in OFF position. GO to **QE4**.

TF4 CHECK THE GSDN CIRCUIT FOR AN OPEN IN THE HARNESS

- PCM connector disconnected.
- Transaxle Assembly-B connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Transaxle Assembly-B Connector, Harness Side
GSDN - Pin T9	GSDN - Pin 10

Is the resistance less than 5 ohms?

Yes	No
GO to **TF5**.	REPAIR the open circuit.

TF5 CHECK THE GSDN CIRCUIT FOR A SHORT TO POWER IN THE HARNESS

- Key ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
GSDN - Pin T9	Negative terminal

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Is the voltage less than 1 V?

Yes	No
Key in OFF position. GO to **TF6**.	Key in OFF position. REPAIR the short circuit to PWR.

TF6 CHECK THE GSDN CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Vehicle Battery
GSDN - Pin T9	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **TF7**.	REPAIR the short circuit to GND.

TF7 CHECK FOR THE GSDN CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

- Measure the resistance between:

(+) Transaxle Assembly-B Connector, Harness Side	(-) Transaxle Assembly-B Connector, Harness Side
GSDN - Pin 10	CTO - Pin 1
GSDN - Pin 10	TGAC - Pin 9
GSDN - Pin 10	TMAC - Pin 4
GSDN - Pin 10	MSDN - Pin 5
GSDN - Pin 10	ISDN2 - Pin 7

Are the resistances greater than 10K ohms?

Yes	No
GO to **TF8**.	REPAIR the short circuit.

TF8 GSDN FUNCTIONAL TEST

- PCM connector connected.
- Transaxle Assembly-B connector connected.
- Isolate the MSDN pin from the PCM connector.
- Connect a 5 amp fused jumper wire between the following:

Point A PCM Connector, Harness Side	Point B PCM Connector, Harness Side
GSDN - Pin T9	MSDN - Pin T11

- Key ON, engine OFF.

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- Access the TCM and monitor the G_SDN_C PID.

Is the PID state OFF?

Yes	No
Key in OFF position. GO to **TF13**.	Key in OFF position. INSTALL a new transaxle assembly.

TF9 RECREATE THE SYMPTOM USING ALL AVAILABLE DATA

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- Access the freeze frame data (if available) and record the DTC malfunction conditions.
- Clear the TCM DTCs.
- Obtain information from the customer information worksheet or any other available data from the customer.
- Access the TCM and monitor the G_SDN_A and G_SDN_C PIDs.
- Recreate the symptom using the freeze frame and customer information.
- When the symptom occurs, press trigger to begin recording. Refer to the diagnostic tool instruction manual for information on the recorder function.

Could the symptom be recreated?

Yes	No
Key in OFF position. GO to **TF10**.	Key in OFF position. GO to Pinpoint Test **Z**.

TF10 CHECK FOR GSDN REQUEST FROM PCM

NOTE: Use the data recorded in the Pinpoint Test Step TF9.

Does the G_SDN_A PID display ON when the symptom occurs?

Yes	No
Key in OFF position. DIAGNOSE the generator shutdown request from the PCM.	GO to **TF11**.

TF11 CHECK THE GSDN CIRCUIT FREQUENCY AT THE TCM

NOTE: Use the data recorded in the Pinpoint Test Step TF9.

Does the G_SDN_C PID display ON when the symptom occurs?

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Yes	No
GO to **TF12**.	GO to Pinpoint Test **Z**.

TF12 CHECK THE GSDN CIRCUIT FOR AN INTERMITTENT CONCERN

- PCM connector connected.
- Transaxle Assembly-B connector connected.
- Key ON, engine OFF.
- Access the TCM and monitor the G_SDN_C PID.
- Carefully wiggle all accessible wiring and connectors associated with the circuit and look for a change in the PID state.

Is a concern present during the wiggle test?

Yes	No
Key in OFF position. REPAIR as necessary.	Key in OFF position. GO to Pinpoint Test **Z**.

TF13 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST TG: DTC P1635: REVOLUTIONS PER MILE FAILURE

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION

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KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

Important Safety Notice

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This pinpoint test is intended to diagnose the following:

- Powertrain control module (PCM) (12A650).
- Transaxle Assembly (7000).

TEST PROCEDURE

TG1 DTC P1635: CHECK FOR THE PRESENCE OF PCM DTC P1635

NOTE: Repair PCM DTC P1635 before entering this pinpoint test.

- Retrieve the PCM continuous memory DTCs.

Is the PCM continuous DTC P1635 present during the self-test?

Yes	No
This DTC may be generated by the PCM VID block not matching the vehicle hardware. DIAGNOSE PCM DTC P1635. REFER to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **TG2**.

TG2 CHECK FOR THE PRESENCE OF ABS DTC B2900

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- Retrieve all continuous memory DTCs from the anti-lock brake system (ABS) module.

Is the ABS DTC B2900 present during self-test?

Yes	No
Using the diagnostic tool, PROGRAM the VID block. If the PCM does not allow programming of the VID block, REFLASH the PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	GO to **TG3**.

TG3 CLEAR AND RETRIEVE TCM CONTINUOUS DTCS

NOTE: Clearing the TCM DTCs will erase any TCM recorded freeze frame data. Make sure to record any TCM freeze frame information before proceeding any further. Refer to the diagnostic tool instruction manual for freeze frame PID menu.

- Clear and retrieve TCM continuous DTCs.

Is DTC P1635 present?

Yes	No
This DTC may be generated by the PCM VID block not matching the vehicle's hardware. GO to **TG4**.	The concern is no longer present. The concern could not be isolated. CLEAR the TCM DTCs.

TG4 CHECK THE PCM VID BLOCK FOR CORRECT INFORMATION

- Verify the PCM VID block information matches vehicle's hardware. Refer to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .

Is the VID block correctly configured?

Yes	No
INSTALL a new transaxle assembly.	Using the diagnostic tool, PROGRAM the VID block. If the PCM does not allow programming of the VID block, REFLASH the PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .

PINPOINT TEST TI: DTC P1A08: GENERATOR MODE SIGNAL

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES,

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COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
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This pinpoint test is intended to diagnose the following:

- Motor electronics cooling system.
- Transaxle assembly (7000).

TEST PROCEDURE

TI1 DTC P1A08: CHECK FOR SELF-TEST DTCS

Is TCM DTC P1A08 present during the self-test?

Yes	No
For KOEO DTC P1A08, GO to **TI3**.	Unable to duplicate or identify the fault at this time.
For continuous memory DTC P1A08, GO to **TI2**.	The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

TI2 CONTINUOUS MEMORY DTC P1A08: CLEAR AND RETRIEVE TCM CONTINUOUS DTCS

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NOTE: Diagnose and repair any PCM and TCM KOEO and KOER self-test DTCs before entering this pinpoint test.

NOTE: Clearing the TCM DTCs will erase any TCM recorded freeze frame data. Make sure to record any TCM freeze frame information before proceeding any further. Refer to the diagnostic tool instruction manual for freeze frame PID menu.

- Record and clear the PCM and TCM continuous DTCs.
- Clear and retrieve TCM continuous DTCs.

Is TCM continuous DTC P1A08 present during the self-test?

Yes	No
GO to **TI3**.	Unable to duplicate or identify the fault at this time. DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

TI3 KOEO DTC P1A08: CHECK THE TCM GENERATOR MODE PID

- Key ON, engine OFF.
- Access the TCM and monitor the GENMODE PID.
- Key ON, engine running.

Does the PID indicate that the GENMODE changed when the key is cycled from RUN to START?

Yes	No
Key in OFF position. INSTALL a new transaxle assembly.	Key in OFF position. GO to **TI4**.

TI4 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY**	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

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(EEPROM) .	

PINPOINT TEST TL: GENERATOR OVER TEMPERATURE FAULT

INTRODUCTION

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This pinpoint test is intended to diagnose the following:

- Motor electronics cooling system.
- Transaxle assembly (7000).

TEST PROCEDURE

TL1 DTCS P0A3B AND P0A3E: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during PCM or TCM self-test: P0A3B, or P0A3E?

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Yes	No
For DTC P0A3B, GO to **TL6**. For DTC P0A3E, GO to **TL2**.	Unable to duplicate or identify the fault at this time. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

TL2 DTC P0A3E: CHECK FOR THE PRESENCE OF PCM DTCS P0A00, P0A02, P0A03, AND P0A7C

Are any of the above listed DTCs present?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **TL3**.

TL3 VISUAL INSPECTION OF MOTOR ELECTRONICS COOLING SYSTEM

NOTE: Repair any motor electronics coolant pump (MECP) DTCs before proceeding.

