PINPOINT TESTS A: NO START

INTRODUCTION

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. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

This pinpoint test is intended to diagnose the following:

- spark (as related to electronic engine control)
- PCM (12A650)

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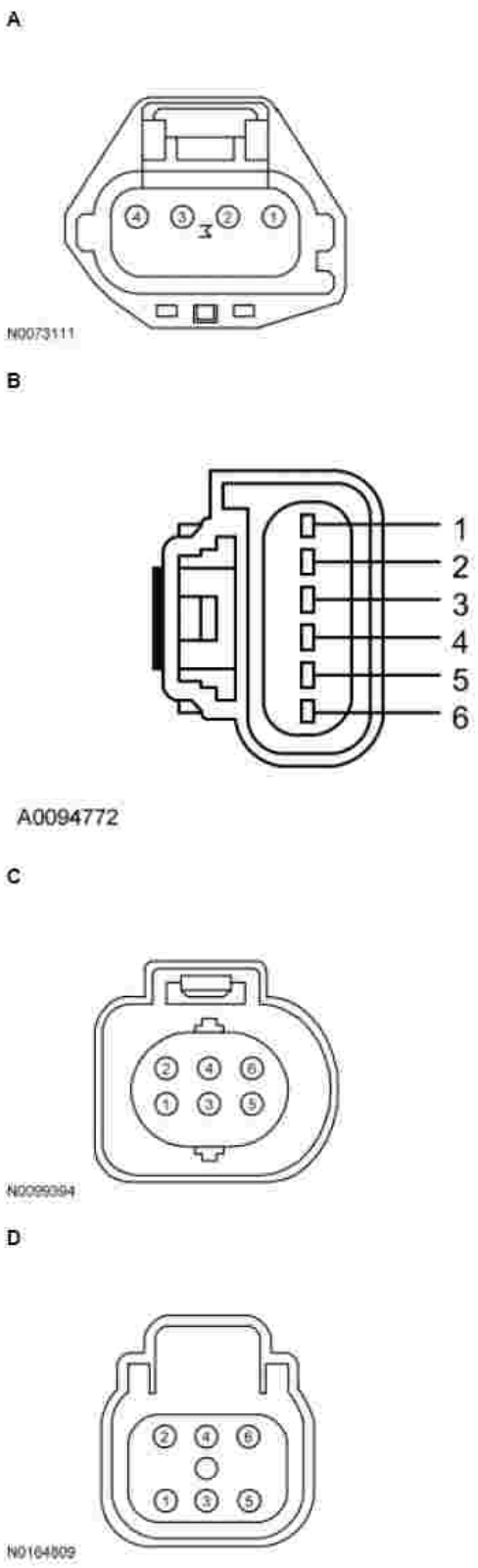

Fig. 1: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 6.8L, Explorer GTDI 3.5L, F-650/F-750, F-Series Super Duty 6.8L, Flex GTDI 3.5L, MKT 3.5L, Motorhome/Stripped Chassis/Step Van, Taurus GTDI 3.5L	A	3 2	ETCRTN ETCREF
EcoSport 2.0L	B	5 4	ETCRTN ETCREF

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Vehicle	Connector	Pin	Circuit
EcoSport 1.5L, EcoSport 1.0L, Escape/Kuga 1.5L, Fiesta 1.0L, Focus 1.0L, Fusion 1.5L, KA 1.0L	C	3 1	ETCRTN ETCREF
Fiesta 1.6L	D	2 6	ETCRTN ETCREF
KA 1.5L	C	2 6	ETCRTN ETCREF
All other vehicles	B	4 5	ETCRTN ETCREF

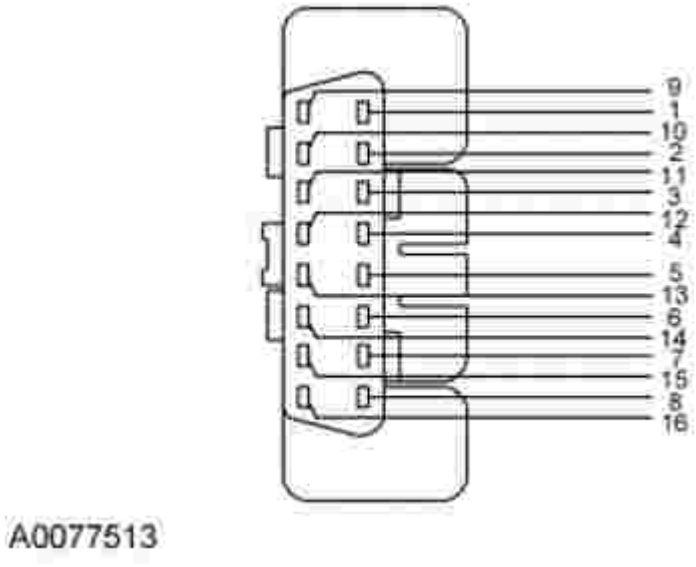

Fig. 2: Data Link Connector (DLC)
Courtesy of FORD MOTOR CO.

Pin	Circuit
13	FEPS (Flash EEPROM Programming Signal)

TEST PROCEDURE

A1 ATTEMPT TO CRANK THE ENGINE

NOTE: Verify the inertia fuel shutoff (IFS) switch is set (button pushed in). Refer to the Owner's Literature for location.

Does the engine crank?

Yes	No
GO to A2.	REFER to the appropriate Starting System article, and DIAGNOSE the engine does not crank symptom.

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 correct repair procedure.

Does the vehicle start?

Yes	No

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Yes	No
The vehicle has an intermittent no start. GO to **PINPOINT TEST Z**.	For DTCs P0320 or P0322, GO to **PINPOINT TEST JD**. For all others, GO to A3.

A3 CHECK VREF VOLTAGE TO THE ETBTPS

- Ignition OFF.
- ETBTPS connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) ETBTPS Connector, Harness Side	(-) ETBTPS Connector, Harness Side
ETCREF	ETCRTN

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to A4.	GO to **PINPOINT TEST C**.

A4 CHECK THE FLASH EEPROM PROGRAMMING SIGNAL (FEPS) CIRCUIT FOR A SHORT TO VOLTAGE

NOTE: **For vehicles without a FEPS circuit, follow the Yes answer.**

- Ignition OFF.
- ETBTPS connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

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

Is the voltage less than 9 V?

Yes	No
GO to A5.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

A5 CHECK THE RPM IN THE PCM

NOTE: **Connect the scan tool to a voltage source that is powered with the ignition in the START position (such as directly to the vehicle battery). Also verify that the vehicle battery is fully charged.**

NOTE: **Normal engine cranking speed is between 150 RPM and 350 RPM.**

- Access the PCM and monitor the RPM (RPM) PID.
- Crank the engine while viewing the RPM PID.

Is the RPM between 150 RPM - 350 RPM?

Yes	No
GO to A6.	For base engine concerns, REFER to the appropriate Engine System article - General Information, and DIAGNOSE difficult starting symptom. For all others, GO to JD2.

A6 CHECK FOR CRANKSHAFT POSITION (CKP) AND CAMSHAFT POSITION (CMP) SYNCHRONIZATION

- Access the PCM and monitor the SYNC (MODE) PID.

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- Crank the engine while viewing the SYNC PID.

Does the SYNC PID read YES?

Yes	No
GO to A7.	GO to **PINPOINT TEST JD**.

A7 CHECK FOR SPARK AT THE CYLINDERS

- Ignition OFF.
- Remove the fuel pump fuse to disable the fuel pump.
- Disconnect the ignition coils from the spark plugs on half of the number of cylinders on the engine.
- Connect the Adjustable Ignition Spark Tester THX458 or equivalent to a spark plug boot and repeat for half the number of cylinders on the engine.
- Observe the spark tester while cranking the engine.

Is a bluish-white spark present for each tested cylinder?

Yes	No
GO to A8.	For Fiesta 1.6L TiVCT, and KA 1.5L, GO to **PINPOINT TEST JE**. For all others, GO to **PINPOINT TEST JF**.

A8 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.
FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

NOTE: **While activating the fuel pump on an electronic returnless fuel system a brief pressure spike may occur.**

- Ignition OFF.
- Relieve the fuel pressure. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure.
- Connect the fuel pressure gauge using the appropriate fuel pressure test hose and adaptor.
- Ignition ON, engine OFF.
- Access the PCM and control the FP (MODE) PID.
- 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
GO to A9.	GO to **PINPOINT TEST HC**.

A9 CHECK THE FUEL PRESSURE LEAKDOWN

- Ignition ON, engine OFF.
- Access the PCM and control the FP (MODE) PID.
- Activate the fuel pump to obtain maximum fuel pressure.
- Monitor the FRP.
- Verify the fuel pressure remains within 34 kPa (5 psi) of the maximum pressure for 1 minute after turning the pump off.

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

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Yes	No
For Continental 2.0L, Continental 2.7L, Continental 3.0L, EcoSport 1.0L, EcoSport 2.0L, Edge 2.0L, Edge 2.7L, Escape/Kuga 1.5L, Escape/Kuga 2.0L, Expedition, Explorer 2.3L, Explorer 3.5L GTDI, F-150 2.7L, F-150 3.3L, F-150 3.5L, F-150 5.0L, Fiesta 1.0L, Fiesta 1.6L GTDI, Flex 3.5L GTDI, Focus, Ford GT, Fusion 1.5L, Fusion 2.0L, Fusion 2.7L, MKC, MKT 2.0L, MKT 3.5L, MKX 2.0L, MKX 2.7L, MKZ, Mustang 2.3L, Mustang 5.0L, Navigator, Taurus 2.0L, Taurus 3.5L GTDI, and Transit 3.5L, GO to A11. For all others, GO to A10.	GO to **PINPOINT TEST HC**.

A10 CHECK THE FUEL INJECTORS FOR VOLTAGE

NOTE: **A no start condition typically exists only if greater than half of the fuel injectors are without voltage. Check at least 2 fuel injectors, 1 on each bank on V type engines.**

- Ignition OFF.
- Disconnect 2 fuel injectors.
- Ignition ON, engine OFF.
- Measure the VPWR voltage at each fuel injector harness connector.

Is the voltage greater than 10.5 V?

Yes	No
GO to A11.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

A11 CHECK THE FUEL INJECTORS' ABILITY TO DELIVER FUEL

- Cycle the ignition several times to charge the fuel system.
- Disable the fuel pump.
- Monitor the fuel pressure gauge while cranking the engine for at least 5 seconds.

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

Yes	No
For Continental 2.0L, Continental 2.7L, Continental 3.0L, EcoSport 1.0L, EcoSport 2.0L, Edge 2.0L, Edge 2.7L, Escape/Kuga 1.5L, Escape/Kuga 2.0L, Expedition, Explorer 2.3L, Explorer 3.5L GTDI, F-150 2.7L, F-150 3.3L, F-150 3.5L, F-150 5.0L, Fiesta 1.0L, Fiesta 1.6L GTDI, Flex 3.5L GTDI, Focus, Ford GT, Fusion 1.5L, Fusion 2.0L, Fusion 2.7L, MKC, MKT 2.0L, MKT 3.5L, MKX 2.0L, MKX 2.7L, MKZ, Mustang 2.3L, Mustang 5.0L, Navigator, Taurus 2.0L, Taurus 3.5L GTDI, and Transit 3.5L, GO to **PINPOINT TEST DI**. For all others, The electronic engine control (EEC) system is not the cause of the no start. RETURN to **SYMPTOM CHARTS** for further direction.	GO to A12.

A12 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.
- 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)** , Programming the VID Block for a Replacement PCM.	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 TESTS AA: AUTO START STOP

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- PCM (12A650)

TEST PROCEDURE

AA1 CHECK FOR DTCS

- Carry out the PCM self-test.
- Check for any other module DTCs.

Are any DTCs other than DTC P164C present?

Yes	No
For PCM DTCs, GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** . For all other module DTCs, REFER to the applicable Service Information article to continue diagnosis.	GO to AA2.

AA2 CHECK FOR CORRECT AUTO START STOP SYSTEM OPERATION

NOTE: **Verify the conditions that disable the auto start stop system operation are not present while checking the auto start stop system for correct operation. Refer to POWERTRAIN CONTROL SOFTWARE , Auto Start Stop.**

NOTE: **When the auto start stop system shuts the engine off, an indicator illuminates in the instrument panel cluster (IPC). Any other engine off conditions should be considered an engine stall.**

NOTE: **When the auto start stop system is inhibited, the On Demand Screen indicates why the engine is not turning off.**

- Place the gear selector in DRIVE and drive the vehicle over 4 km/h (2.5 mph) until the engine operating temperature is greater than 60Â°C (140Â°F).
- Bring the vehicle to a complete stop with the brake pedal fully applied for greater than 5 seconds.
- Monitor the instrument panel cluster and engine for auto start stop shut down.
- After the engine is shut down, release the brake pedal.
- Verify the engine restarts.

Does the engine shut down while stopped and restart when the brake pedal is released?

Yes	No
The system is operating correctly at this time.	GO to AA3.

AA3 MONITOR ALL THE AUTO START STOP PIDS

- Ignition ON, engine OFF.
- Access the PCM and monitor all the start stop PIDs. Select the START STOP option from the scan tool POWERTRAIN menu (if equipped).
- Check the PIDs for indications the auto start stop system is disabled or inhibited.

Do any of the PIDs indicate that the auto start stop system is disabled or inhibited?

Yes	No

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Yes	No
The system is operating correctly at this time. For additional information, REFER to **POWERTRAIN CONTROL SOFTWARE** , for the auto start stop system description.	REPROGRAM or UPDATE the calibration. REFER to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM. VERIFY the repair. If the concern is still present, GO to AA4.

AA4 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.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS AB: COLD START SYSTEM

INTRODUCTION

WARNING: REFER TO THE FUEL SYSTEM WARNING INFORMATION AT THE BEGINNING OF PINPOINT TEST HC.
FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

This pinpoint test is intended to diagnose the following:

- cold start fuel pump
- cold start relay
- cold start valve
- fuel injector heaters
- fuel injector heater control module
- harness circuits: B+, CSM, CSRC, CSV, FIHC, FIHM, FIH1, FIH2, FIH3, GND, PWRGND, VBATT and VPWR

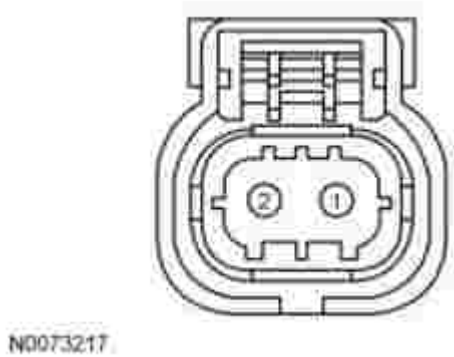

Fig. 3: Cold Start Fuel Pump Connector
Courtesy of FORD MOTOR CO.