- Visually inspect the motor electronics cooling system for leaks, pinched hoses, restricted radiator air flow, correct coolant level, coolant flow at the motor electronics coolant reservoir, fan operation, and loose electrical connections.

Is the motor electronics cooling system OK?

Yes	No
GO to **TL4**.	REPAIR as necessary. TEST the system for normal operation.

TL4 CHECK THE TCM MECT PID

NOTE: The MECT PID must be accessed from the freeze frame PID menu. Refer to the diagnostic tool instruction manual for freeze frame PID menu.

- Access the TCM and monitor the MECT PID.

Is the temperature less than 60°C (140 °F)?

Yes	No
INSTALL a new transaxle assembly.	GO to **TL5**.

TL5 CHECK THE GCLTEMP WHILE RECREATING THE SYMPTOM

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

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- Access the Freeze Frame Data (if available) and record the DTC malfunction conditions.
- Clear the TCM DTCs.
- Obtain information from the customer information worksheet or any other available data from the customer.
- Recreate the symptom using freeze frame and customer information.
- Access the TCM and monitor the GCLTEMP PID.

Is the temperature less than 220°C (428°F) when the symptom occurs?

Yes	No
Unable to duplicate or identify the fault at this time. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.	INSTALL a new transaxle assembly.

TL6 DTC P0A3B: CHECK THE AUTOMATIC TRANSAXLE FLUID LEVEL

NOTE: A low automatic transaxle fluid level may cause an generator motor over temperature condition.

- Verify the automatic transaxle fluid level is correct. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - ELECTRONICALLY CONTROLLED CONTINUOUSLY VARIABLE TRANSMISSION (ECVT)** .

Is the transaxle fluid level correct?

Yes	No
GO to **TL7**.	ADD the necessary fluid to obtain the correct fluid level. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - ELECTRONICALLY CONTROLLED CONTINUOUSLY VARIABLE TRANSMISSION (ECVT)** . GO to **TL8**.

TL7 VISUAL INSPECTION OF MOTOR ELECTRONICS COOLING SYSTEM

NOTE: Repair any motor electronics coolant pump (MECP) DTCs before proceeding.

- Visually inspect the motor electronics cooling system for leaks, pinched hoses, restricted radiator air flow, correct coolant level, coolant flow at the motor electronics coolant reservoir, fan operation, and loose electrical connections.

Is the motor electronics cooling system OK?

Yes	No

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GO to **TL8**.	REFER to **TRANSAXLE/TRANSMISSION COOLING - HYBRID** to diagnose motor electronics cooling concerns.

TL8 MONITOR THE GCLTEMP WHILE RECREATING THE SYMPTOM

NOTE: Refer to the diagnostic tool instruction manual for freeze frame PID menu.

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- Access the Freeze Frame Data (if available) and record the DTC malfunction conditions.
- Clear the TCM DTCs.
- Obtain information from the customer information worksheet or any other available data from the customer.
- Recreate the symptom using freeze frame and customer information.
- Access the TCM and monitor the GCLTEMP PID.
- Record the GCLTEMP PID reading when the symptom occurs.

Could the symptom be recreated?

Yes	No
GO to **TL9**.	Unable to duplicate or identify the fault at this time. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

TL9 CHECK THE GCLTEMP WHILE RECREATING THE SYMPTOM

Is the temperature less than 220°C (428°F) when the symptom occurs?

Yes	No
The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.	INSTALL a new transaxle assembly.

PINPOINT TEST TM: TRACTION MOTOR OVER TEMPERATURE FAULT

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION

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KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
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This pinpoint test is intended to diagnose the following:

- Motor electronics cooling system.
- Transaxle assembly (700).

TEST PROCEDURE

TM1 DTCS P0A2F AND P0A3C: CHECK FOR SELF-TEST DTCS

Are any of the following DTCs present during PCM or TCM self-test: P0A2F, or P0A3C?

Yes	No
For DTC P0A2F, GO to **TM6**. For DTC P0A3C, GO to **TM2**.	Unable to duplicate or identify the fault at this time. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

TM2 DTC P0A3C: CHECK FOR THE PRESENCE OF PCM DTCS P0A00, P0A02, P0A03, P0A7C

Are any of the above listed DTCs present?

Yes	No
DISREGARD the current diagnostic trouble code	

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(DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **TM3**.

TM3 VISUAL INSPECTION OF MOTOR ELECTRONICS COOLING SYSTEM

NOTE: Repair any motor electronics coolant pump (MECP) DTCs before proceeding.

- Visually inspect the motor electronics cooling system for leaks, pinched hoses, restricted radiator air flow, correct coolant level, coolant flow at the motor electronics coolant reservoir, fan operation, and loose electrical connections.

Is the motor electronics cooling system OK?

Yes	No
GO to **TM4**.	REPAIR as necessary. TEST the system for normal operation.

TM4 CHECK THE TCM MECT PID

NOTE: The MECT PID must be accessed from the freeze frame PID menu.

Refer to the diagnostic tool instruction manual for freeze frame PID menu.

- Access the TCM and monitor the MECT PID.

Is the temperature less than 60°C (140 °F)?

Yes	No
INSTALL a new transaxle assembly.	GO to **TM5**.

TM5 CHECK THE MCLTEMP WHILE RECREATING THE SYMPTOM

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- Access the Freeze Frame Data (if available) and record the DTC malfunction conditions.
- Clear the TCM DTCs.
- Obtain information from the customer information worksheet or any other available data from the customer.
- Recreate the symptom using freeze frame and customer information.
- Access the TCM and monitor the MCLTEMP PID.

Is the temperature less than 220°C (428°F) when the symptom occurs?

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Yes	No
Unable to duplicate or identify the fault at this time. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.	INSTALL a new transaxle assembly.

TM6 DTC P0A2F: CHECK THE AUTOMATIC TRANSAXLE FLUID LEVEL

NOTE: A low automatic transaxle fluid level may cause an traction motor over temperature condition.

- Verify the automatic transaxle fluid level is correct. Refer to the **AUTOMATIC TRANSAXLE/TRANSMISSION - ELECTRONICALLY CONTROLLED CONTINUOUSLY VARIABLE TRANSMISSION (ECVT)** .

Is the transaxle fluid level correct?

Yes	No
GO to **TM7**.	ADD the necessary fluid to obtain the correct fluid level. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION - ELECTRONICALLY CONTROLLED CONTINUOUSLY VARIABLE TRANSMISSION (ECVT)** . GO to **TM8**.

TM7 VISUAL INSPECTION OF MOTOR ELECTRONICS COOLING SYSTEM

NOTE: Repair any motor electronics coolant pump (MECP) DTCs before proceeding.

- Visually inspect the motor electronics cooling system for leaks, pinched hoses, restricted radiator air flow, correct coolant level, coolant flow at the motor electronics coolant reservoir, fan operation, and loose electrical connections.

Is the motor electronics cooling system OK?

Yes	No
GO to **TM8**.	REFER to **TRANSAXLE/TRANSMISSION COOLING - HYBRID** to diagnose motor electronics cooling concerns.

TM8 CHECK THE MCLTEMP WHILE RECREATING THE SYMPTOM

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- Access the Freeze Frame Data (if available) and record the DTC malfunction conditions.

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- Clear the TCM DTCs.
- Obtain information from the customer information worksheet or any other available data from the customer.
- Recreate the symptom using freeze frame and customer information.
- Access the TCM and monitor the MCLTEMP PID.
- Record the MCLTEMP PID reading when the symptom occurs.

Could the symptom be recreated?

Yes	No
GO to **TM9**.	Unable to duplicate or identify the fault at this time. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

TM9 CHECK THE MCLTEMP WHILE RECREATING THE SYMPTOM

Is the temperature less than 220°C (428°F) when the symptom occurs?

Yes	No
The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.	INSTALL a new transaxle assembly.

PINPOINT TEST TO: GENERATOR OVERSPEED

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
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This pinpoint test is intended to diagnose the transaxle assembly (7000).

ENGINE AND GENERATOR MOTOR RPM

Engine RPM	Generator Motor RPM
0	0
800	2,715
1,000	3,394
1,200	4,073
1,400	4,752
1,600	5,430
1,800	6,109
2,000	6,788

TEST PROCEDURE

TO1 CONTINUOUS MEMORY DTC P0A50: CHECK FOR THE PRESENCE OF DTC P1270

Is PCM DTC P1270 present during the self-test?