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Pin	Circuit
1	GND (Ground)
2	CSM (Cold Start Monitor)

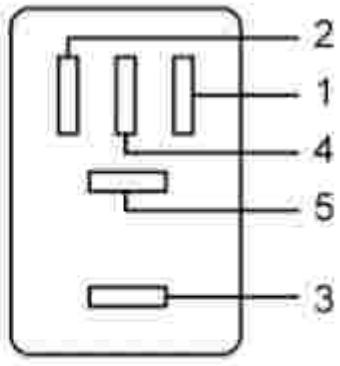

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Fig. 4: Cold Start Relay Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
5	CSM (Cold Start Monitor)
2	CSRC (Cold Start Relay Control)
1, 3	B+ (Battery Positive Voltage)

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Fig. 5: Cold Start Valve Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	CSV (Cold Start Valve)
1	VPWR (Vehicle Power)

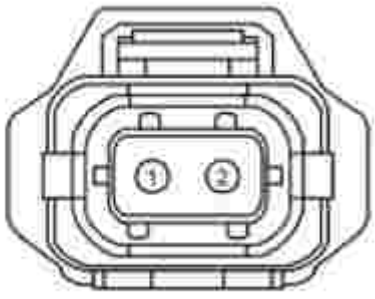

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Fig. 6: Fuel Injector Heater Assembly Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	GND (Ground)

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Pin	Circuit
1	FIH (Fuel Injector Heater)

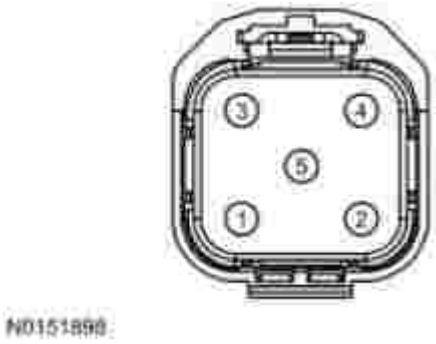

Fig. 7: Fuel Injector Heater Control-A Module Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	FIHM (Fuel Injection Heater Monitor)
2	FIHC (Fuel Injection Heater Control)
3	PWRGND (Power Ground)
4	VPWR (Vehicle Power)
5	VBATT (Battery Voltage)

Fig. 8: Fuel Injector Heater Control-B Module Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Fusion	A	3 1 4 6	FIH4 FIH3 FIH2 FIH1
All other vehicles	A	4 1 3	FIH3 FIH2 FIH1

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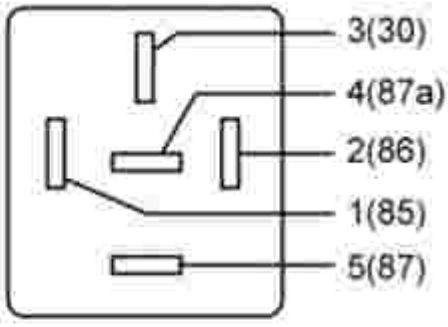

Fig. 9: Powertrain Control Module Power (PCM Power) Relay Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
5	VPWR (Vehicle Power)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
EcoSport 1.5L Manual Transmission	112 PIN	E12 E46	FIHM FIHC
Fusion	198 PIN	B28	FIHM
Ranger	128 PIN	E13 E41	FIHM FIHC
All other vehicles	198 PIN	B28 E16	FIHM FIHC

TEST PROCEDURE

AB1 CHECK FOR DTCS

NOTE: **Diagnose any VPWR circuit or any PCM power relay concerns before entering this pinpoint test.**

Are DTCs P02FC, P02FD, P1030, P1031, P1032, P1033, P1034, P1035, P1038, P1039, P103A, P103B, P1698, P169B or P169C present?

Yes	No
For DTCs P02FC, P02FD, P1698, P169B or P169C, GO to AB12. For DTCs P1038, P1039, P103A or P103B, GO to AB6. For all others, GO to AB2.	For cold start fuel pump concerns, GO to AB20. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

AB2 CHECK THE VBATT CIRCUIT

- Ignition OFF.
- Fuel Injector Heater Control-A Module connector disconnected.
- Measure the voltage between:

(+) Fuel Injector Heater Control-A Module Connector, Harness Side	(-)
VBATT - Pin 5	Ground

Is the voltage greater than 10.5 V?

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Yes	No
GO to AB3.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

AB3 CHECK FOR AN OPEN CIRCUIT

NOTE: **Only the suspect fuel injector heater indicated by the DTC needs to be diagnosed.**

- Fuel Injector Heater Control-B Module connector disconnected.
- Fuel Injector Heater Assembly connector disconnected.
- Measure the resistance between:

(+) Fuel Injector Heater Assembly Connector, Harness Side	(-) Fuel Injector Heater Control-B Module Connector, Harness Side
FIH - Pin 1	FIH

- Measure the resistance between:

(+) Fuel Injector Heater Assembly Connector, Harness Side	(-)
GND - Pin 2	Ground

Is the resistance less than 5 ohms?

Yes	No
GO to AB4.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

AB4 CHECK THE FIH FOR A SHORT TO GROUND

- Measure the resistance between:

(+) Fuel Injector Heater Assembly Connector, Harness Side	(-)
FIH - Pin 1	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to AB5.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

AB5 CHECK THE CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) Fuel Injector Heater Assembly Connector, Harness Side	(-)
FIH - Pin 1	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new Fuel Injector Heater assembly. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. Clear the PCM DTCs. REPEAT the self-test.

AB6 CHECK FOR VOLTAGE

- Ignition OFF.
- Fuel Injector Heater Control-A Module connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

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(+) Fuel Injector Heater Control-A Module Connector, Harness Side	(-)
VBATT - Pin 5	Ground
VPWR - Pin 4	Ground

Are the voltages greater than 10.5 V?

Yes	No
GO to AB7.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

AB7 CHECK THE PWRGND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure the resistance between:

(+) Fuel Injector Heater Control-A Module Connector, Harness Side	(-)
PWRGND - Pin 3	Ground

Is the resistance less than 5 ohms?

Yes	No
GO to AB8.	REPAIR the open circuit. CLEAR the DTCs. REPEAT the self-test.

AB8 CHECK THE CONTROL CIRCUITS FOR AN OPEN

- PCM connector disconnected.
- Measure the resistance between:

(+) Fuel Injector Heater Control-A Module Connector, Harness Side	(-) PCM Connector, Harness Side
FIHC - Pin 2	FIHC
FIHM - Pin 1	FIHM

Are the resistances less than 5 ohms?

Yes	No
GO to AB9.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

AB9 CHECK THE CONTROL CIRCUITS FOR A SHORT TO GROUND

- Measure the resistance between:

(+) Fuel Injector Heater Control-A Module Connector, Harness Side	(-)
FIHC - Pin 2	Ground
FIHM - Pin 1	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to AB10.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

AB10 CHECK THE CONTROL CIRCUITS FOR A SHORT TO VOLTAGE

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

(+) Fuel Injector Heater Control-A Module Connector, Harness Side	(-)
FIHC - Pin 2	Ground
FIHM - Pin 1	Ground

Is any voltage present?

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Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to AB11.

AB11 CHECK FOR CORRECT FUEL INJECTOR HEATER CONTROL MODULE OPERATION

- Disconnect all the fuel injector heater control module connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the fuel injector control module connectors and make sure they seat correctly.
- Carry out the PCM self-test.

Is the concern still present?

Yes	No
INSTALL a new Fuel Injector Heater Control module. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. CLEAR the DTCs. REPEAT the self-test.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

- **AB12 CHECK THE COLD START RELAY**
  - Ignition OFF.
  - Cold Start Relay connector disconnected.
  - Connect a 5 amp fused jumper wire between the following:

Point A Cold Start Relay Connector, Component Side	Point B Vehicle Battery
B+ - Pin 1, 3	Positive terminal

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

Point A Cold Start Relay Connector, Component Side	Point B Vehicle Battery
CSRC - Pin 2	Negative terminal

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

(+) Cold Start Relay Connector, Component Side	(-) Vehicle Battery
CSM - Pin 5	Negative terminal

  - Remove the jumper wire from the CSRC circuit.

Is the voltage greater than 10.5 V with the jumper wire connected and less than 1 V with the jumper wire removed?

Yes	No
GO to AB13.	INSTALL a new Cold Start relay. Clear the PCM DTCs. REPEAT the self-test.

- **AB13 CHECK THE VOLTAGE TO THE COLD START RELAY**
  - Ignition ON, engine OFF.
  - Measure the voltage between:

(+) Cold Start Relay Connector, Harness Side	(-)
B+ - Pin 1, 3	Ground

Is the voltage greater than 10.5 V?

Yes	No

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Yes	No
GO to AB14.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

- **AB14 CHECK THE VOLTAGE CIRCUITS**
  - Ignition OFF.
  - Cold Start Fuel Pump connector disconnected.
  - Cold Start Valve connector disconnected.
  - PCM Power Relay connector disconnected.
  - Measure the resistance between:

(+) Cold Start Fuel Pump Connector, Harness Side	(-) Cold Start Relay Connector, Harness Side
CSM - Pin 2	CSM - Pin 5

  - Measure the resistance between:

(+) PCM Power Relay Connector, Harness Side	(-) Cold Start Valve Connector, Harness Side
VPWR - Pin 5	VPWR - Pin 1

Are the resistances less than 5 ohms?

Yes	No
GO to AB15.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

- **AB15 CHECK THE CIRCUIT FOR A SHORT**
  - Ignition ON, engine OFF.
  - Measure the voltage between:

(+) Cold Start Relay Connector, Harness Side	(-)
CSM - Pin 5	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to AB16.

- **AB16 CHECK THE FUEL PUMP GND CIRCUIT**
  - Ignition OFF.
  - Measure the resistance between:

(+) Cold Start Fuel Pump Connector, Harness Side	(-)
GND - Pin 1	Ground

Is the resistance less than 5 ohms?

Yes	No
GO to AB17.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

- **AB17 CHECK THE CIRCUITS**
  - PCM connector disconnected.
  - Measure the resistance between:

(+) Cold Start Relay Connector, Harness Side	(-) PCM Connector, Harness Side
CSRC - Pin 2	CSRC
CSM - Pin 5	CSM

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- Measure the resistance between:

(+) Cold Start Valve Connector, Harness Side	(-) PCM Connector, Harness Side
CSV - Pin 2	CSV

Are the resistances less than 5 ohms?

Yes	No
GO to AB18.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

- **AB18 CHECK FOR A SHORT TO GROUND**
  - Measure the resistance between:

(+) Cold Start Relay Connector, Harness Side	(-)
CSRC - Pin 2	Ground

  - Measure the resistance between:

(+) Cold Start Valve Connector, Harness Side	(-)
CSV - Pin 2	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to AB19.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

- **AB19 CHECK FOR A SHORT TO VOLTAGE**
  - Ignition ON, engine OFF.
  - Measure the voltage between:

(+) Cold Start Relay Connector, Harness Side	(-)
CSRC - Pin 2	Ground

  - Measure the voltage between:

(+) Cold Start Valve Connector, Harness Side	(-)
CSV - Pin 2	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to AB21.

- **AB20 CHECK THE PUMP RUNS CONTINUOUSLY**

NOTE: **If the cold start fuel pump runs continuously, the CSM circuit is shorted to voltage.**

  - Ignition ON, engine OFF.
  - Check the cold start fuel pump for continuous operation.

Does the cold start fuel pump run continuously?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to AB21.

- **AB21 CHECK SYSTEM FUNCTION**
  - Ignition OFF.

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- Cold Start Valve connector disconnected.
- Disconnect the cold start fuel line at the cold start fuel pump outlet port.
- Disconnect the cold start fuel line at the intake manifold.
- Connect a suitable hose adapter to the cold start fuel line.
- Connect the Evaporative Emission Leak Detector With On Board Nitrogen Generator 218-522C or equivalent. Refer to the tool manufacturer's instruction manual.
- Start the pressure supply. Notice that the ball in the flowmeter is all the way at the top. This indicates the system is being pressurized.
- Continue to pressurize the system 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 cold start valve has passed the leak test. If the measurement is above the indicator flag, the cold start valve has a leak.
- Monitor the ball in the flowmeter as the jumper wires are connected and then removed.
- Connect a 5 amp fused jumper wire between the following:

Point A Cold Start Valve Connector, Component Side	Point B Vehicle Battery
CSV - Pin 2	Negative terminal

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

Point A Cold Start Valve Connector, Component Side Point	B Vehicle Battery
VPWR - Pin 1	Positive terminal

- Remove the jumper wires.

Does the pressure in the cold start fuel line decrease after the jumper wires are connected and does the pressure increase after the jumper wires are removed?

Yes	No
GO to AB22.	INSTALL a new Cold Start valve. Clear the PCM DTCs. REPEAT the self-test.

- **AB22 CHECK THE COLD START FUEL PUMP**

NOTE: **Disconnect the jumper wires at the first sign of fuel entering the approved gasoline fuel container.**

- Cold Start Fuel Pump connector disconnected.
- Securely connect an approved gasoline fuel hose (obtained locally) to the cold start fuel pump outlet port that is long enough to route to an approved gasoline fuel container.
- Securely route the approved gasoline fuel hose to an approved gasoline fuel container away from any heat sources or any other ignition sources.
- Connect a 5 amp fused jumper wire between the following:

Point A Cold Start Fuel Pump Connector, Component Side	Point B Vehicle Battery
CSM - Pin 2	Positive terminal

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

Point A Cold Start Fuel Pump Connector, Component Side	Point B Vehicle Battery
GND - Pin 1	Negative terminal

- Verify fuel is flowing into the approved gasoline fuel container.
- Remove the jumper wires.

Does fuel flow from the cold start fuel pump when the jumper wires are connected?

Yes	No

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Yes	No
For symptoms without DTCs, RETURN to **SYMPTOM CHARTS** for further direction. For all others, GO to AB23.	INSTALL a new Cold Start Fuel Pump. Clear the PCM DTCs. REPEAT the self-test.