Yes	No
The generator overspeed condition was a result of an engine overspeed. REPAIR DTC P1270 before continuing. REFER to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **TO2**.

TO2 CHECK FOR CORRECT GENERATOR RPM

NOTE: Refer to the table at the beginning of this pinpoint test for correct generator to engine RPM correlations.

- Clear the TCM DTCs.
- Access the TCM and monitor the G_SPEED and RPM PIDs.
- Place gear selector lever in PARK.
- Key ON, engine running.
- Record the generator RPM at different engine speeds.

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Does the generator RPM correspond with the engine RPM in the table?

Yes	No
Unable to duplicate or identify the fault at this time. RETURN to **SYMPTOM CHARTS** to continue diagnosis.	INSTALL a new transaxle assembly.

PINPOINT TEST TP: TRACTION MOTOR OVERSPEED

INTRODUCTION

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This pinpoint test is intended to diagnose the transaxle assembly (7000).

VEHICLE SPEED KM/H (MPH) AND TRACTION MOTOR RPM

Vehicle Speed KM/H (MPH)	Traction Motor RPM

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0 (0)	0
26 (16)	1,996
55 (34)	4,392
80 (50)	6,389
109 (68)	8,784

TEST PROCEDURE

TP1 CONTINUOUS MEMORY DTC P0A44: CHECK FOR CORRECT TRACTION MOTOR RPM DURING THE ROAD TEST

NOTE: Refer to VEHICLE SPEED KM/H (MPH) AND TRACTION MOTOR RPM for correct traction motor to vehicle speed correlations.

- Clear the TCM DTCs.
- Access the TCM and monitor the VSS and M_SPEED PIDs.
- Road test the vehicle.
- Record traction motor RPM at different vehicle speeds.

Does the traction motor RPM correspond with the vehicle speed?

Yes	No
Unable to duplicate or identify the fault at this time. RETURN to **SYMPTOM CHARTS** to continue diagnosis.	INSTALL a new transaxle assembly.

PINPOINT TEST TQ: PARK MECHANISM MALFUNCTION

INTRODUCTION

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This pinpoint test is intended to diagnose the following:

- Gear selector assembly/cable (7K004).
- Transaxle assembly (7000).

TEST PROCEDURE

TQ1 DTC P2806: CHECK THE FUNCTION OF THE GEAR SELECTOR

- Key ON, engine OFF.
- Move the gear selector lever from PARK to REVERSE, NEUTRAL, DRIVE, and LOW gears.

Does the gear selector indicator on the instrument cluster match the position of the gear selector lever?

Yes	No
Key in OFF position. GO to **TQ2**.	Key in OFF position. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS - HYBRID** and diagnose the shift control is out of correct relationship condition.

TQ2 CHECK GEAR SELECTOR LEVER CABLE ALIGNMENT

NOTE: This step checks if the gear selector lever aligns with the drive position rib on the transaxle case.

- Key ON, engine OFF.
- Gear selector in DRIVE position.
- Visually check if the gear selector lever aligns with the drive position rib on the transaxle case. Refer to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS - HYBRID** for the alignment procedure.

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Does the gear selector lever align with the drive position rib on the transaxle case?

Yes	No
GO to **TQ3**.	REFER to **AUTOMATIC TRANSAXLE/TRANSMISSION EXTERNAL CONTROLS - HYBRID** to align the gear selector lever.

TQ3 CHECK THE GEAR SELECTOR LEVER CABLE AND BRACKET

- Inspect the gear selector lever cable and bracket for binding or damage.
- Check for loose gear selector lever cable and bracket.

Is a concern present?

Yes	No
REPAIR as necessary.	GO to **TQ4**.

TQ4 CHECK THE PARK PAWL FUNCTION

- Place vehicle on a slight grade with the gear selector in PARK with the brake applied.
- Release the brake pedal.

Does the park pawl keep the vehicle from moving when the brake is released?

Yes	No
Unable to duplicate or identify the fault at this time. RETURN to **SYMPTOM CHARTS** to continue diagnosis.	INSTALL a new transaxle assembly.

PINPOINT TEST TR: IMMEDIATE SHUTDOWN (ISDN) 1 AND 2 SIGNALS

INTRODUCTION

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This pinpoint test is intended to diagnose the following:

- Harness circuits: ISDN1, ISDN2.
- Transaxle assembly (7000).
- Inertia fuel shutoff (IFS) switch (9341).

Fig. 117: Identifying Traction Battery-A (TB-A) Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 118: Identifying Transaxle Assembly-A Connector Terminal
Courtesy of FORD MOTOR CO.

Fig. 119: Identifying Transaxle Assembly-B Connector Terminal
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

TR1 KOEO AND CONTINUOUS MEMORY DTC P1A0A: VERIFY THAT THE HARD FAULT IS PRESENT

NOTE: Clearing the TCM DTCs will erase any TCM recorded freeze frame data. Make sure to record any TCM freeze frame information before proceeding any further. Refer to the diagnostic tool instruction manual for freeze frame PID menu.

- Clear and retrieve TCM continuous DTCs.

Is DTC P1A0A present?

Yes	No

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GO to **TR2**.	GO to **TR15**.

TR2 CHECK THE IFS_PWR INPUT VOLTAGE TO THE TRACTION BATTERY

NOTE: Verify the front and rear inertia fuel shut off (IFS) switches are not tripped.

- Key in OFF position.
- TB-A connector disconnected.
- Key ON, engine OFF.
- Measure the voltage between:

(+) TB-A Connector, Harness Side	(-) Vehicle Battery
IFS_PWR - Pin 23, 7	Negative terminal

Is the voltage greater than 10.5 V?

Yes	No
Key in OFF position. GO to **TR4**.	Key in OFF position. GO to **TR3**.

TR3 CHECK THE FRONT AND REAR IFS FOR AN OPEN

- Disconnect the front and rear IFS switches.
- Reset the front and rear inertia switches.
- Measure the resistance across the normally closed contacts of the front and rear IFS switches.

Is each resistance less than 5 ohms?

Yes	No
Key in OFF position. IFS switch circuit failure. REPAIR as necessary. CHECK the condition of fuel fuse. If damaged, CHECK the VPWR circuit for a short to ground.	INSTALL a new IFS switch.

TR4 CHECK FOR AN IMMEDIATE SHUTDOWN REQUEST FROM TBCM

- Key ON, engine OFF.
- Access the TCM and monitor the I_SDN_1 and I_SDN_2 PIDs.

Do both I_SDN_1 and I_SDN_2 PIDs indicate discharge?

Yes	No
An open interlock circuit may be the cause for immediate shutdown. GO to **HJ3**.	GO to **TR5**.

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TR5 CHECK FOR ISDN1 SIGNAL LOW

NOTE: Use the PID reading from the PPT TR2.

Does only the I_SDN_1 PID indicate discharge?

Yes	No
Key in OFF position. GO to **TR6**.	GO to **TR10**.

TR6 CHECK THE ISDN1 CIRCUIT FOR AN OPEN IN THE HARNESS

- Transaxle Assembly-A connector disconnected.
- Measure the resistance between:

(+) TB-A Connector, Harness Side	(-) Transaxle Assembly-A Connector, Harness Side
ISDN1 - Pin 27	ISDN1 - Pin 6

Is the resistance less than 5 ohms?

Yes	No
GO to **TR7**.	REPAIR the open circuit.

TR7 CHECK THE ISDN1 CIRCUIT FOR A SHORT TO GROUND IN HARNESS

- Measure the resistance between:

(+) TB-A Connector, Harness Side	(-) Vehicle Battery
ISDN1 - Pin 27	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **TR8**.	REPAIR the short circuit to GND.

TR8 CHECK FOR THE ISDN1 CIRCUIT SHORTED TO CIRCUITS IN THE SAME HARNESS

- Measure the resistance between:

(+) Transaxle Assembly-A Connector, Harness Side	(-) Transaxle Assembly-A Connector, Harness Side
ISDN1 - Pin 6	CAN+ - Pin 1
ISDN1 - Pin 6	CAN- - Pin 7
ISDN1 - Pin 6	B+ - Pin 12
ISDN1 - Pin 6	GND - Pin 2, 8

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ISDN1 - Pin 6	PSR - Pin 4, 5

Are the resistances greater than 10K ohms?

Yes	No
GO to **TR9**.	REPAIR the short circuit.

TR9 SIMULATE ISDN1 NOT DISCHARGE SIGNAL TO THE TCM

- TB-A connector connected.
- Transaxle Assembly-A connector connected.
- Isolate the ISDN1 circuit at the TB-A connector.
- Connect a 5 amp fused jumper wire between the following:

Point A TB-A Connector, Harness Side	Point B Vehicle Battery
ISDN1 - Pin 27	Positive terminal

- Key ON, engine OFF.
- Access the TCM and monitor the I_SDN_1 PID.

Does the I_SDN_1 PID indicate discharge?

Yes	No
INSTALL a new transaxle assembly.	INSTALL a new traction battery.

TR10 CHECK FOR ISDN2 SIGNAL LOW

NOTE: Use the PID reading from the PPT TR2.

Does only the I_SDN_2 PID indicate discharge?

Yes	No
Key in OFF position. GO to **TR11**.	Key in OFF position. GO to **TR15**.

TR11 CHECK THE ISDN2 CIRCUIT FOR AN OPEN IN THE HARNESS

- TB-A connector disconnected.
- Transaxle Assembly-B connector disconnected.
- Measure the resistance between:

(+) TB-A Connector, Harness Side	(-) Transaxle Assembly-B Connector, Harness Side
ISDN2 - Pin 13	ISDN2 - Pin 7

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Is the resistance less than 5 ohms?

Yes	No
GO to **TR12**.	REPAIR the open circuit.

TR12 CHECK THE ISDN2 CIRCUIT FOR A SHORT TO GROUND IN THE HARNESS

- Measure the resistance between:

(+) Transaxle Assembly-B Connector, Harness Side	(-) Vehicle Battery
ISDN2 - Pin 7	Negative terminal

Is the resistance greater than 10K ohms?

Yes	No
GO to **TR13**.	REPAIR the short circuit to GND.

TR13 CHECK FOR THE ISDN1 CIRCUIT SHORTED TO SIGNALS IN THE SAME HARNESS

- Measure the resistance between:

(+) Transaxle Assembly-B Connector, Harness Side	(-) Transaxle Assembly-B Connector, Harness Side
ISDN2 - Pin 7	CTO - Pin 1
ISDN2 - Pin 7	TGAC - Pin 9
ISDN2 - Pin 7	TMAC - Pin 4
ISDN2 - Pin 7	MSDN - Pin 5
ISDN2 - Pin 7	GSDN - Pin 10

Are the resistances greater than 10K ohms?

Yes	No
GO to **TR14**.	REPAIR the short circuit.

TR14 SIMULATE ISDN2 NOT DISCHARGE SIGNAL TO THE TCM

- TB-A connector connected.
- Transaxle Assembly-B connector connected.
- Isolate the ISDN2 circuit at the TB-A connector.
- Connect a 5 amp fused jumper wire between the following:

Point A TB-A Connector, Harness Side	Point B Vehicle Battery
ISDN2 - Pin 13	Positive terminal

- Key ON, engine OFF.

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- Access the TCM and monitor the I_SDN_2 PID.

Does the I_SDN_2 PID indicate discharge?

Yes	No
INSTALL a new transaxle assembly.	INSTALL a new traction battery.

TR15 CHECK THE ISDN1 CIRCUIT FOR AN INTERMITTENT CONCERN

- Key ON, engine OFF.
- Access the TCM and monitor the I_SDN_1 PID.
- Carefully wiggle all accessible wiring and connectors associated with the circuit and look for a change in the PID state.

Is a concern present during the wiggle test?

Yes	No
Key in OFF position. REPAIR as necessary.	Key in OFF position. GO to **TR16**.

TR16 CHECK THE ISDN2 CIRCUIT FOR AN INTERMITTENT CONCERN

- Key ON, engine OFF.
- Access the TCM and monitor the I_SDN_2 PID.
- Carefully wiggle all accessible wiring and connectors associated with the circuit and look for a change in the PID state.

Is a concern present during the wiggle test?

Yes	No
Key in OFF position. REPAIR as necessary.	Key in OFF position. No fault found. The problem may be intermittent. GO to Pinpoint Test **Z**.

PINPOINT TEST TS: TRACTION MOTOR AND GENERATOR MOTOR HIGH VOLTAGE INVERTER PERFORMANCE.

INTRODUCTION

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MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
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This pinpoint test is intended to diagnose the transaxle assembly (7000).

TEST PROCEDURE

TS1 DTCS P0A78 AND P0A7A: CHECK FOR THE PRESENCE OF TBCM DTCS P0A1F, P0A27, OR P0A8D

NOTE: The TCM DTC P0A78 or P0A7A could be stored as a result of a traction battery fault.

- Carry out the TBCM self-test.

Is TBCM DTC P0A1F, P0A27, or P0A8D present during self-test?

Yes	No
DIAGNOSE TBCM DTC P0A1F, P0A27, or P0A8D before continuing. REFER to **HIGH VOLTAGE TRACTION BATTERY** .	GO to **TS2**.

TS2 CARRY OUT THE TCM SELF-TEST

- Clear the TCM continuous DTCs.
- Carry out the TCM KOEO on demand self-test.

Is TCM DTC P0A78 or P0A7A present during the self-test?

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Yes	No
INSTALL a new transaxle assembly.	Unable to duplicate or identify the fault at this time.

PINPOINT TEST TT: INVERTER HIGH VOLTAGE PERFORMANCE

INTRODUCTION

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This pinpoint test is intended to diagnose the following:

- High voltage cable from the transaxle assembly to the traction battery (14B322).
- High voltage traction battery (10B759).
- Transaxle assembly (7000).

Fig. 120: Identifying Traction Battery-High Voltage (TB-HV) Connector
Courtesy of FORD MOTOR CO.

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Fig. 121: Identifying Transaxle Assembly-Traction Battery High Voltage (TBHV) Connector
Courtesy of FORD MOTOR CO.

TEST PROCEDURE

TT1 DTC P1A07: CHECK FOR THE PRESENCE OF TBCM DTC P0A1F

NOTE: The TCM DTC P1A07 could be stored as a result of a traction battery fault.

- Carry out the TBCM self-test.

Is TBCM DTC P0A1F present during self-test?

Yes	No
DIAGNOSE TBCM DTC P0A1F before continuing. REFER to **HIGH VOLTAGE TRACTION BATTERY** .	GO to **TT2**.

TT2 VISUAL INSPECTION OF THE HIGH VOLTAGE SYSTEM

- Visually inspect all the high voltage cables.
- Make sure all the high voltage connectors are properly and securely connected.
- Examine all the high voltage cables and connectors for damaged, burned or overheated insulation and loose or broken conditions.
- Make sure the transmission inverter cover is securely closed and it was not removed from the vehicle.

Is a concern present?

Yes	No
REPAIR as necessary.	GO to **TT3**.

TT3 KOEO AND CONTINUOUS MEMORY DTC P1A07: VERIFY THAT THE HARD FAULT IS PRESENT

NOTE: Clearing the TCM DTCs will erase any TCM recorded freeze frame data. Make sure to record any TCM freeze frame information before proceeding any further. Refer to the diagnostic tool instruction manual for freeze frame PID menu.

- Clear and retrieve TCM continuous DTCs.

Is DTC P1A07 present?

Yes	No
GO to **TT4**.	GO to **TT10**.

TT4 CHECK THE DTCFZ PID FOR A DTC DETAIL NUMBER

NOTE: The DTCFZ PID is a freeze frame PID.

- Access the TCM and monitor the DTCFZ PID.

Does the DTCFZ PID indicate freeze detail number 93 or 94 present?

Yes	No
INSTALL a new transaxle assembly.	GO to **TT5**.

TT5 CHECK THE HIGH VOLTAGE BATTERY CONTACTOR STATUS AT TCM

- Key ON, engine OFF.
- Access the TCM and monitor the CONTACT PID.

Is the PID state CLOSED?

Yes	No
GO to **TT6**.	Key in OFF position. Unable to close the Traction Battery contactors. REFER to **HIGH VOLTAGE TRACTION BATTERY** .

TT6 CHECK FOR HIGH VOLTAGE AT THE TRANSAXLE POWER INVERTERS

- Access the TCM and monitor the HVBAT_V PID.
- Record the PID voltage.
- Access the TCM and monitor the G_INV_V and M_INV_V PIDs.

Are both PID voltages within 60 volts of the traction battery voltage recorded in this step?

Yes	No
GO to **TT10**.	GO to **TT7**.

TT7 CHECK FOR HIGH VOLTAGE AT THE TRANSAXLE POWER INVERTERS

- Access the TCM and monitor the M_INV_V and G_INV_V PIDs.

Is only one PID voltage within 60 volts of the traction battery voltage recorded in step TT6?