- **AB23 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.
- 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)**, Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

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

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- harness circuits: B+, INJPWRM, ISP-R, PCMRC, and VPWR
- PCM power relay (12A646)
- PCM (12A650)

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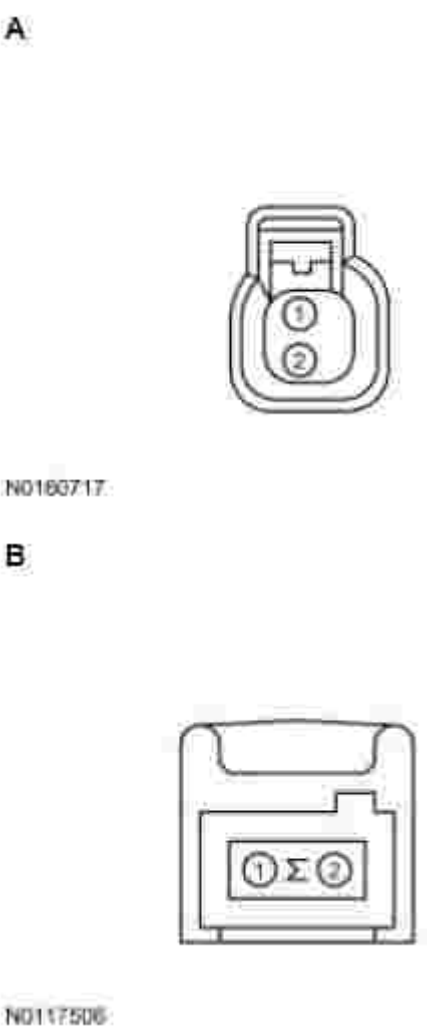

Fig. 10: Injector (INJ) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
EcoSport, Fiesta	A	1	VPWR
KA 1.5L	B	1	VPWR
All other vehicles	A	2	VPWR

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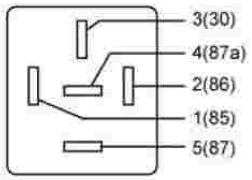
A



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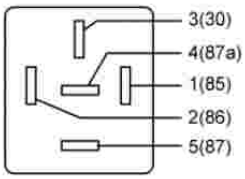

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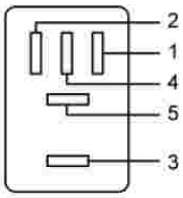

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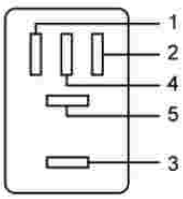

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Fig. 11: Powertrain Control Module Power (PCM Power) Relay Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 2.0L, Continental 2.7L, Continental 3.0L, Explorer, Focus, KA, MKC, Transit, Transit Connect	A	5 2 1, 3	VPWR PCMRC B+
Continental 3.7L	A	5 1 2, 3	VPWR PCMRC B+

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Vehicle	Connector	Pin	Circuit
EcoSport, Escape/Kuga, F-Series Super Duty	B	5 2 1, 3	VPWR PCMRC B+
Expedition, F-150, Fusion, MKX, MKZ, Navigator	C	5 1 2, 3	VPWR PCMRC B+
F-650/F-750, Motorhome/Stripped Chassis/Step Van	B	5 1 2, 3	VPWR PCMRC B+
Mustang	D	3 2 1, 5	VPWR PCMRC B+
All other vehicles	C	5 2 1, 3	VPWR PCMRC B+

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 3.7L, E-Series, F-650/F-750, Mustang 5.2L, Taurus 3.7L, Transit 3.7L	198 PIN	B97, B99 B64 B20	VPWR ISP-R PCMRC
EcoSport 1.5L Automatic Transmission	198 PIN	E18 B97, B99 B41 B20	INJPWRM VPWR ISP-R PCMRC
EcoSport 1.5L Manual Transmission	112 PIN	E22 B55, B56 B43 B25	INJPWRM VPWR ISP-R PCMRC
Edge 3.5L, F-Series Super Duty	198 PIN	B49 B97, B99 B64 B20	INJPWRM VPWR ISP-R PCMRC
Escape/Kuga 1.5L	198 PIN	B101, B102, B103 B36 B37	VPWR ISP-R PCMRC
Escape/Kuga 2.5L, Transit Connect	198 PIN	B97, B99 B41 B20	VPWR ISP-R PCMRC
Expedition, Navigator	198 PIN	B101, B102, B103 B48 B25	VPWR ISP-R PCMRC
Explorer TiVCT 3.5L, Explorer 3.7L, MKX 3.7L, Motorhome/Stripped Chassis/Step Van	198 PIN	E18 B97, B99 B64 B20	INJPWRM VPWR ISP-R PCMRC

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Vehicle	Connector	Pin	Circuit
F-150 2.7L, F-150 3.3L, F-150 5.0L, Mustang 5.0L	306 PIN	B1, B16, B2 B13 B60	VPWR ISP-R PCMRC
F-150 3.5L	198 PIN	B101, B102, B103 B83 B25	VPWR ISP-R PCMRC
Fiesta TiVCT 1.6L	128 PIN	B11, B12, E13, E37 B8 B1	VPWR ISP-R PCMRC
Flex GTDI 3.5L, MKT 3.5L, Taurus GTDI 3.5L	198 PIN	B21 B101, B102, B103 B48 B58	INJPWRM VPWR ISP-R PCMRC
Flex TiVCT 3.5L, MKT 3.7L, Taurus TiVCT 3.5L	198 PIN	B21 B97, B99 B64 B20	INJPWRM VPWR ISP-R PCMRC
Focus GDI 2.0L	154 PIN	B5, B6 B15 B27	VPWR ISP-R PCMRC
Ford GT	198 PIN	B95 B101, B102, B103 B48 B58	INJPWRM VPWR ISP-R PCMRC
Fusion 2.5L	198 PIN	B21 B97, B99 B41 B20	INJPWRM VPWR ISP-R PCMRC
KA	128 PIN	E29 B36, E24 B45 B37	INJPWRM VPWR ISP-R PCMRC
Mustang 2.3L	198 PIN	B101, B102, B103 B64 B25	VPWR ISP-R PCMRC
Ranger	128 PIN	B11, B12 B8 B1	VPWR ISP-R PCMRC
All other vehicles	198 PIN	B101, B102, B103 B48 B58	VPWR ISP-R PCMRC

TEST PROCEDURE

B1 CHECK FOR DTCS

NOTE: **If DTC P0607, P068A or P06B8 is retrieved after a PCM reprogramming, turn the ignition OFF and allow the PCM to complete a normal power down sequence. Clear the PCM DTCs and repeat the PCM self-test. If DTC P0607, P068A or P06B8 is retrieved again, continue with this pinpoint test.**

Are DTCs P0685, P0686, P0687, P0689, P068A, P0690, P1793, P2510, or U300C present?

Yes	No
For DTC P068A, GO to B2. For DTCs P0689 or P2510, GO to B7. For all others, GO to B9.	GO to B4.

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B2 CHECK THE BATTERY AND CHARGING SYSTEM

- Check the battery and charging system voltages. Refer to the appropriate Charging System article, Inspection and Verification.

Are the battery and charging system voltages within specification?

Yes	No
GO to B3.	REPAIR as necessary. REFER to the appropriate Charging System article, Symptom Chart to diagnose the system voltage low or battery is discharged symptom or the system voltage high symptom. Clear the PCM DTCs. REPEAT the self-test.

B3 CHECK THE PCM POWER RELAY

- Carry out the PCM power relay component test. Refer to the appropriate Wiring Diagrams, Component Testing article.

Does the PCM power relay pass the component test?

Yes	No
GO to B4.	INSTALL a new PCM Power Relay. Clear the PCM DTCs. REPEAT the self-test.

B4 CHECK THE B+ VOLTAGE TO PCM POWER RELAY

- Ignition OFF.
- PCM Power Relay connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) PCM Power Relay Connector, Harness Side	(-)
B+	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to B5.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

B5 CHECK THE PCMRC CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Power Relay Connector, Harness Side	(-) PCM Connector, Harness Side
PCMRC	PCMRC

Is the resistance less than 5 ohms?

Yes	No
GO to B6.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

B6 CHECK THE PCMRC CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) PCM Connector, Harness Side	(-)
PCMRC	Ground

Is any voltage present?

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Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to B7.

B7 CHECK THE ISP-R VOLTAGE AT THE PCM

- Ignition OFF.
- PCM Power Relay connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
ISP-R	Ground

Is the voltage greater than 10.5 V?

Yes	No
For DTCs P0689 or P2510, GO to B13. For all others, GO to B8.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

B8 CHECK FOR AN OPEN VPWR CIRCUIT BETWEEN THE PCM AND POWER RELAY

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Power Relay Connector, Harness Side	(-) PCM Connector, Harness Side
VPWR	VPWR

Is the resistance less than 5 ohms?

Yes	No
For DTC P068A, GO to B13. For all others, INSTALL a new PCM Power relay. Clear the PCM DTCs. REPEAT the self-test.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

B9 CHECK THE PCMRC CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- PCM Power Relay connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
PCMRC	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to B10.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

B10 CHECK THE ISP-R CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition OFF.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
ISP-R	Ground

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Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	For Continental 2.0L, Continental 2.7L, Continental 3.0L, EcoSport 1.0L, EcoSport 2.0L, Edge 2.0L, Edge 2.7L, Escape/Kuga 1.5L, Escape/Kuga 2.0L, Expedition, Explorer 2.3L, Explorer 3.5L GTDI, F-150 2.7L, F-150 3.3L, F-150 3.5L, F-150 5.0L, Fiesta 1.0L, Fiesta 1.6L GTDI, Flex 3.5L GTDI, Focus, Ford GT, Fusion 1.5L, Fusion 2.0L, Fusion 2.7L, MKC, MKT 2.0L, MKT 3.5L, MKX 2.0L, MKX 2.7L, MKZ, Mustang 2.3L, Mustang 5.0L, Navigator, Taurus 2.0L, Taurus 3.5L GTDI, and Transit 3.5L, GO to B12. For all others, GO to B11.

B11 CHECK THE INJPWRM CIRCUIT FOR AN OPEN

- INJ connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) INJ Connector, Harness Side
INJPWRM	VPWR

Is the resistance less than 5 ohms?

Yes	No
GO to B13.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

B12 CHECK THE INJPWR_M PID

- Ignition OFF.
- PCM Power Relay connector connected.
- PCM connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the INJPWR_M (VOLT) PID.

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- Record the INJPWR_M PID value.
- Ignition OFF.
- Record the INJPWR_M PID value.

Is the INJPWR_M PID voltage reading above 10.5 V with ignition ON and 0 V with the ignition OFF?

Yes	No
GO to B13.	REPAIR the circuit. Clear the PCM DTCs. REPEAT the self-test.

B13 CHECK FOR CORRECT PCM OPERATION

- Ignition OFF.
- 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.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS C: REFERENCE VOLTAGE (VREF)

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- harness circuits: APPVREF1, APPVREF2, APPRTN1, APPRTN2, ETCREF, ETCRTN, SIGRTN and VREF
- accelerator pedal position (APP) sensor (9F836)
- air conditioning pressure (ACP) transducer sensor (19D594)
- brake vacuum sensor
- crankcase pressure sensor (6758)
- crankshaft position (CKP) sensor (6C315)
- camshaft position (CMP) sensor (6B288)
- differential pressure feedback exhaust gas recirculation (EGR) sensor
- electric exhaust gas recirculation (EGR) valve
- electronic throttle body throttle position sensor (ETBTPS) (9E928)
- exhaust pressure (EP) sensor
- fuel pressure sensor (9F972)
- fuel rail pressure (FRP) sensor (6B288)
- fuel rail pressure temperature (FRPT) sensor (9G756)
- fuel tank pressure (FTP) sensor (9C052)
- generator current sensor (14B357)
- intake manifold runner control bank 1 (IMRC1) sensor (9J559)
- intake manifold runner control bank 2 (IMRC2) sensor (9J559)
- manifold absolute pressure (MAP) sensor (9F479)

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- manifold absolute pressure temperature (MAPT) sensor (9F479)
- manifold absolute pressure (MAP)/charge air cooler temperature (CACT) sensor (9F479)
- manifold absolute pressure (MAP)/intake air temperature 2 (IAT2) sensor (9F479)
- particulate filter pressure bank 1, sensor 1 (9G824)
- turbocharger boost pressure (TCBP) sensor (9F479)
- turbocharger boost pressure (TCBP)/charge air cooler temperature (CACT) sensor (9F479)
- turbocharger inlet pressure and temperature (TCIPT) sensor (9F479)
- wastegate vacuum sensor (9F479)
- PCM (12A650)

SENSORS CONNECTED TO VOLTAGE REFERENCE

Applications	APP Or FTP Or ACP	Fuel Pressure Sensor Or FRP Or FRPT	MAP Or MAPT Or TCBP Or TCBP/CACT Or MAP/CACT Or MAP/IAT2 Or TCIPT	CKP Or CMP	WVS	CPP	Generator Current Sensor	IMRC	Crankcase Pressure Sensor	Brake Vacuum Sensor Or DPFEGR Sensor Or EP Sensor Or Particulate Filter Pressure Sensor
Continental, Edge, Escape/Kuga, Explorer, Fusion, MKC, MKX, MKZ	X	X	X	X	Â	X	X	Â	X	X
EcoSport, Fiesta, Focus, KA	X	X	X	X	Â	X	X	Â	X	X
E-Series, F-Series Super Duty	X	Â	Â	Â	Â	Â	X	X	Â	Â
Expedition, F-150, Mustang, Navigator	X	X	X	X	X	Â	X	X	X	X
F-650/F-750, Motorhome/Stripped Chassis/Step Van	X	Â	Â	Â	Â	Â	X	Â	Â	Â
Flex, MKT, Taurus, Transit	X	X	X	X	Â	Â	X	Â	X	X
Ford GT	X	X	X	X	Â	Â	X	Â	X	X
Ranger	X	Â	X	X	Â	Â	X	Â	X	Â
Transit Connect	X	Â	X	X	Â	Â	X	Â	X	X

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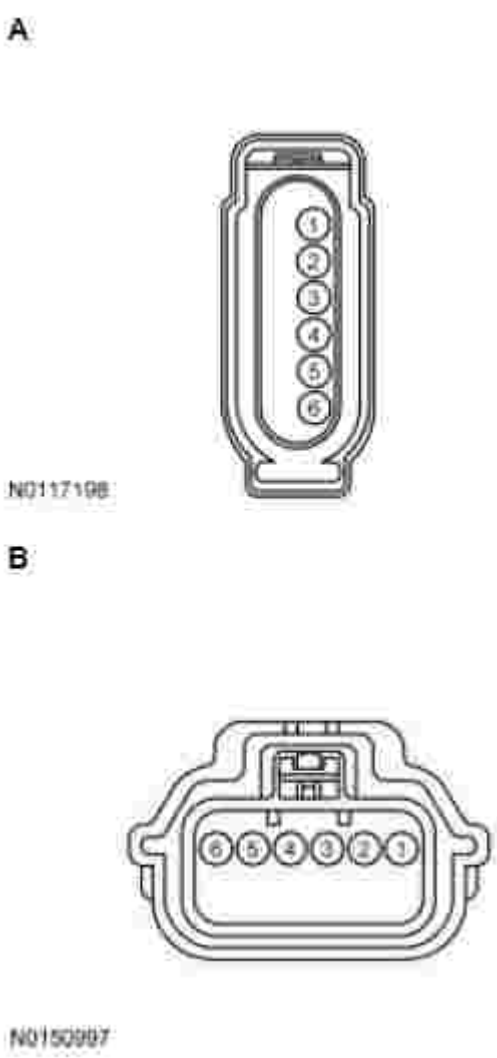

Fig. 12: Accelerator Pedal Position (APP) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Fiesta	A	3 1	APPRTN2 APPVREF2
All other vehicles	B	4 6 3 1	APPRTN2 APPVREF2 APPRTN1 APPVREF1

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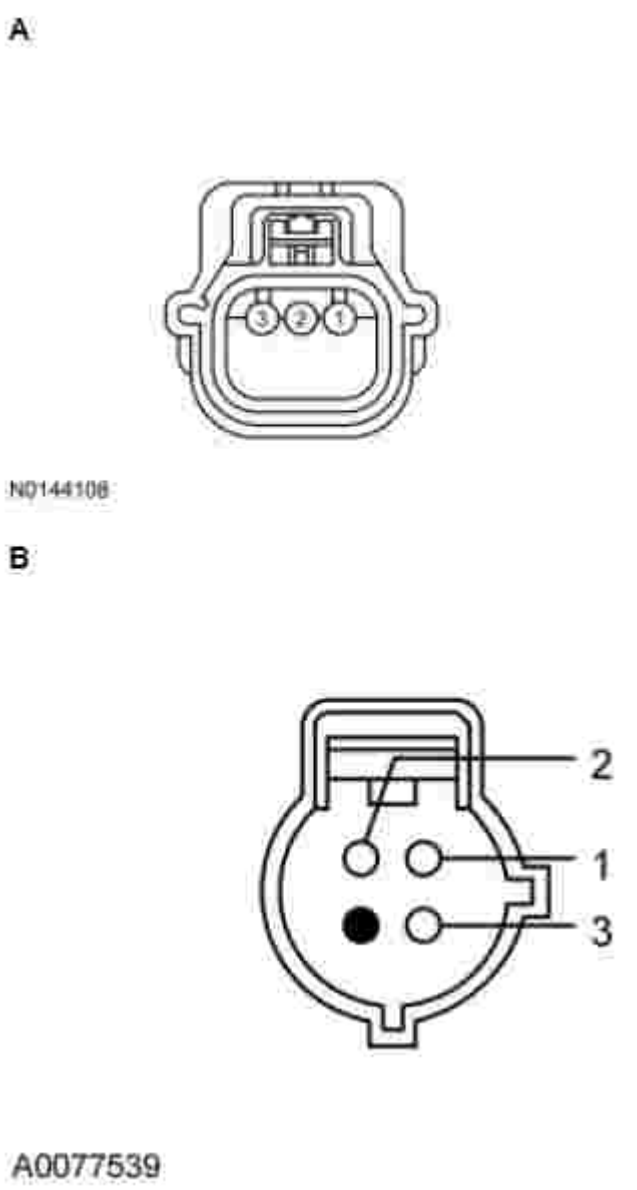

Fig. 13: Air Conditioning Pressure (ACP) Transducer Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition, Navigator	A	1 2	SIGRTN VREF
Fiesta, Ranger	B	1 2	SIGRTN VREF
All other vehicles	A	1 3	SIGRTN VREF

Fig. 14: Brake Vacuum Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
3	VREF (Reference Voltage)

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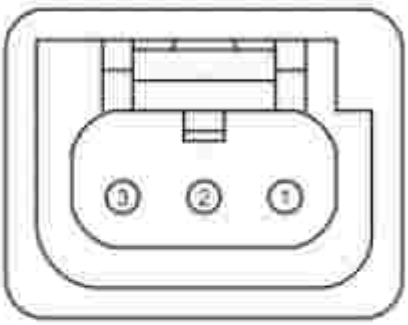
A



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B

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C

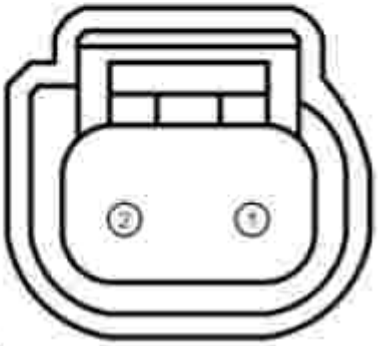

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Fig. 15: Camshaft Position Bank 1 Sensor 1 (CMP11) Sensor Connector (1 Of 2)
Courtesy of FORD MOTOR CO.

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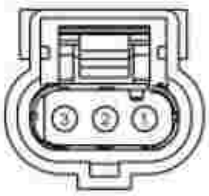
D



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E

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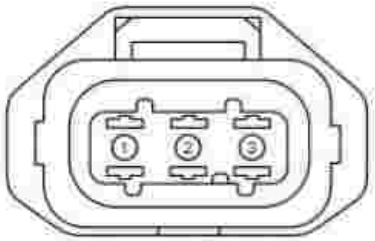
F



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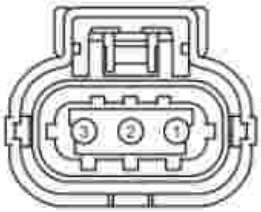

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Fig. 16: Camshaft Position Bank 1 Sensor 1 (CMP11) Sensor Connector (2 Of 2)
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
Continental 2.0L, EcoSport 2.0L, Edge 2.0L, Escape/Kuga 2.0L, Explorer 2.3L, Focus 2.0L, Focus 2.3L, Fusion 2.0L, MKC, MKT 2.0L, MKX 2.0L, MKZ 2.0L, Mustang 2.3L, Taurus 2.0L	A	2 1	SIGRTN VREF
E-Series 6.2L, F-Series Super Duty 6.2L	B	2	SIGRTN
E-Series 6.8L, F-650/F-750, F-Series Super Duty 6.8L, Flex TiVCT 3.5L, MKT 3.7L, Motorhome/Stripped Chassis/Step Van, Taurus 3.7L	C	1	SIGRTN
EcoSport 1.5L, F-150 5.0L, Mustang 5.0L	D	2 1	SIGRTN VREF
EcoSport 1.0L, Fiesta TiVCT 1.6L, Focus 1.0L, Ranger	D	3 1	SIGRTN VREF
Escape/Kuga 2.5L, Fusion 2.5L, Transit Connect	E	3	SIGRTN
Escape/Kuga 1.5L, Fiesta GTDI 1.6L, Fusion 1.5L	F	1 3	SIGRTN VREF
Expedition, F-150 3.3L, F-150 3.5L, F-150 2.7L, Navigator	D	2 3	SIGRTN VREF
Fiesta 1.0L, KA	G	3 1	SIGRTN VREF
Mustang 5.2L	B	3	SIGRTN
All other vehicles	D	2	SIGRTN

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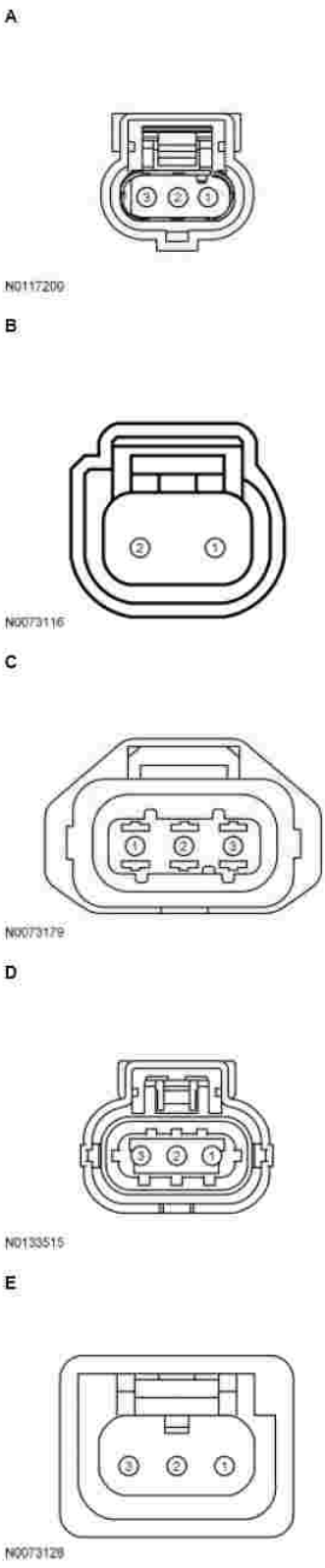

Fig. 17: Camshaft Position Bank 1 Sensor 2 (CMP12) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, Edge 2.7L, Ford GT, Fusion 2.7L, MKX 2.7L, MKZ 3.0L, Transit 3.5L	A	2	SIGRTN

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Vehicle	Connector	Pin	Circuit
Continental 3.7L, Edge 3.5L, Explorer 3.7L, Explorer 3.5L, Flex, MKT 3.7L, MKX 3.7L, Mustang 5.2L, Taurus 3.5L, Taurus 3.7L, Transit 3.7L	B	1	SIGRTN
EcoSport 1.5L, F-150 5.0L, Mustang 5.0L	A	1 2	VREF SIGRTN
EcoSport 1.0L, Fiesta TiVCT 1.6L, Focus 1.0L	A	1 3	VREF SIGRTN
Escape/Kuga 1.5L, Fiesta GTDI 1.6L, Fusion 1.5L	C	3 1	VREF SIGRTN
Expedition, F-150 2.7L, F-150 3.3L, F-150 3.5L, Navigator	A	3 2	VREF SIGRTN
Fiesta 1.0L, KA	D	1 3	VREF SIGRTN
All other vehicles	E	1 2	VREF SIGRTN

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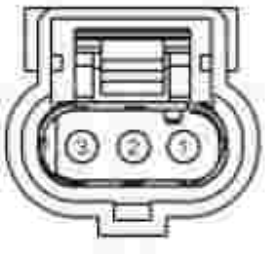
A

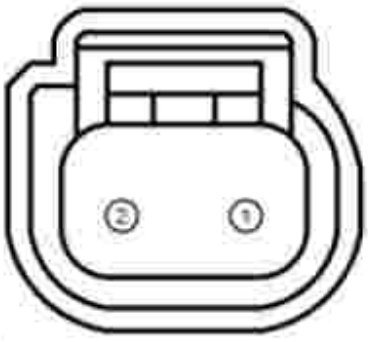
N0073033

B



N0117200

C



N0073116

Fig. 18: Camshaft Position Bank 2 Sensor 1 (CMP21) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series, F-Series Super Duty	A	2	SIGRTN
Expedition, F-150 2.7L, F-150 3.3L, F-150 3.5L, Navigator	B	2 3	SIGRTN VREF
F-150 5.0L	B	2 1	SIGRTN VREF
Flex TiVCT 3.5L, MKT 3.7L	C	1	SIGRTN

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Vehicle	Connector	Pin	Circuit
Mustang 5.0L	A	2 1	SIGRTN VREF
Mustang 5.2L	A	3	SIGRTN
All other vehicles	B	2	SIGRTN

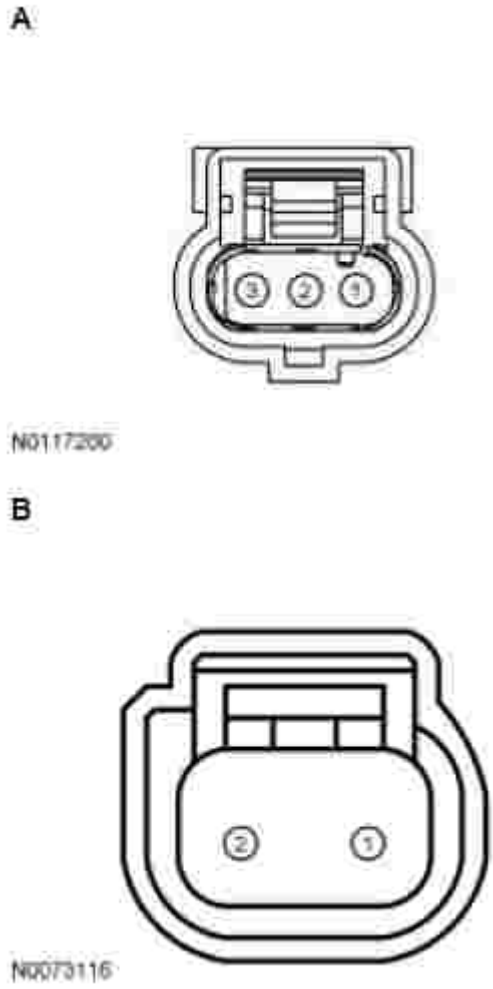

Fig. 19: Camshaft Position Bank 2 Sensor 2 (CMP22) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, Edge 2.7L, Ford GT, Fusion, MKX 2.7L, MKZ, Transit 3.5L	A	2	SIGRTN
Expedition, F-150 2.7L, F-150 3.3L, F-150 3.5L, Navigator	A	2 3	SIGRTN VREF
F-150 5.0L, Mustang 5.0L 1	A	2 1	SIGRTN VREF
All other vehicles	B	1	SIGRTN

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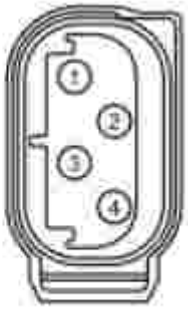
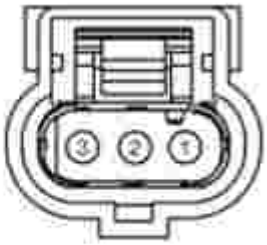


N0163521

Fig. 20: Clutch Pedal Position (CPP) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	SIGRTN (Signal Return)
3	VREF (Reference Voltage)



N0117200

Fig. 21: Crankcase Pressure Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
3	VREF (Reference Voltage)

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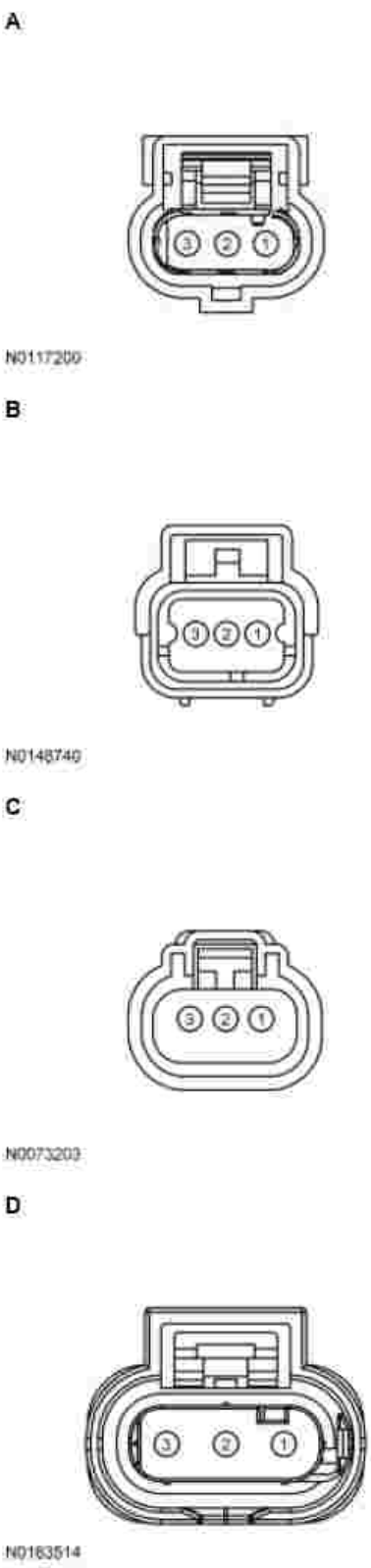