Yes	No
Key in OFF position. INSTALL a new transaxle assembly.	Key in OFF position. GO to **TT8**.

TT8 CHECK THE HIGH VOLTAGE POSITIVE CABLE FOR AN OPEN

- Key in OFF position.
- Transaxle Assembly-TBHV connector disconnected.

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- TB-HV connector disconnected.
- Measure the resistance between:

(+) Transaxle Assembly-TBHV Connector, Harness Side	(-) TB-HV Connector, Harness Side
HVP - Pin (+)	HVP - Pin (+)

Is the resistance less than 5 ohms?

Yes	No
GO to **TT9**.	INSTALL a new high voltage cable from the transaxle assembly to the traction battery.

TT9 CHECK THE HIGH VOLTAGE NEGATIVE CABLE FOR AN OPEN

- Measure the resistance between:

(+) Transaxle Assembly-TBHV Connector, Harness Side	(-) TB-HV Connector, Harness Side
HVN - Pin (-)	HVN - Pin (-)

Is the resistance less than 5 ohms?

Yes	No
INSTALL a new transaxle assembly.	INSTALL a new high voltage cable from the transaxle assembly to the traction battery.

TT10 CHECK THE HIGH VOLTAGE CABLES FOR AN INTERMITTENT CONCERN

- Key ON, engine OFF.
- Access the TCM and monitor the G_INV_V and M_INV_V PIDs.
- Carefully wiggle all accessible wiring and connectors associated with the High Voltage Cable from the Transaxle Assembly to the Traction Battery, and look for a change in the PID state.

Is a concern present during the wiggle test?

Yes	No
Key in OFF position. REPAIR as necessary.	GO to Pinpoint Test **Z**.

PINPOINT TEST TU: CALCULATED TORQUE ERROR

INTRODUCTION

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HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
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This pinpoint test is intended to diagnose the following:

- Powertrain control module (PCM) (12A650).
- Transaxle assembly (7000).

TEST PROCEDURE

TU1 KOEO AND CONTINUOUS MEMORY DTC P1145: VERIFY THAT THE HARD FAULT IS PRESENT

NOTE: Clearing the TCM DTCs will erase any TCM recorded freeze frame data. Make sure to record any TCM freeze frame information before proceeding any further. Refer to the diagnostic tool instruction manual for freeze frame PID menu.

- Clear and retrieve TCM continuous DTCs.

Is DTC P1145 present?

Yes	No

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GO to **TU2**.	GO to **TU6**.

TU2 CHECK THE DTCFZ PID FOR A DTC DETAIL NUMBER

NOTE: The DTCFZ PID is a freeze frame PID.

- Access the TCM and monitor the DTCFZ PID.

Does the DTCFZ PID indicate freeze detail number 41, 42, 61, 62 or 178 present?

Yes	No
INSTALL a new transaxle assembly.	GO to **TU3**.

TU3 CHECK THE TCM TOTAL TORQUE DESIRED PID VALUE IN REVERSE

NOTE: Do not apply the brake pedal when recording the PID value because it may produce false readings.

NOTE: Refer to diagnostic tool instruction manual for information on the recorder function.

- Key ON, engine running.
- Gear selector in REVERSE position.
- Access the TCM and monitor the TQ_DSD PID.
- Record the PID value when driving the vehicle in REVERSE.

Is the torque between -4,000 - 0 Nm (-2,950 - 0 lb ft)?

Yes	No
GO to **TU4**.	Key in OFF position. GO to **TU11**.

TU4 CHECK THE TCM TOTAL TORQUE DESIRED PID VALUE IN DRIVE

NOTE: Do not apply the brake pedal during this test because it may produce false readings.

NOTE: Refer to diagnostic tool instruction manual for information on the recorder function.

- Gear selector in DRIVE position.
- Access the TCM and monitor the TQ_DSD PID.
- Record the PID value when driving the vehicle in DRIVE.

Is the torque between 0 - 4,000 Nm (0 - 2,950 lb ft)?

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Yes	No
GO to **TU5**.	Key in OFF position. GO to **TU11**.

TU5 CHECK THE TCM TOTAL TORQUE DESIRED PID VALUE IN LOW

NOTE: Do not apply the brake pedal during this test because it may produce false readings.

NOTE: Refer to diagnostic tool instruction manual for information on the recorder function.

- Gear selector in LOW position.
- Access the TCM and monitor the TQ_DSD PID.
- Record the PID value when driving the vehicle in LOW.

Is the torque between 0 - 4,000 Nm (0 - 2,950 lb ft)?

Yes	No
INSTALL a new transaxle assembly.	Key in OFF position. GO to **TU11**.

TU6 CHECK THE DTCFZ PID FOR A DTC DETAIL NUMBER

NOTE: The DTCFZ PID is a freeze frame PID.

- Access the TCM and monitor the DTCFZ PID.

Does the DTCFZ PID indicate freeze detail number 41, 42, 61, 62 or 178 present?

Yes	No
INSTALL a new transaxle assembly.	GO to **TU7**.

TU7 RECREATE THE SYMPTOM USING ALL AVAILABLE DATA

NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- Access the Freeze Frame Data (if available) and record the DTC malfunction conditions.
- Clear the TCM DTCs.
- Obtain information from the customer information worksheet or any other available data from the customer.
- Access the TCM and monitor the TQ_DSD PID.
- Recreate the symptom using freeze frame and customer information.
- When the symptom occurs, press trigger to begin recording. Refer to diagnostic tool instruction

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manual for information on the recorder function.

Could the symptom be recreated?

Yes	No
Key in OFF position. GO to **TU8**.	Key in OFF position. GO to Pinpoint Test **Z**.

TU8 CHECK THE TCM TOTAL TORQUE DESIRED PID VALUE IN REVERSE

NOTE: Use the data recorded in the Pinpoint Test Step TU7.

Does the TCM TQ_DSD PID display between -4,000 - 0 Nm (-2,950 - 0 lb-ft) when the symptom occurs?

Yes	No
GO to **TU9**.	GO to **TU11**.

TU9 CHECK THE TCM TOTAL TORQUE DESIRED PID VALUE IN DRIVE

NOTE: Use the data recorded in the Pinpoint Test Step TU7.

Does the TCM TQ_DSD PID display between 0 - 4,000 Nm (0 - 2,950 lb-ft) when the symptom occurs?

Yes	No
INSTALL a new transaxle assembly.	GO to **TU11**.

TU10 CHECK THE TCM TOTAL TORQUE DESIRED PID VALUE IN LOW

NOTE: Use the data recorded in the Pinpoint Test Step TU7.

Does the TCM TQ_DSD PID display between 0 - 4,000 Nm (0 - 2,950 lb-ft) when the symptom occurs?

Yes	No
GO to **TU10**.	GO to **TU11**.

TU11 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.

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- Carry out the PCM self-test and verify the concern is still present.

Is the concern still present?

Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST TV: ENGINE SPEED DESIRED SIGNAL OUT OF RANGE

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
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This pinpoint test is intended to diagnose the following:

- Powertrain control module (PCM) (12A650)

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- Transaxle assembly (7000).

TEST PROCEDURE

TV1 KOEO AND CONTINUOUS MEMORY DTC P1A05: CHECK FOR PCM DTCS

- Retrieve all continuous memory and on-demand self-test DTCs from the PCM.

Are any engine speed related DTCs present?

Yes	No
DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	GO to **TV2**.

TV2 VERIFY THAT THE HARD FAULT IS PRESENT

NOTE: Clearing the TCM DTCs will erase any TCM recorded freeze frame data. Make sure to record any TCM freeze frame information before proceeding any further. Refer to the diagnostic tool instruction manual for freeze frame PID menu.

- Clear and retrieve TCM continuous DTCs.

Is DTC P1A05 present?

Yes	No
GO to **TV3**.	The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

TV3 ATTEMPT TO START THE ENGINE

- Key ON, engine running.

Does the engine start?

Yes	No
Key in OFF position. INSTALL a new transaxle assembly.	Key in OFF position. GO to **TV4**.

TV4 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.

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- Carry out the PCM self-test and verify the concern is still present.

Is the concern still present?

Yes	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST TY: TRANSMISSION RANGE SIGNAL

INTRODUCTION

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This pinpoint test is intended to diagnose the following:

- Powertrain control module (PCM) (12A650)

- Transaxle assembly (7000).

TEST PROCEDURE

TY1 DTC P1921: CHECK FOR THE PRESENCE OF DTC P1145

NOTE: Diagnose and repair any transmission range (TR) sensor KOEO and KOER self-test DTCs before entering this pinpoint test.

NOTE: The TCM DTC P1921 may be set as a result of DTC P1145.

Is TCM DTC P1145 present during the self-test?

Yes	No
DISREGARD DTC P1921 at this time and DIAGNOSE TCM DTC P1145. GO to Pinpoint Test **TU**.	GO to **TY2**.

TY2 KOEO AND CONTINUOUS MEMORY DTC P1921: VERIFY THAT THE HARD FAULT IS PRESENT

NOTE: Clearing the TCM DTCs will erase any TCM recorded freeze frame data. Make sure to record any TCM freeze frame information before proceeding any further. Refer to the diagnostic tool instruction manual for freeze frame PID menu.

- Clear and retrieve the TCM continuous DTCs.

Is DTC P1921 present?

Yes	No
GO to **TY3**.	GO to **TY4**.

TY3 CHECK THE TCM SHIFT POSITION PID

- Key ON, engine OFF.
- Access the TCM and monitor the PRNDL_T PID.
- Move the gear selector lever from PARK to REVERSE, NEUTRAL, DRIVE and LOW gears.

Does the gear selector match the PRNDL_T PID in every gear?

Yes	No
INSTALL a new transaxle assembly.	Key in OFF position. GO to **TY6**.

TY4 RECREATE THE SYMPTOM USING ALL AVAILABLE DATA

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NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- Access the Freeze Frame Data (if available) and record the DTC malfunction conditions.
- Clear the TCM DTCs.
- Obtain information from the customer information worksheet or any other available data from the customer.
- Access the TCM and monitor the PRNDL_T PID.
- Recreate the symptom using freeze frame and customer information.
- When the symptom occurs, press trigger to begin recording. Refer to diagnostic tool instruction manual for information on the recorder function.

Could the symptom be recreated?

Yes	No
Key in OFF position. GO to **TY5**.	GO to Pinpoint Test **Z**.

TY5 CHECK THE TCM SHIFT POSITION PID

NOTE: Use the data recorded in the Pinpoint Test Step TY3.

Does the gear selector match the TCM PRNDL_T PID in every gear?

Yes	No
INSTALL a new transaxle assembly.	GO to **TY6**.

TY6 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST TZ: VEHICLE MODE SIGNAL

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This pinpoint test is intended to diagnose the following:

- Powertrain control module (PCM) (12A650).
- Transaxle assembly (7000).

TEST PROCEDURE

TZ1 KOEO AND CONTINUOUS MEMORY DTC P1A06: VERIFY THAT THE HARD FAULT IS PRESENT

NOTE: Clearing the TCM DTCs will erase any TCM recorded freeze frame data. Make sure to record any TCM freeze frame information before proceeding any further. Refer to the diagnostic tool instruction manual for freeze frame PID menu.

- Clear and retrieve TCM continuous DTCs.

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Is DTC P1A06 present?

Yes	No
GO to **TZ2**.	Unable to duplicate or identify the fault at this time. The concern is elsewhere. RETURN to **SYMPTOM CHARTS** for further direction.

TZ2 CHECK THE TCM VEHICLE MODE PID

- Key ON, engine OFF.
- Access the TCM and monitor the VEHMODE PID.
- Key ON, engine running.

Does the PID indicate that the VEHMODE changed when the key is cycled from ON to START?

Yes	No
Key in OFF position. INSTALL a new transaxle assembly.	Key in OFF position. GO to **TZ3**.

TZ3 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	No
INSTALL a new PCM. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TEST Z: INTERMITTENT

INTRODUCTION

WARNING: THIS VEHICLE IS EQUIPPED WITH HIGH VOLTAGE CABLES, COMPONENTS, AND WIRING. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. CERTIFIED RUBBER INSULATING GLOVES AND A FACE SHIELD MUST BE WORN WHEN WORKING WITH THE

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HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING. THE IGNITION KEY MUST BE CYCLED TO THE OFF POSITION FOR A MINIMUM OF 5 MINUTES, AND THE HIGH VOLTAGE TRACTION BATTERY SERVICE DISCONNECT PLUG PLACED IN THE SERVICING/SHIPPING POSITION BEFORE DISCONNECTING THE HIGH VOLTAGE CABLES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.
DO NOT DISCONNECT, DISABLE, OR TOUCH THE HIGH VOLTAGE CABLES, COMPONENTS, OR WIRING DURING THE MODULE REPROGRAMMING PROCEDURE BECAUSE HIGH VOLTAGE IS PRESENT. THE HIGH VOLTAGE WARNING LABELS CONTAINING THE HIGH VOLTAGE SYMBOL ARE LOCATED ON EACH HIGH VOLTAGE COMPONENT. HIGH VOLTAGE CABLES, AND WIRING ARE ORANGE IN COLOR. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.

Important Safety Notice

Appropriate repair methods and procedures are essential for the safe, reliable operation of all motor vehicles, as well as the personal safety of the individual doing the work. This article provides general directions for repairing vehicles with tested, effective techniques. Following them will help ensure reliability. There are numerous variations in procedures, techniques, tools, and parts for repairing vehicles, as well as in the skill of the individual doing the work. This article cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this article must first establish that they compromise neither their personal safety nor the vehicle integrity by their choice of methods, tools, or parts.

This pinpoint test is intended to diagnose and isolate intermittent concerns for the following:

- All electronic engine control (EEC) subsystems.
- Transaxle assembly (7000).

This chart is used to determine which test to run for the suspect circuit. Corresponding PIDs to each circuit are listed. Some circuits do not have an associated PID or the PID may not be available and has to be measured with a digital multimeter. More specific PIDs can be found in **REFERENCE VALUES** .

PCM/TCM PIDS/SIGNALS

PCM/TCM* PIDS/SIGNALS	Associated Circuit	Test Type
ACCR	A/CCR	output
ACCS	A/CCS	input
AC_ET	ACET	input
ACFDS_P	A/CFDS	input
Use Digital Multimeter	A/CLPCS	input
ACP	A/CPSW	input
ACRDV	A/CRDV	output
ACRSW	A/CRSW	input
AMC	AMC	output
APP1	APPS1	input

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APP2	APPS2	input
APP3	APPS3	input
ARPMDES*, ENG_CTO*	CTO	input
BPO, BPO_HZ	BPO	input
BPP/BOO	BPP	input
Use Digital Multimeter	BPS	input
Use Digital Multimeter	CD-A (primary)	output
Use Digital Multimeter	CD-B (primary)	output
Use Digital multimeter	CD-C (primary)	output
Use Digital Multimeter	CD-D (primary)	output
CHT, CHT V	CHT	input
Use Digital Multimeter	CKP(+)	input
Use Digital Multimeter	CMP	input
Use Digital Multimeter	CTO	output
DCE, DCE_F	DCE	output
Use Digital Multimeter	DCF	input
EGRMC1	EGRMC1	output
EGRMC2	EGRMC2	output
EGRMC3	EGRMC3	output
EGRMC4	EGRMC4	output
EVAPCV	CANV	output
EVAPPDC	VMV	output
FP	FP	output
FPM	FPM	input
FRP, FRP_V	FRP	input
FRT, FRT_V	FRT	input
FTIV	FTIV	output
FTP, FTP_V	FTP	input
G_SDN, Use Digital Multimeter	GSDN	output
G_SDN_A*, G_SDN_C*	GSDN	input
GTQ_CMD	TGAC	input
GTQ_CMD*	TGAC	output
HFC	FC3	output
HPUMP	HPCR	output
HTR11	HTR11	output
HTR12	HTR12	output
IAT, IAT_V	IAT	input
IGN_R	ISP-R	input
IGN_R/S	ISP-RS	input
IMRC	IMRC	output
IMRCM	IMRCM	input
INJ1	INJ1	output
INJ2	INJ2	output
INJ3	INJ3	output

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	INJ4	output
ISDN1*	ISDN1	input
ISDN2*	ISDN2	input
Use Digital Multimeter	KAPWR	input
KS1	KS(+)	input
LFC	FC1	output
MAF, MAF_V	MAF	input
MAP	MAP	input
MECP	MECP	output
Use Digital Multimeter	MECT	input
MFC	FC2	output
M_SDN, Use Digital Multimeter	MSDN	output
MTQ_OUT	TMAC	input
MTQ_OUT*	TMAC	output
O2S11SV	HO2S11	input
O2S12SV	HO2S12	input
PSR	PSR	output
TACM (+)	TACM (+)	output
TACM (-)	TACM (-)	output
TP1	TP1	input
TP2	TP2	input
TR-A1	TR-A1	input
TR-A2	TR-A2	input
TR-A3	TR-A3	input
VPWR	VPWR	input
Use Digital Multimeter	VREF	output

TEST PROCEDURE

Z1 DIRECTION FOR INTERMITTENT DIAGNOSTIC PATH

NOTE: **Proceed with this step only if the powertrain control module (PCM) or transaxle control module (TCM) DTCs were not previously cleared. Record freeze frame data prior to clearing the PCM DTCs. Clearing the DTCs will clear any freeze frame data and eliminate FMEM. This will help to recreate the original conditions that set the DTCs or caused the symptom.**

- Key ON, engine OFF.
- Clear PCM DTCs first and then TCM DTCs.