Fig. 22: Crankshaft Position (CKP) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, Edge 2.7L, F-150 2.7L, F-150 5.0L, MKX 2.7L, MKZ 3.0L, Mustang 5.0L	A	1 3	SIGRTN VREF

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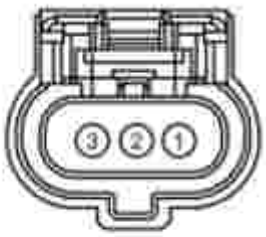
Vehicle	Connector	Pin	Circuit
EcoSport 1.0L, Escape/Kuga 1.5L, Fiesta, Focus 1.0L, KA	B	2 1	SIGRTN VREF
EcoSport 1.5L	A	2 1	SIGRTN VREF
Expedition, Explorer GTDI 3.5L, F-150 3.3L, F-150 3.5L, Flex, Ford GT, MKT 3.5L, Navigator, Taurus GTDI 3.5L, Transit	A	2 3	SIGRTN VREF
Explorer 2.3L, Focus GDI 2.0L, MKC 2.3L, MKT 2.0L, Mustang 2.3L, Taurus 2.0L	C	3 1	SIGRTN VREF
Fusion 1.5L	D	2 1	SIGRTN VREF
Fusion 2.7L	A	1 2	SIGRTN VREF
All other vehicles	A	3 1	SIGRTN VREF



N0177477

Fig. 23: Differential Pressure Feedback EGR Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
3	VREF (Reference Voltage)
2	SIGRTN (Signal Return)

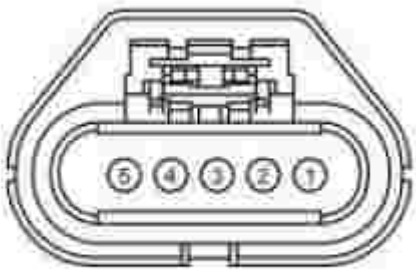


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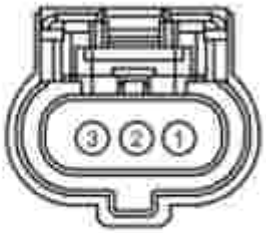
Fig. 24: Electric Exhaust Gas Recirculation (EEGR) Assembly Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
F-150 2.7L	A	3 1	VREF SIGRTN
F-150 3.3L	A	3 5	VREF SIGRTN



N0177477

Fig. 25: Exhaust Pressure (EP) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
1	VREF (Reference Voltage)

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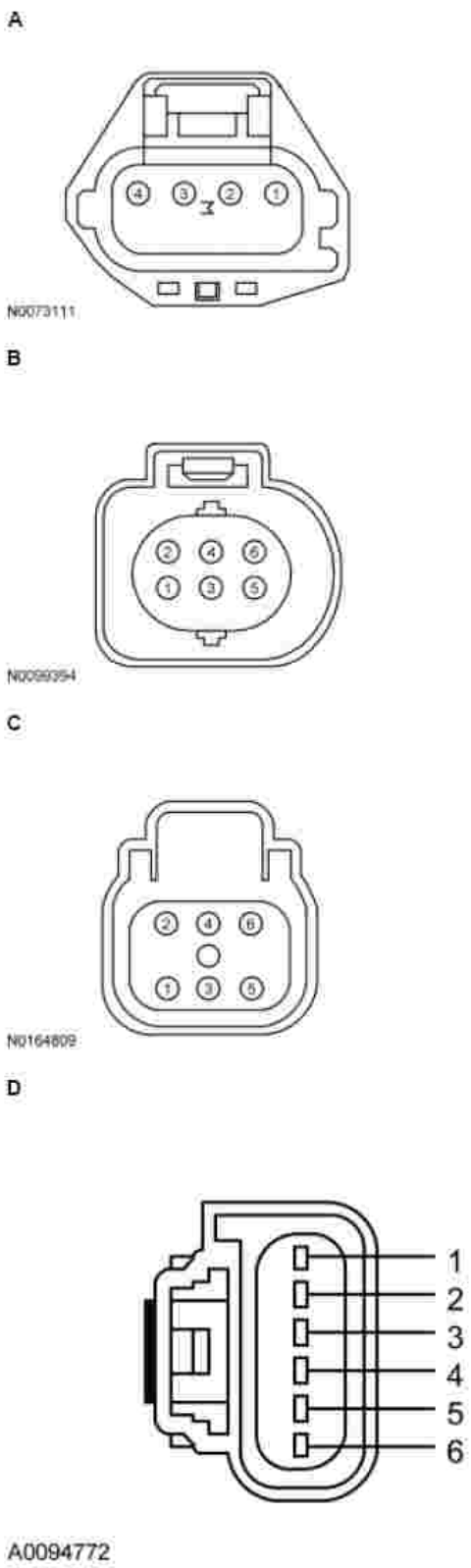

Fig. 26: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 6.8L, Explorer GTDI 3.5L, F-650/F-750, F-Series Super Duty 6.8L, Flex GTDI 3.5L, MKT 3.5L, Motorhome/Stripped Chassis/Step Van, Taurus GTDI 3.5L	A	3 2	ETCRTN ETCREF

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Vehicle	Connector	Pin	Circuit
EcoSport 1.5L, EcoSport 1.0L, Escape/Kuga 1.5L, Fiesta 1.0L, Focus 1.0L, Fusion 1.5L, KA 1.0L	B	3 1	ETCRTN ETCREF
Fiesta 1.6L	C	2 6	ETCRTN ETCREF
KA 1.5L	B	2 6	ETCRTN ETCREF
All other vehicles	D	4 5	ETCRTN ETCREF

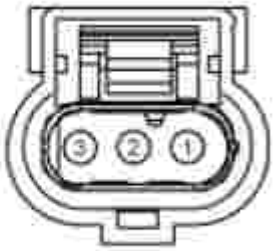

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Fig. 27: Fuel Pressure Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
3	VREF (Reference Voltage)

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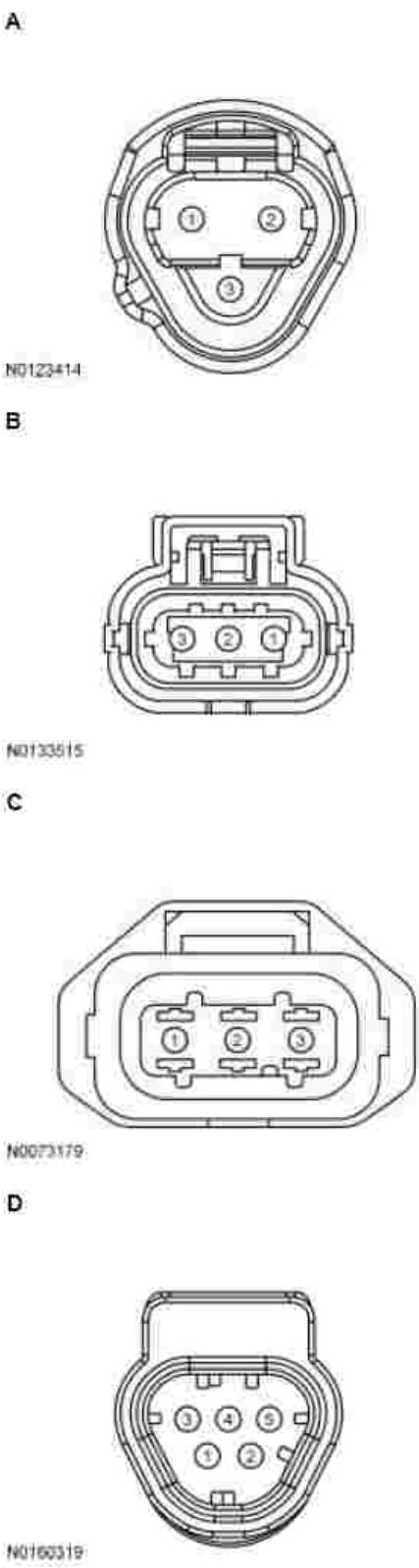

Fig. 28: Fuel Rail Pressure (FRP) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, EcoSport 2.0L, Edge 2.7L, Focus GDI 2.0L, Fusion 2.7L, MKX 2.7L, MKZ 3.0L, Transit	A	3 1	SIGRTN VREF
EcoSport 1.0L	B	3 1	SIGRTN VREF

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Vehicle	Connector	Pin	Circuit
Escape/Kuga 1.5L, Fusion 1.5L	C	2 1	SIGRTN VREF
Escape/Kuga 2.0L	D	5 3	SIGRTN VREF
Expedition, Navigator	D	3 4	SIGRTN VREF
Explorer GTDI 3.5L, Fiesta, Flex, Focus GTDI 2.0L, Focus 1.0L, Fusion 2.0L, MKC 2.0L, MKT, MKZ 2.0L, Taurus	C	1 3	SIGRTN VREF
F-150 2.7L, F-150 5.0L, Mustang 5.0L	B	2 1	SIGRTN VREF
All other vehicles	D	3 5	SIGRTN VREF

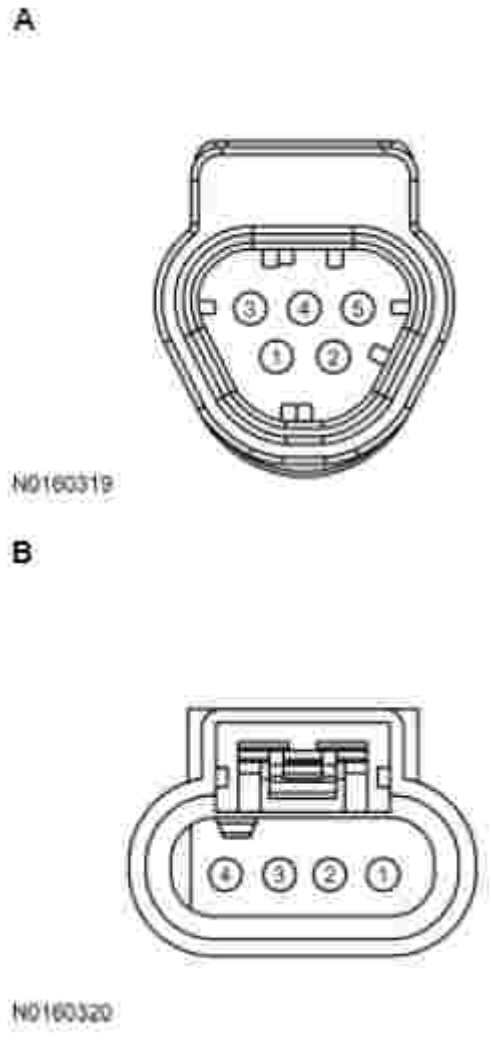

Fig. 29: Fuel Rail Pressure Temperature (FRPT) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition, Navigator	A	4 2	SIGRTN VREF

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Vehicle	Connector	Pin	Circuit
F-150 3.3L, F-150 5.0L, Mustang 5.0L	B	2 1	SIGRTN VREF
All other vehicles	A	4 3	SIGRTN VREF

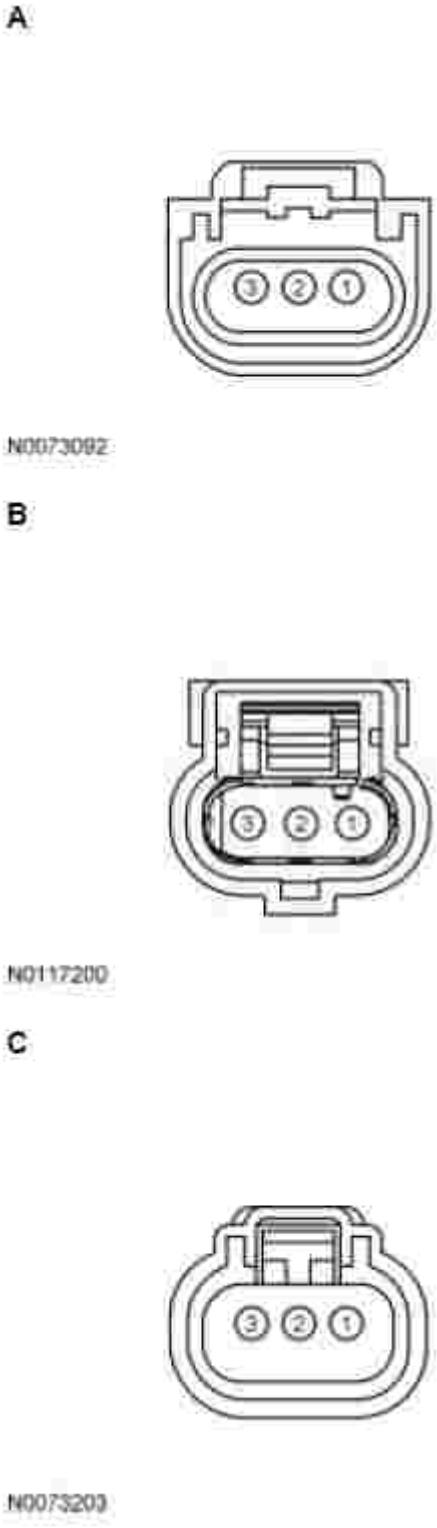

Fig. 30: Fuel Tank Pressure (FTP) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit

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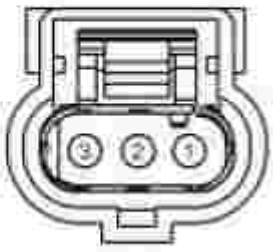
Vehicle	Connector	Pin	Circuit
E-Series, F-650/F-750, Motorhome/Stripped Chassis/Step Van, Ranger, Taurus, Transit, Transit Connect	A	3 2	VREF SIGRTN
Ford GT	B	3 2	VREF SIGRTN
All other vehicles	C	3 2	VREF SIGRTN

N0150320

Fig. 31: Generator Current Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
1	VREF (Reference Voltage)

A



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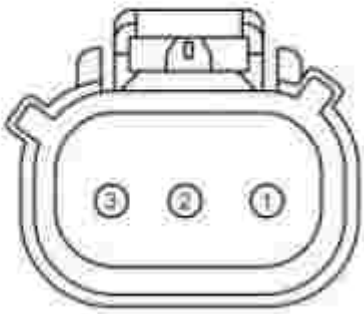
B



N0073182

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Fig. 32: Intake Manifold Runner Control Bank 1 (IMRC1) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
F-150, Mustang 5.0L	A	1 3	SIGRTN VREF
F-Series Super Duty, Mustang 5.2L	B	3 2	SIGRTN VREF