Have the DTCs been cleared?

Yes	No
GO to **Z2**.	CLEAR the DTCs. GO to **Z2**.

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Z2 SELECT THE PIDS AND/OR SIGNALS RELATED TO THE SYSTEM

- A list of related PIDs and/or signals are needed for use with the diagnostic tool to monitor the suspect areas. Obtain the customer symptom description. Use the Reference Value Symptom chart and proceed to the **REFERENCE VALUE PID/MEASURED SIGNAL CHART** .
- Highlight each available PID/signal recommended by the charts under the PID/signal selection menu on the diagnostic tool.

Have all available PIDs/signals related to the symptom been selected?

Yes	No
GO to **Z3**.	REPEAT the test step to obtain the required information.

Z3 DECISION TO VERIFY THE SYMPTOM

NOTE: The path to symptom verification is optional, but is recommended for several reasons. For example:

- The vehicle is in for a repeat repair.
- No DTC is present.
- Customer has difficulty describing the symptom.

Has a fault symptom been detected?

Yes	No
GO to **Z10**.	GO to **Z4**.

Z4 COLLECT ANY SYMPTOM RELATED DATA TO AID IN VERIFICATION

NOTE: Only MIL codes trigger freeze frame data. Refer to the diagnostic tool instruction manual to retrieve the freeze frame information.

- Prepare the freeze frame data for use with information from the **SYMPTOM CHARTS** article.
- Check the continuous memory DTCs that should have been recorded from an earlier pinpoint test.
- Access information from the customer information worksheet and the customer if available. Access any other symptom related data available, such as TSBs and CQIS reports.

Has all available data been recorded?

Yes	No
GO to **Z5**.	GATHER as much data as possible to aid in isolating the intermittent fault area. REPEAT the test step to obtain the required information.

Z5 RECREATE THE SYMPTOM USING ALL AVAILABLE DATA

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NOTE: To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.

- With the diagnostic tool, select and monitor the same PIDs as displayed in freeze frame along with previously selected PIDs/signals from Step Z2. Using freeze frame data recorded earlier, recreate the conditions described by each freeze frame PID. Pay special attention to ECT, LOAD, RPM and VSS. Also, use any available data from the customer, TSBs, and other sources to aid in producing the correct conditions for recreating the symptom.
- When the symptom occurs, press the trigger to begin recording. Refer to the diagnostic tool instruction manual for information on the recorder function.

Could the symptom be recreated?

Yes	No
GO to **Z10**.	GO to **Z6**.

Z6 RECREATE THE SYMPTOM USING THE KOEO AND ROAD TEST PROCEDURE

NOTE: PIDs for output in the Reference Value Charts represent command values only. Circuit measurements with a digital multimeter indicate the actual output status. Therefore, in the case of a fault, the PID and circuit reading on the vehicle may not correspond with each other. PIDs for PCM/TCM circuits with a mismatch in the digital multimeter measurement indicate a possible PCM/TCM concern.

- The road test is the last attempt to locate the area of concern before physically disturbing vehicle circuits.
- The intermittent road test procedure is a set of instructions for monitoring PIDs/signals with a diagnostic tool and circuit measurements with a digital multimeter. This is done under 4 different conditions - key on/engine off, hot idle, 48 km/h (30 mph) and 88 km/h (55 mph). Use the **TYPICAL DIAGNOSTIC REFERENCE VALUES** to compare with the actual vehicle. For actual road test at speeds, a planned route or test track and passenger is required.
- Locate the correct reference value chart in **REFERENCE VALUES** article.
- Set the vehicle up to measure the circuits with a digital multimeter and a diagnostic tool.
- Connect the diagnostic tool to the data link connector (DLC).
- Key ON, engine OFF.
- With the diagnostic tool, select and monitor PIDs and measure circuits shown in the Reference Value Chart **TYPICAL DIAGNOSTIC REFERENCE VALUES** article.
- Compare the diagnostic tool PIDs and digital multimeter values to the Reference Value Charts.

Are any values out of range?

Yes	No
GO to **Z10**.	GO to **Z7**.

Z7 RECREATE THE SYMPTOM USING THE HOT IDLE ROAD TEST PROCEDURE

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- The engine temperature should be at least 87°C (189°F).
- Key ON, engine running.
- Continue to monitor the PIDs and circuits as in the previous step.

Are any values out of range?

Yes	No
GO to **Z10**.	GO to **Z8**.

Z8 RECREATE THE SYMPTOM USING THE 48 KM/H (30 MPH) SLOW CRUISE ROAD TEST PROCEDURE

- Drive the vehicle on a preplanned route.
- Continue to monitor the PIDs and circuits as in the previous step.

Are any values out of range?

Yes	No
GO to **Z10**.	GO to **Z9**.

Z9 RECREATE THE SYMPTOM USING 88 KM/H (55 MPH) HIGH CRUISE ROAD TEST PROCEDURE

- Continue to drive the vehicle on the preplanned route.
- Continue to monitor the PIDs and circuits as in the previous step.

Are any values out of range?

Yes	No
GO to **Z10**.	Attempt to recreate the intermittent concern. GO to **Z10**.

Z10 SELECT CIRCUITS FROM THE INTERMITTENT TEST CHART

- Remain in the PID/Signal selection menu with the diagnostic tool.
- If the intermittent road test was used to verify the symptom, highlight the PIDs/signals that were displayed as a mismatch to the Reference Values from **REFERENCE VALUES** article. Otherwise, highlight only the PIDs/signals from step Z2.
- Proceed to the intermittent test chart located at the beginning of this pinpoint test.
- Match the selected PIDs/signals to the corresponding circuit in the chart. There may be more than one circuit to test. If a PID/signal recording was made with the diagnostic tool, it may be helpful to replay it at this time. Refer to the diagnostic tool instruction manual for recorder function information.
- Input Test - used on sensing inputs such as temperature, position or oxygen.
- Output Test - used on output devices such as relays, coils or solenoids.

Has a test been chosen?

Yes	No

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For the input test, GO to **Z11**. For the output test, GO to **Z16**.	REFER to **SYMPTOM CHARTS** to diagnose other driveability symptoms.

Z11 KOEO INPUT TEST PROCEDURE FOR THE PCM/TCM SENSORS

WARNING: WHEN CARRYING OUT ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING, OR TOOLS NEAR COOLING FANS, BELTS, OR HOT SURFACES.

- Using the circuits chosen from the Intermittent Test Chart, select only the recommended PIDs/signals to monitor with the diagnostic tool. If a PID is not available for the circuit, use a digital multimeter to check the value.
- Proceed to the area of the suspect wiring or component fault.
- Key ON, engine OFF.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or digital multimeter while tapping on the component.
- Monitor while wiggling the sensor harness wire from the component to the PCM/TCM.
- Look for abrupt changes in the values. Compare these actual values to the **TYPICAL DIAGNOSTIC REFERENCE VALUES** .

Are there abrupt changes in the PID values that do not compare with TYPICAL DIAGNOSTIC REFERENCE VALUES ?

Yes	No
REPAIR as necessary. TEST the system for normal operation.	GO to **Z12**.

Z12 KOER INPUT TEST PROCEDURE FOR THE PCM/TCM SENSORS

WARNING: WHEN CARRYING OUT ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING, OR TOOLS NEAR COOLING FANS, BELTS, OR HOT SURFACES.

- Key ON, engine running.
- Continue to monitor the PIDs and circuits as in the previous step.
- Proceed to the area of the suspect wiring or component fault.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or digital multimeter while tapping on the component.
- Monitor while wiggling the sensor harness wire from the component to the PCM/TCM.
- Look for abrupt changes in the values. Compare these actual values to the **TYPICAL DIAGNOSTIC REFERENCE VALUES** .

Are any values fluctuating in and out of range?

Yes	No
REPAIR as necessary.	

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TEST the system for normal operation.	GO to **Z13**.