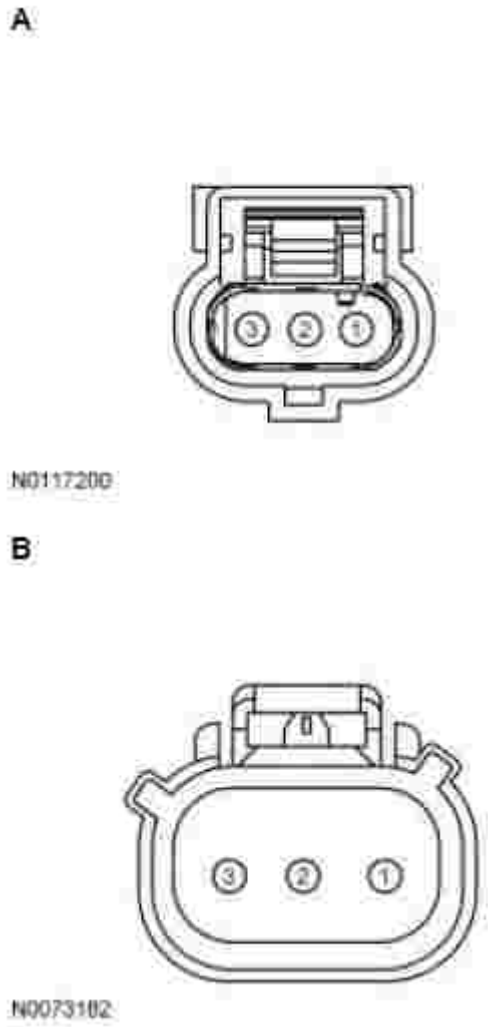

Fig. 33: Intake Manifold Runner Control Bank 2 (IMRC2) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
F-150, Mustang 5.0L	A	1 3	SIGRTN VREF
F-Series Super Duty, Mustang 5.2L	B	3 2	SIGRTN VREF

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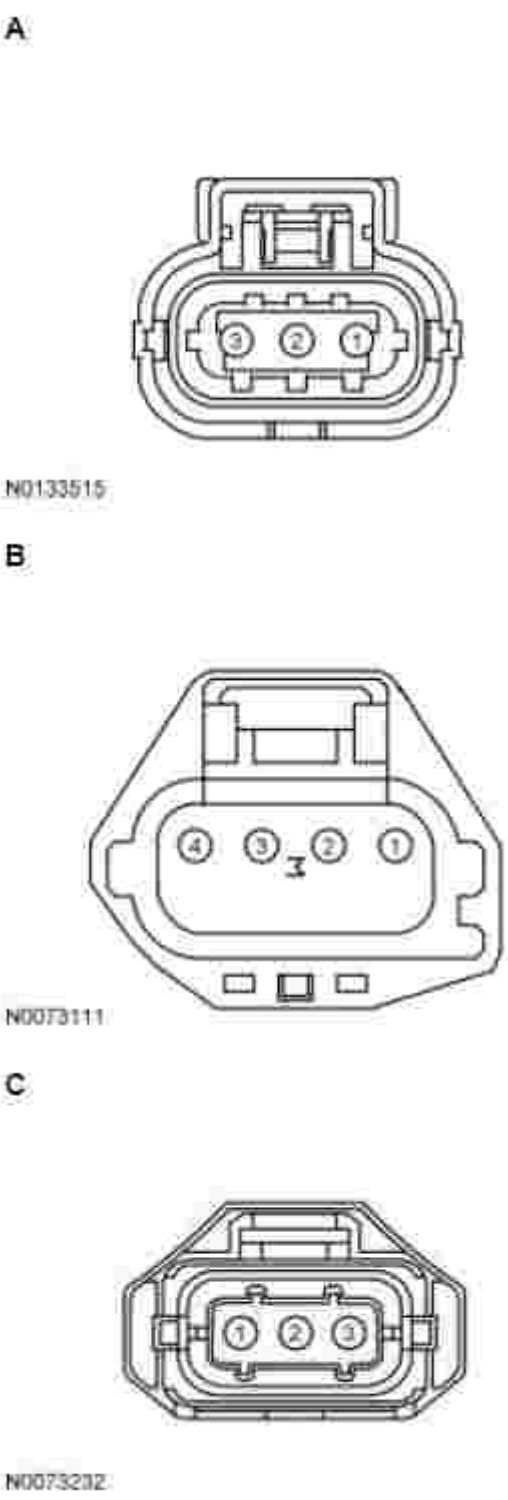

Fig. 34: Manifold Absolute Pressure (MAP) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Kuga 2.0L, Focus, MKC, MKT, Taurus	A	2 3	SIGRTN VREF
Fusion 2.0L, MKZ	C	2 1	SIGRTN VREF
All other vehicles	B	4 2	SIGRTN VREF

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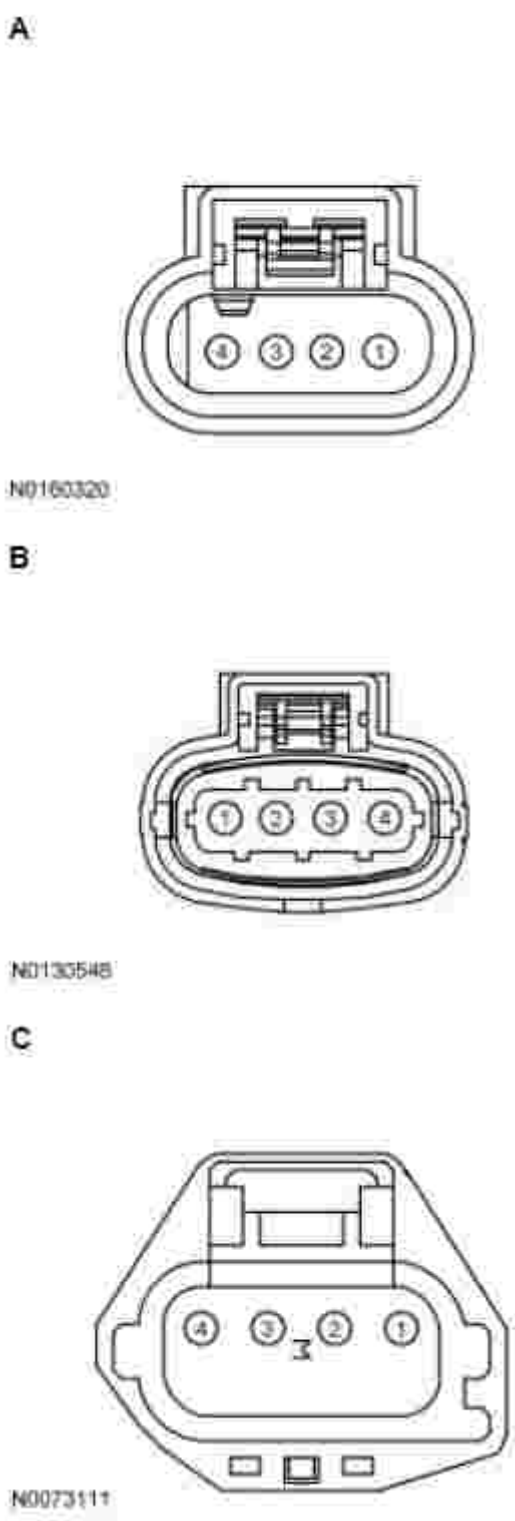

Fig. 35: Manifold Absolute Pressure Temperature (MAPT) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental, EcoSport 1.5L, Edge 3.5L, Explorer 3.5L, Explorer 3.7L, F-150 3.3L, Flex 3.5L, MKT 3.7L, MKX, Taurus 3.5L, Transit 3.7L	A	4 2	SIGRTN VREF
Ranger	C	4 2	SIGRTN VREF

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Vehicle	Connector	Pin	Circuit
All other vehicles	B	1 3	SIGRTN VREF

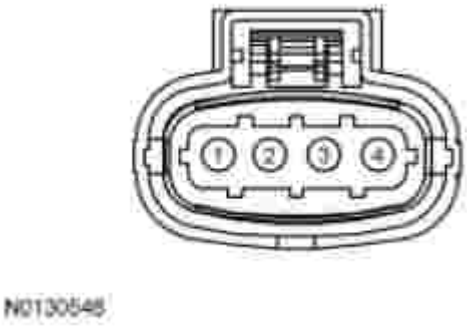

Fig. 36: Manifold Absolute Pressure/Charge Air Cooler Temperature (MAP/CACT) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	SIGRTN (Signal Return)
3	VREF (Reference Voltage)

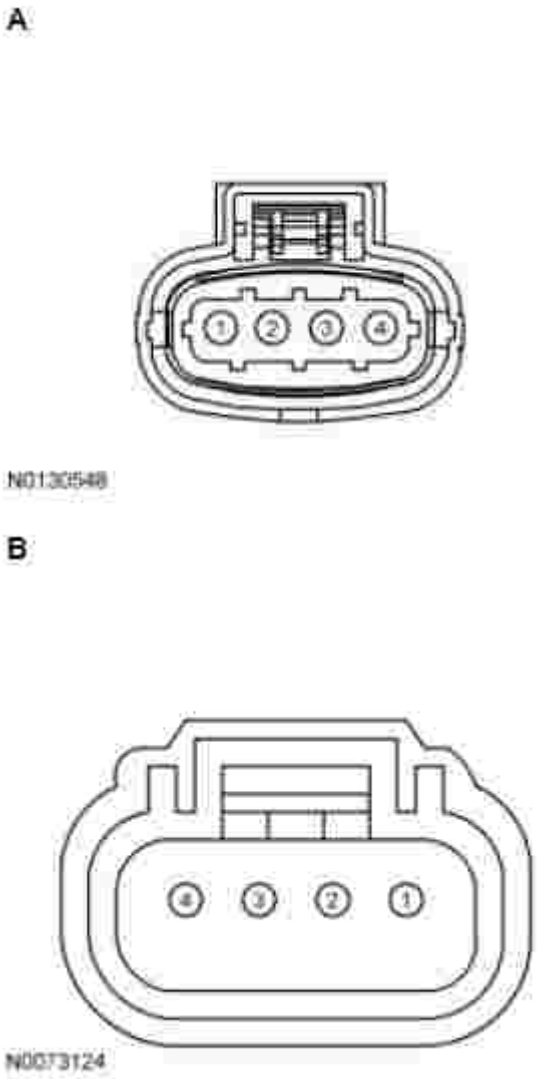

Fig. 37: Manifold Absolute Pressure/Intake Air Temperature 2 (MAP/IAT2) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
Continental 2.0L, EcoSport, Escape/Kuga, Fiesta, MKC, Mustang	A	1 3	SIGRTN VREF
Edge 2.7L, Explorer 3.5L, F-150 2.7L, Flex, MKT, MKX 2.7L, Taurus, Transit	B	4 2	SIGRTN VREF
Explorer 2.3L	B	2 1	SIGRTN VREF
All other vehicles	A	4 2	SIGRTN VREF

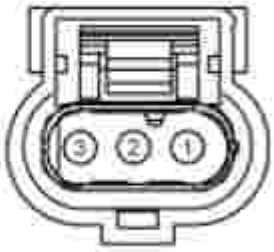

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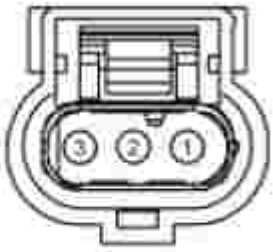
Fig. 38: Particulate Filter Pressure Bank 1, Sensor 1 Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
3	VREF (Reference Voltage)



N0135809

Fig. 39: Particulate Filter Pressure Bank 2, Sensor 1 Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
3	VREF (Reference Voltage)

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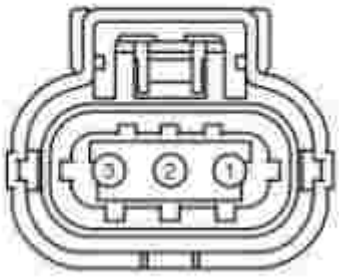
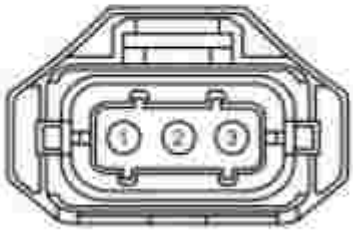
A



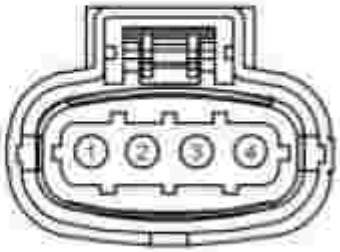
N0133515

B



N0073232

C



N0130548

Fig. 40: Turbocharger Boost Pressure (TCBP) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 2.0L, EcoSport, Explorer 2.3L, Focus 2.3L, Focus 1.0L, Mustang	A	2 3	SIGRTN VREF
Edge 2.0L, Escape/Kuga 1.5L, MKX 2.0L	B	1 2	SIGRTN VREF
Escape/Kuga 2.0L, Fiesta 1.0L, MKC	C	1 3	SIGRTN VREF

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Vehicle	Connector	Pin	Circuit
Fusion 1.5L	A	2 1	SIGRTN VREF

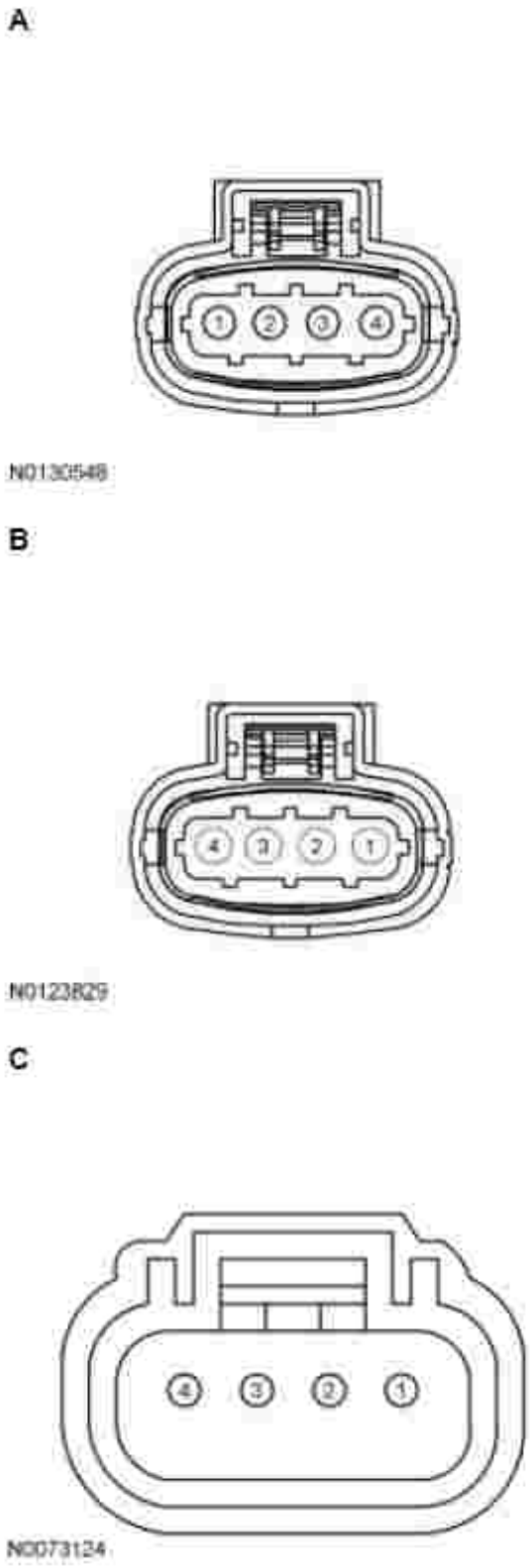

Fig. 41: Turbocharger Boost Pressure/Charge Air Cooler Temperature (TCBP/CACT) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Fiesta, Fusion 2.0L, MKC, MKZ 2.0L, Taurus 2.0L	A	1 3	SIGRTN VREF
Focus, MKT 2.0L	B	1 3	SIGRTN VREF

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Vehicle	Connector	Pin	Circuit
All other vehicles	C	4 2	SIGRTN VREF

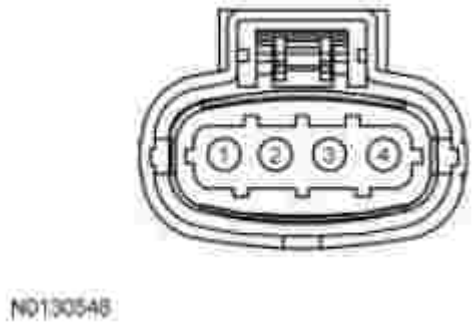

Fig. 42: Turbocharger Intake Pressure And Temperature (TCIPT) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	SIGRTN (Signal Return)
3	VREF (Reference Voltage)

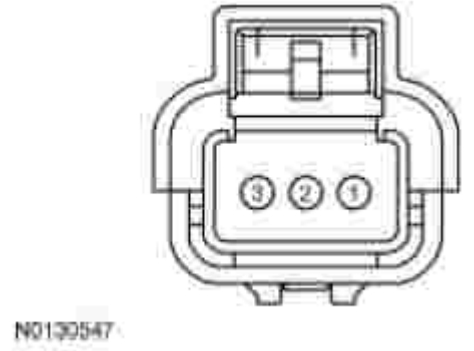

Fig. 43: Wastegate Vacuum Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
1	VREF (Reference Voltage)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, Taurus GTDI 3.5L	198 PIN	B101, B102, B103 B16, B18, B37, B38, E20, E53 B35 B36 E31 B11, B13, E8 B10 B12 E7	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF

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Vehicle	Connector	Pin	Circuit
Continental 3.7L	198 PIN	B97, B99 B51, B71, B90, E29, E40, E49, E51, E54 B59 B35 E23 E34 B40 B36 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
E-Series 6.2L	198 PIN	B97, B99 B16, B18, B19, B30, B51, B54, B71, B90, E20, E29, E37, E49, E51, E53 B59 B35 E23 E74 B40 B36 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
E-Series 6.8L	198 PIN	B97, B99 B54, B71, B90, E49, E54 B59 B35 E23 E74 B40 B36 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
EcoSport 1.0L Automatic Transmission	198 PIN	B101, B102, B103 B16, B18, B19, B38, B9, E19, E20, E22, E53, E54 B35 B36 E31 B11, B13, E6, E8 B10 B12 E7	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
EcoSport 1.0L Manual Transmission	198 PIN	B101, B102, B103 B17, B19, B34, E10, E19, E20, E54 B35 B36 E18 B11, E3, E7 B10 B12 E5	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
EcoSport 1.5L Automatic Transmission	198 PIN	B97, B99 B13, B15, B33, B51, B53, E12, E29, E35, E53 B35 B59 E23 B52, E11, E28, E34 B36 B40 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF

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Vehicle	Connector	Pin	Circuit
EcoSport 1.5L Manual Transmission	112 PIN	B55, B56 B19, B8, B9, E1, E2, E23, E3, E38, E4, E44, E5 B12 B3 E6 E1, E10, E11, E7, E9 B11 B2 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
EcoSport 2.0L	198 PIN	B101, B102, B103 B16, B18, B38, B9, E20, E35, E53, E56, E7 B35 B36 E31 B11, B13, E5, E6, E8 B10 B12 E7	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Edge 2.0L	198 PIN	B101, B102, B103 B16, B18, B19, B38, B7, E20, E53 B35 B36 E31 B11, B13, E6, E8 B10 B12 E7	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Edge 2.7L, Fusion 2.7L, MKZ 3.0L	198 PIN	B101, B102, B103 B16, B18, B19, B37, B38, B7, E20, E53 B35 B36 E31 B11, B13, E6, E8 B10 B12 E7	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Edge 3.5L	198 PIN	B97, B99 B2, B51, B71, B90, E29, E40, E49, E54, E71 B59 B35 E23 B52, B66, E34 B40 B36 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Escape/Kuga 1.5L	198 PIN	B101, B102, B103 B16, B24, B25, B26, B73, E13, E14, E20, E26, E27, E29 B27 B15 E12 B11, B13, B17, E11, E6, E7, E8, E9 B28 B16 E10	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF

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Vehicle	Connector	Pin	Circuit
Escape/Kuga 2.0L	198 PIN	B101, B102, B103 B16, B17, B18, B19, B34, B38, E20, E53 B35 B36 E31 B11, B13, E6, E8 B10 B12 E7	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Escape/Kuga 2.5L	198 PIN	B97, B99 B30, B33, B54, B56, B71, E35 B35 B59 E23 B52, B66, E34 B36 B40 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Expedition	198 PIN	B101, B102, B103 B16, B17, B18, B30, B34, B37, B38, B75, B94, E10, E20, E29, E32, E53 B15 B19 E35 B11, B13, B5, E2, E3, E5, E6, E8 B14 B18 E4	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Explorer 2.3L, MKT 2.0L, Taurus 2.0L	198 PIN	B101, B102, B103 B16, B18, B38, E20, E53 B35 B36 E31 B11, B13, E6, E8 B10 B12 E7	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Explorer GTDI 3.5L	198 PIN	B101, B102, B103 B16, B18, B37, B38, E20, E53 B35 B36 E4 B11, B13, E8 B10 B12 E35	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Explorer TiVCT 3.5L, MKX 3.7L, Taurus TiVCT 3.5L	198 PIN	B97, B99 B51, B56, B71, B90, E29, E40, E49, E54 B59 B35 E23 B52, B66, E34 B40 B36 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF

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Vehicle	Connector	Pin	Circuit
Explorer 3.7L	198 PIN	B97, B99 B51, B56, B71, B90, E29, E40, E49, E54 B59 B35 E23 B5, B52, B66, E34 B40 B36 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
F-150 2.7L	306 PIN	B1, B16, B2 B17, B18, B34, B37, B38, B43, E113, E121, E13, E47, E5, E91, E99, T84, T85 B72 B87 E114 E115, E116, E118, E120 B71 B86 E117	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
F-150 3.3L	306 PIN	B1, B16, B2 B43, E113, E13, E47, E5, E91, E99, T84, T85 B72 B87 E114 E116, E118, E120 B71 B86 E117	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
F-150 3.5L	198 PIN	B101, B102, B103 B16, B17, B18, B30, B34, B37, B38, B7, B75, B94, E10, E20, E29, E32, E53 B15 B19 E35 B11, B13, B5, E2, E3, E5, E6, E8 B14 B18 E4	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
F-150 5.0L	306 PIN	B1, B16, B2 B43, E113, E13, E47, E5, E91, E99, T84, T85 B72 B87 E114 E115, E116, E118, E120 B71 B86 E117	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
F-650/F-750	198 PIN	B97, B99 B54, B71, E49, E54 B59 B35 E23 B52, B66 B40 B36 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF

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Vehicle	Connector	Pin	Circuit
F-Series Super Duty 6.2L	198 PIN	B97, B99 B51, B56, B71, B90, E29, E32, E49, T26 B59 B35 E23 B52, B66, E34 B40 B36 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
F-Series Super Duty 6.8L	198 PIN	B97, B99 B30, B51, B56, B71, E29, E32, E49, T26 B59 B35 E23 B52, B66 B40 B36 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Fiesta 1.0L	198 PIN	B101, B102, B103 B16, B17, B19, B37, B40, B9, E1, E10, E19, E20, E22, E54 E18 B13, B14, E3, E7 E5	VPWR SIGRTN ETCRTN VREF ETCREF
Fiesta GTDI 1.6L	198 PIN	B101, B102, B103 B16, B17, B19, B37, B40, B9, E1, E10, E19, E20, E22, E49, E54 E18 B13, B14, E3, E7 E5	VPWR SIGRTN ETCRTN VREF ETCREF
Fiesta TiVCT 1.6L	128 PIN	B11, B12, E13, E37 B38, B40, E3, E6, E9, T27, T29 E4 B14, B16, E30, T11, T13 E28	VPWR SIGRTN ETCRTN VREF ETCREF
Flex GTDI 3.5L, MKT 3.5L	198 PIN	B101, B102, B103 B16, B18, B37, B38, E20, E41, E53 B35 B36 E31 B11, B13, E8 B10 B12 E7	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Flex TiVCT 3.5L, MKT 3.7L	198 PIN	B97, B99 B51, B56, B71, B90, E29, E40, E41, E49, E54 B59 B35 E23 B52, B66, E34 B40 B36 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF

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Vehicle	Connector	Pin	Circuit
Focus 1.0L	198 PIN	B101, B102, B103 B16, B18, B19, B38, B74, E20, E53 B35 B36 E31 B11, B13, E6, E8 B10 B12 E7	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Focus GDI 2.0L	154 PIN	B5, B6 B21, B34, E10, E32, E33, E34, E36, E44, E46, E47 B38 B36 E58 B31, B7, E15, E16, E18, E23 B46 B53 E19	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Focus GTDI 2.0L	198 PIN	B101, B102, B103 B16, B18, B19, B37, E20, E36, E53 B35 B36 E31 B11, E6, E8 B10 B12 E7	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Focus 2.3L	198 PIN	B101, B102, B103 B16, B18, B19, B37, B38, E20, E32, E53 B35 B36 E31 B11, B13, E5, E6, E8 B10 B12 E7	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Ford GT	198 PIN	B101, B102, B103 B18, B37, B38, B9, E20, E32, E53, E56 B35 B36 E31 B11, E5, E6, E8 B10 B12 E7	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Fusion 2.5L	198 PIN	B97, B99 B33, B54, B56, B71, E35, T41 B35 B59 E23 B66, E34 B36 B40 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF

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Vehicle	Connector	Pin	Circuit
KA 1.0L	128 PIN	B36, E24 E14, E15, E7, E8, T17, T20, T21, T22 B33 B32 T19 B26, E2, T26, T28, T30 B46 B44 T27	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
KA 1.5L	128 PIN	B36, E24 E15, E7, E8, T17, T20, T21, T22 B33 B32 T19 B26, T26, T28, T30 B46 B44 T27	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
MKC	198 PIN	B101, B102, B103 B16, B18, B19, B37, B38, E20, E53 B35 B36 E31 B11, E6, E8 B10 B12 E7	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
MKX 2.7L	198 PIN	B101, B102, B103 B16, B18, B37, B38, E20, E53 B35 B36 E31 B13, E8 B10 B12 E7	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Motorhome/Stripped Chassis/Step Van	198 PIN	B97, B99 B54, B56, B71, B90, E29, E49, T26 B59 B35 E23 B52, B66 B40 B36 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Mustang 2.3L	198 PIN	B101, B102, B103 B17, B18, B19, B36, B37, B38, B55, E13, E14, E20, E32, E5, E53, E57 B19 B18 E16 B11, B13, B16, E19, E30, E5, E6, E8 B38 B37 E10	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF

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Vehicle	Connector	Pin	Circuit
Mustang 5.0L	306 PIN	B1, B16, B2 B26, B43, B51, B54, B56, B58, E113, E13, E22, E32, E40, E47, E49, E5, E54, E91, E99, T57, T71, T84, T85 B72 B87 E114 B52, B66, B81, E115, E118, E120, E34, T81 B71 B86 E117	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Mustang 5.2L	198 PIN	B97, B99 B51, B54, B71, B90, E40, E49, E54 B59 B35 E23 B52, E34 B40 B36 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Navigator	198 PIN	B101, B102, B103 B16, B17, B18, B30, B34, B37, B38, B75, B94, E10, E20, E29, E32, E53 B15 B19 E35 B11, B13, B5, E2, E5, E6, E8 B14 B18 E4	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Ranger	128 PIN	B11, B12 B33, B38, B40, E3, E6, E9, T29 B41 B42 E4 B14, B16, T18 B17 B18 E28	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Taurus 3.7L	198 PIN	B97, B99 B51, B56, B71, B90, E29, E40, E49, E54, T41 B59 B35 E23 B52, B55, B61, E34, E35, E57 B40 B36 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF

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Vehicle	Connector	Pin	Circuit
Transit 3.5L	198 PIN	B101, B102, B103 B18, B37, B38, E20, E53 B35 B36 E31 B11, E8 B10 B12 E7	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Transit 3.7L	198 PIN	B97, B99 B51, B71, B90, E29, E40, E49, E54 B59 B35 E23 E29, E34 B40 B36 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
Transit Connect	198 PIN	B97, B99 B30, B35, B54, B56, B71, E35 B35 B59 E23 E34 B36 B40 E8	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF
All other vehicles	198 PIN	B101, B102, B103 B16, B18, B19, B38, E20, E53 B35 B36 E31 B11, B13, E6, E8 B10 B12 E7	VPWR SIGRTN APPRTN2 APPRTN1 ETCRTN VREF APPVREF2 APPVREF1 ETCREF

TEST PROCEDURE

C1 CHECK THE REFERENCE VOLTAGE TO SIGNAL RETURN

NOTE: **Diagnostic trouble codes (DTCs) P0642, P0643, P06A6, P06A7 and P06A8 are set due to VREF circuit concerns only. DTCs P0652 and P0653 are set due to ETCREF circuit concerns only. When diagnosing DTC P0642, P0643, P06A6, P06A7 or P06A8, follow the path for VREF concerns. When diagnosing DTC P0652 or P0653, follow the path for ETCREF concerns.**

- Ignition OFF.
- Suspect Sensor connector disconnected.
- Ignition ON, engine OFF.
- For ETCREF concerns.
- Measure the voltage between:

(+) ETBTPS Connector, Harness Side	(-) ETBTPS Connector, Harness Side
ETCREF	ETCRTN

- For APPVREF concerns.
- Measure the voltage between:

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(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APPVREF1	APPRTN1
APPVREF2	APPRTN2

- For VREF concerns.
- Measure the voltage between:

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

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C37.	GO to C2.