Z13 KOEO WATER SOAK TEST PROCEDURE FOR THE PCM/TCM SENSORS, EXCLUDING HIGH VOLTAGE CIRCUITS

WARNING: WHEN CARRYING OUT ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING, OR TOOLS NEAR COOLING FANS, BELTS, OR HOT SURFACES.

- Key ON, engine OFF.
- Continue to monitor the PIDs and circuits as in the previous step.
- Proceed to the area of the suspect wiring or component fault.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or digital multimeter values while lightly spraying a water mist on the component to PCM/TCM.
- Monitor while spraying the sensor harness wire from the component to the PCM/TCM.
- Look for abrupt changes in the values. Compare these actual values to the **TYPICAL DIAGNOSTIC REFERENCE VALUES** .

Are any values fluctuating in and out of range?

Yes	No
REPAIR as necessary. TEST the system for normal operation.	GO to **Z14**.

Z14 KOER WATER SOAK TEST PROCEDURE FOR THE PCM/TCM SENSORS, EXCLUDING HIGH VOLTAGE CIRCUITS

WARNING: WHEN CARRYING OUT ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING, OR TOOLS NEAR COOLING FANS, BELTS, OR HOT SURFACES.

- Key ON, engine running.
- Continue to monitor the PIDs and circuits as in the previous step.
- Proceed to the area of the suspect wiring or component fault.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or digital multimeter values while lightly spraying a water mist on the component to PCM/TCM.
- Monitor while spraying the sensor harness wire from the component to the PCM/TCM.
- Look for abrupt changes in the values. Compare these actual values to the **TYPICAL DIAGNOSTIC REFERENCE VALUES** .

Are any values fluctuating in and out of range?

Yes	No
REPAIR as necessary.	

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TEST the system for normal operation.	GO to **Z15**.

Z15 KOER WATER SOAK TEST PROCEDURE FOR THE PCM/TCM SENSORS, EXCLUDING HIGH VOLTAGE CIRCUITS

WARNING: WHEN CARRYING OUT ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING, OR TOOLS NEAR COOLING FANS, BELTS, OR HOT SURFACES.

CAUTION: The cooling fans or the fuel pump may turn on during the next steps.

NOTE: Remember that PIDs selected from the Intermittent Test Chart display commanded values only. A digital multimeter measurement is needed to display the actual values. Be sure to compare them. Look for fluctuations to occur during any part of the following test. The Output State Test may not control some outputs, such as injectors and ignition coils and may not be available for all actuators.

- Using the circuits chosen from the Intermittent Test Chart, select only the recommended PIDs/signals to monitor with the diagnostic tool. If a PID is not available for the circuit, use a digital multimeter to check the value.
- Key ON, engine OFF.
- With the diagnostic tool, turn on selected outputs using Output State Control. Refer to the diagnostic tool instruction manual.
- Proceed to the area of the suspect wiring or component fault.
- Monitor the PID or digital multimeter while tapping on the component.
- Monitor while wiggling the sensor harness wire from the component to the PCM/TCM.
- Look for abrupt changes in the values. Compare these actual values to the **TYPICAL DIAGNOSTIC REFERENCE VALUES** .

Is there a mismatch between command and actual, or are any values fluctuating in and out of range when compared to the TYPICAL DIAGNOSTIC REFERENCE VALUES ?

Yes	No
REPAIR as necessary. TEST the system for normal operation.	GO to **Z16**.

Z16 KOEO WATER SOAK TEST PROCEDURE FOR THE PCM/TCM ACTUATORS, EXCLUDING HIGH VOLTAGE CIRCUITS

WARNING: WHEN CARRYING OUT ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING, OR TOOLS NEAR COOLING FANS, BELTS, OR HOT SURFACES.

NOTE: Remember that PIDs selected from the Intermittent Test Chart display commanded values only. A digital multimeter measurement is needed to

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display the actual values. Make sure to compare them. Look for fluctuations to occur during any part of the following test. The Output State Test may not control some outputs, such as injectors and ignition coils and may not be available for all actuators.

- To test these output types, GO to **Z18**.
- Key ON, engine running.
- Proceed to the area of the suspect wiring or component fault.
- Monitor the PIDs with the diagnostic tool and note the values. Compare the diagnostic tool values with values from a digital multimeter with the engine at idle. While tapping on the suspect component look for fluctuations in the values.
- If a coil for a coil on plug application is suspect, turn off the key. Gain access to the coil and measure continuity from the spark plug terminal to the signal terminal while tapping the coil. A large fluctuation in resistance indicates an intermittent open or short.
- Monitor the PIDs while wiggling the sensor harness wire from the component to the PCM/TCM.
- Look for abrupt changes in the values. Compare these actual, values to the **TYPICAL DIAGNOSTIC REFERENCE VALUES** .

Is there a diagnostic tool to digital multimeter value mismatch or an idle fluctuation?

Yes	No
REPAIR as necessary. TEST the system for normal operation.	GO to **Z17**.

Z17 KOEO WATER SOAK TEST PROCEDURE FOR THE PCM/TCM ACTUATORS, EXCLUDING HIGH VOLTAGE CIRCUITS

WARNING: WHEN CARRYING OUT THE WATER SOAK TEST ON ELECTRICAL COMPONENTS AND/OR HARNESSES, AVOID CONTACT WITH THE PCM, TCM, GEM, AND OTHER MODULES IF POSSIBLE.

WARNING: WHEN CARRYING OUT ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING, OR TOOLS NEAR COOLING FANS, BELTS, OR HOT SURFACES.

NOTE: Remember that PIDs selected from the Intermittent Test Chart display commanded values only. A digital multimeter measurement is needed to display the actual values. Be sure to compare them. Look for fluctuations to occur during any part of the following test. The Output State Test may not control some outputs, such as injectors and ignition coils and may not be available for all actuators.

- To test these output types, GO to **Z18**.
- Key ON, engine OFF.
- With the diagnostic tool, turn on selected outputs using Output State Control. Refer to the diagnostic tool instruction manual.
- Proceed to the area of the suspect wiring or component fault.

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- Monitor the PID or digital multimeter values while lightly spraying a water mist on the component to PCM/TCM.
- Look for abrupt changes in the values. Compare these actual values to the **TYPICAL DIAGNOSTIC REFERENCE VALUES** .

Is there a mismatch between command and actual or are any values fluctuating in and out of range when compared to the TYPICAL DIAGNOSTIC REFERENCE VALUES ?

Yes	No
REPAIR as necessary. TEST the system for normal operation.	GO to **Z18**.

Z18 KOER WATER SOAK TEST PROCEDURE FOR THE PCM/TCM ACTUATORS

WARNING: WHEN CARRYING OUT THE WATER SOAK TEST ON ELECTRICAL COMPONENTS AND/OR HARNESSES, AVOID CONTACT WITH THE PCM, TCM, GEM, AND OTHER MODULES IF POSSIBLE.

WARNING: WHEN CARRYING OUT ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING, OR TOOLS NEAR COOLING FANS, BELTS, OR HOT SURFACES.

- Key ON, engine running.
- Using the circuits chosen from the Intermittent Test Chart, select only the recommended PIDs/signals to monitor with the diagnostic tool. If a PID is not available for the circuit, use a digital multimeter to check the value.
- Proceed to the area of the suspect wiring or component fault.
- Monitor the PID or digital multimeter values while lightly spraying a water mist on the component to PCM/TCM.
- Monitor while spraying the sensor harness wire from the component to the PCM/TCM.
- Look for abrupt changes in the values. Compare these actual values to the **TYPICAL DIAGNOSTIC REFERENCE VALUES** .

Is there a mismatch between command and actual or are any values fluctuating in and out of range when compared to the TYPICAL DIAGNOSTIC REFERENCE VALUES ?

Yes	No
REPAIR as necessary. TEST the system for normal operation.	GO to **Z19**.

Z19 INSPECT FOR INTERMITTENT MECHANICAL CONCERNS

NOTE: It is possible for an intermittent mechanical concern to cause a good PCM/TCM system to react abnormally.

- An inspection of DTC related mechanical systems should have been performed in an earlier article. If not, visually inspect at this time.

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- Look for possible vacuum lines, wires, cables, linkage, or hoses that may become kinked, shorted, or restricted during normal engine operation.
- This may include engine/transmission gear changes, acceleration and deceleration, rough roads, and various engine RPM and torque related conditions.

Is a mechanical concern detected?

Yes	No
REPAIR as necessary. TEST the system for normal operation.	It is necessary to SEEK additional help. . A vehicle data recorder (VDR) or similar recorder may also be useful.

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