C2 CHECK THE REFERENCE VOLTAGE TO GROUND

- For ETCREF concerns.
- Measure the voltage between:

(+) ETBTPS Connector, Harness Side	(-)
ETCREF	Ground

- For APPVREF concerns.
- Measure the voltage between:

(+) APP Sensor Connector, Harness Side	(-)
APPVREF1	Ground
APPVREF2	Ground

- For VREF concerns.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C36.	GO to C3.

C3 CHECK THE REFERENCE VOLTAGE WITH ALL SENSORS DISCONNECTED

NOTE: **Refer to the Sensors Connected To Reference Voltage Chart at the beginning of this pinpoint test and the appropriate Wiring Diagrams article, Electronic Engine Controls to identify the sensors connected to VREF, ETCREF and APPVREF.**

- Ignition OFF.
- Disconnect all of the sensors connected to the reference voltage circuits.
- Ignition ON, engine OFF.
- Measure the voltage at the sensor disconnected in C1.
- For ETCREF concerns.
- Measure the voltage between:

(+) ETBTPS Connector, Harness Side	(-)
ETCREF	Ground

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- For APPVREF concerns.
- Measure the voltage between:

(+) APP Sensor Connector, Harness Side	(-)
APPVREF1	Ground
APPVREF2	Ground

- For VREF concerns.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C8.	GO to C4.

C4 CHECK THE REFERENCE VOLTAGE CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- For ETCREF concerns.
- Measure the resistance between:

(+) ETBTPS Connector, Harness Side	(-) PCM Connector, Harness Side
ETCREF	ETCREF

- For APPVREF concerns.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APPVREF1	APPVREF1
APPVREF2	APPVREF2

- For VREF concerns.
- Measure the resistance between:

(+) Suspect Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	VREF

Is the resistance less than 5 ohms?

Yes	No
GO to C5.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

C5 CHECK THE REFERENCE VOLTAGE CIRCUIT FOR A SHORT TO GROUND

- For APPVREF or ETCREF concerns.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
ETCREF	ETCRTN
APPVREF1	APPRTN1
APPVREF2	APPRTN2
APPVREF1	APPRTN2
APPVREF2	APPRTN1

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- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
ETCREF	Ground
APPVREF1	Ground
APPVREF2	Ground

- For VREF concerns.
- Measure the resistance between:

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

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
VREF	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to C6.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

C6 CHECK THE REFERENCE VOLTAGE CIRCUIT FOR A SHORT TO VPWR

- For ETCREF concerns.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
ETCREF	VPWR

- For APPVREF concerns.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
APPVREF1	VPWR
APPVREF2	VPWR

- For VREF concerns.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) PCM Connector, Harness Side
VREF	VPWR

Is the resistance greater than 10K ohms?

Yes	No
GO to C7.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

C7 CHECK THE REFERENCE VOLTAGE CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For ETCREF concerns.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
ETCREF	Ground

- For APPVREF concerns.

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- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
APPVREF1	Ground
APPVREF2	Ground

- For VREF concerns.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
VREF	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to C38.

C8 CHECK THE REFERENCE VOLTAGE WITH THE ETBTPS CONNECTED

NOTE: If this sensor was used for the measurement in C3, GO to C9.

- Ignition OFF.
- ETBTPS connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) APP Sensor Connector, Harness Side	(-)
APPVREF1	Ground
APPVREF2	Ground

Are the voltages between 4.5 - 5.5 V?

Yes	No
GO to C9.	INSTALL a new ETBTPS. REFER to the appropriate Engine Controls - Fuel Charging And Controls article or appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

C9 CHECK THE REFERENCE VOLTAGE WITH THE APP SENSOR CONNECTED

NOTE: If this sensor was used for the measurement in C3, GO to C10.

- Ignition OFF.
- APP Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) ETBTPS Connector, Harness Side	(-)
ETCREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C10.	INSTALL a new APP sensor. REFER to the appropriate Acceleration Control article. Clear the PCM DTCs. REPEAT the self-test.

C10 CHECK THE REFERENCE VOLTAGE WITH THE MAP SENSOR CONNECTED

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NOTE: **If the vehicle is not equipped with a MAP sensor or if this sensor was used for the VREF measurement in C3, GO to C11.**

- Ignition OFF.
- MAP Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C11.	INSTALL a new MAP sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

C11 CHECK THE REFERENCE VOLTAGE WITH THE TCBP/CACT SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a TCBP/CACT sensor or if this sensor was used for the VREF measurement in C3, GO to C12.**

- Ignition OFF.
- TCBP/CACT Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C12.	INSTALL a new TCBP/CACT sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

C12 CHECK THE REFERENCE VOLTAGE WITH THE MAP/IAR2 SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a TMAP/IAT2 sensor or if this sensor was used for the VREF measurement in C3, GO to C13.**

- Ignition OFF.
- MAP/IAT2 Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C13.	INSTALL a new MAP/IAT2 sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

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C13 CHECK THE REFERENCE VOLTAGE WITH THE FRP SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a FRP sensor or if this sensor was used for the VREF measurement in C3, GO to C14.**

- Ignition OFF.
- FRP Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C14.	INSTALL a new FRP sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

C14 CHECK THE REFERENCE VOLTAGE WITH THE CRANKCASE PRESSURE SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a crankcase pressure sensor or if this sensor was used for the VREF measurement in C3, GO to C15.**

- Ignition OFF.
- Crankcase Pressure Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C15.	INSTALL a new Crankcase Pressure sensor. REFER to the appropriate Engine Emission Control article. Clear the PCM DTCs. REPEAT the self-test.

C15 CHECK THE REFERENCE VOLTAGE WITH THE IMRC1 SENSOR CONNECTED

NOTE: **f the vehicle is not equipped with an IMRC1 sensor or if this sensor was used for the VREF measurement in C3, GO to C16.**

- Ignition OFF.
- IMRC1 Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No

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Yes	No
GO to C16.	INSTALL a new IMRC1 sensor. REFER to the appropriate Engine System article. Clear the PCM DTCs. REPEAT the self-test.

C16 CHECK THE REFERENCE VOLTAGE WITH THE IMRC2 SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with an IMRC2 sensor or if this sensor was used for the VREF measurement in C3, GO to C17.**

- Ignition OFF.
- IMRC2 Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

Is the voltage between 4.5 - 5.5 V?

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Yes	No
GO to C17.	INSTALL a new IMRC2 sensor. REFER to the appropriate Engine System article. Clear the PCM DTCs. REPEAT the self-test.

C17 CHECK THE REFERENCE VOLTAGE WITH THE CPP SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a CPP sensor or if this sensor was used for the VREF measurement in C3, GO to C18.**

- Ignition OFF.
- CPP Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C18.	INSTALL a new CPP sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

C18 CHECK THE REFERENCE VOLTAGE WITH THE ACP TRANSDUCER SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with an ACP transducer sensor or if this sensor was used for the VREF measurement in C3, GO to C19.**

- Ignition OFF.
- Air Conditioning Pressure (ACP) Transducer Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

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Yes	No
GO to C19.	INSTALL a new Air Conditioning Pressure (ACP) Transducer Sensor. Clear the PCM DTCs. REPEAT the self-test.

C19 CHECK THE REFERENCE VOLTAGE WITH THE FUEL PRESSURE SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a fuel pressure sensor or if this sensor was used for the VREF measurement in C3, GO to C20.**

- Ignition OFF.
- Fuel Pressure Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C20.	INSTALL a new Fuel Pressure Sensor. REFER to the appropriate Fuel Tank and Lines article. Clear the PCM DTCs. REPEAT the self-test.

C20 CHECK THE REFERENCE VOLTAGE WITH THE CKP SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a CKP sensor or if this sensor was used for the VREF measurement in C3, GO to C21.**

- Ignition OFF.
- CKP Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C21.	INSTALL a new CKP sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

C21 CHECK THE REFERENCE VOLTAGE WITH THE CMP SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a CMP sensor or if this sensor was used for the VREF measurement in C3, GO to C22.**

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- CMP Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

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Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C22.	INSTALL a new CMP sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

C22 CHECK THE REFERENCE VOLTAGE WITH THE WASTEGATE VACUUM SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a wastegate vacuum sensor or if this sensor was used for the VREF measurement in C3, GO to C23.**

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- Wastegate Vacuum Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C23.	INSTALL a new Wastegate Vacuum Sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

C23 CHECK THE REFERENCE VOLTAGE WITH THE MAPT SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a MAPT sensor or if this sensor was used for the VREF measurement in C3, GO to C24.**

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- MAPT Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C24.	INSTALL a new MAPT sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

C24 CHECK THE REFERENCE VOLTAGE WITH THE GENERATOR CURRENT SENSOR CONNECTED

NOTE: **If the vehicle is not equipped with a generator current sensor or if this sensor was used for the VREF measurement in C3, GO to C25.**

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

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- Ignition OFF.
- Generator Current Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C25.	INSTALL a new Generator Current sensor. REFER to the appropriate Charging System - Battery, Mounting and Cables. Clear the PCM DTCs. REPEAT the self-test.

- **C25 CHECK THE REFERENCE VOLTAGE WITH THE MAP/CACT SENSOR CONNECTED**

NOTE: **If the vehicle is not equipped with a MAP/CACT sensor or if this sensor was used for the VREF measurement in C3, GO to C26.**

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- MAP/CACT Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C26.	INSTALL a new MAP/CACT sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

- **C26 CHECK THE REFERENCE VOLTAGE WITH THE TCBP SENSOR CONNECTED**

NOTE: **If the vehicle is not equipped with a TCBP sensor or if this sensor was used for the VREF measurement in C3, GO to C27.**

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- TCBP Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No

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Yes	No
GO to C27.	INSTALL a new TCBP sensor. Clear the PCM DTCs. REPEAT the self-test.

- **C27 CHECK THE REFERENCE VOLTAGE WITH THE FRPT SENSOR CONNECTED**

NOTE: **If the vehicle is not equipped with a FRPT sensor or if this sensor was used for the VREF measurement in C3, GO to C28.**

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- FRPT Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C28.	INSTALL a new FRPT sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

- **C28 CHECK THE REFERENCE VOLTAGE WITH THE BRAKE VACUUM SENSOR CONNECTED**

NOTE: **If the vehicle is not equipped with a brake vacuum sensor or if this sensor was used for the VREF measurement in C3, GO to C29.**

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- Brake Vacuum Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C29.	INSTALL a new Brake Vacuum sensor. Clear the PCM DTCs. REPEAT the self-test.

- **C29 CHECK THE REFERENCE VOLTAGE WITH THE PARTICULATE FILTER PRESSURE BANK 1, SENSOR 1 CONNECTED**

NOTE: **If the vehicle is not equipped with a particulate filter pressure bank 1, sensor 1 or if this sensor was used for the VREF measurement in C3, GO to C30.**

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- Particulate Filter Pressure Bank 1, Sensor 1 connector connected.

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

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C31.	INSTALL a new Particulate Filter Pressure Bank 1, Sensor 1. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

- **C30 CHECK THE REFERENCE VOLTAGE WITH THE PARTICULATE FILTER PRESSURE BANK 2, SENSOR 1 CONNECTED**

NOTE: **If the vehicle is not equipped with a particulate filter pressure bank 2, sensor 1 or if this sensor was used for the VREF measurement in C3, GO to C31.**

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- Particulate Filter Pressure Bank 2, Sensor 1 connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C31.	INSTALL a new Particulate Filter Pressure Bank 2, Sensor 1. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

- **C31 CHECK THE REFERENCE VOLTAGE WITH THE TCIPT SENSOR CONNECTED**

NOTE: **If the vehicle is not equipped with a TCIPT sensor or if this sensor was used for the VREF measurement in C3, GO to C32.**

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- TCIPT Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C32.	INSTALL a new TCIPT sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

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- **C32 CHECK THE REFERENCE VOLTAGE WITH THE EP SENSOR CONNECTED**

NOTE: **If the vehicle is not equipped with an EP sensor or if this sensor was used for the VREF measurement in C3, GO to C33.**

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- EP Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C33.	INSTALL a new EP sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

- **C33 CHECK THE REFERENCE VOLTAGE WITH THE EGR VALVE CONNECTED**

NOTE: **If the vehicle is not equipped with an EGR valve or if this valve was used for the VREF measurement in C3, GO to C34.**

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- EEGR Assembly connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C34.	INSTALL a new EEGR assembly. Clear the PCM DTCs. REPEAT the self-test.

- **C34 CHECK THE REFERENCE VOLTAGE WITH THE DIFFERENTIAL PRESSURE FEEDBACK EXHAUST GAS RECIRCULATION (DPFEGR) SENSOR CONNECTED**

NOTE: **If the vehicle is not equipped with a DPFEGR sensor or if this sensor was used for the VREF measurement in C3, GO to C35.**

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- Differential Pressure Feedback EGR Sensor connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

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

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(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to C35.	INSTALL a new DPFEGR sensor. Clear the PCM DTCs. REPEAT the self-test.

- **C35 CHECK THE REFERENCE VOLTAGE WITH THE FTP SENSOR CONNECTED**
  - Ignition OFF.
  - FTP Sensor connector connected.
  - Ignition ON, engine OFF.
  - Measure the voltage between:

(+) Suspect Sensor Connector, Harness Side	(-)
VREF	Ground

Is the voltage between 4.5 - 5.5 V?

Yes	No
The concern is intermittent. GO to **PINPOINT TEST Z**.	INSTALL a new FTP sensor. REFER to the appropriate Evaporative Emissions article. Clear the PCM DTCs. REPEAT the self-test.

- **C36 CHECK THE SIGRTN OR ETCRTN CIRCUITS FOR AN OPEN**
  - Ignition OFF.
  - Disconnect the PCM.
  - For ETCRTN concerns.
  - Measure the resistance between:

(+) ETBTPS Connector, Harness Side	(-) PCM Connector, Harness Side
ETCRTN	ETCRTN

  - For APPRTN concerns.
  - Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APPRTN1	APPRTN1
APPRTN2	APPRTN2

  - For SIGRTN concerns.
  - Measure the resistance between:

(+) Suspect Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
SIGRTN	SIGRTN

Is the resistance less than 5 ohms?

Yes	No
GO to C38.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

- **C37 CHECK THE SUSPECT SENSOR FOR AN INTERNAL SHORT**
- Clear the KOEO, KOER, and continuous DTCs.
- Ignition OFF.
- Connect the suspect sensor.

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- Ignition ON, engine OFF.
- Carry out the PCM self-test.

Is the concern still present?

Yes	No
INSTALL a new sensor for the sensor in question. Clear the PCM DTCs. REPEAT the self-test.	The concern is intermittent. GO to **PINPOINT TEST Z**.

C38 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.
- 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)**, Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS DA: INTAKE AIR TEMPERATURE (IAT) SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- IAT sensor (12A697)
- integrated mass airflow/intake air temperature (MAF/IAT) sensor (12B579)
- manifold absolute pressure and temperature (MAPT) sensor (9F479)
- harness circuits: IAT and SIGRTN
- PCM (12A650)

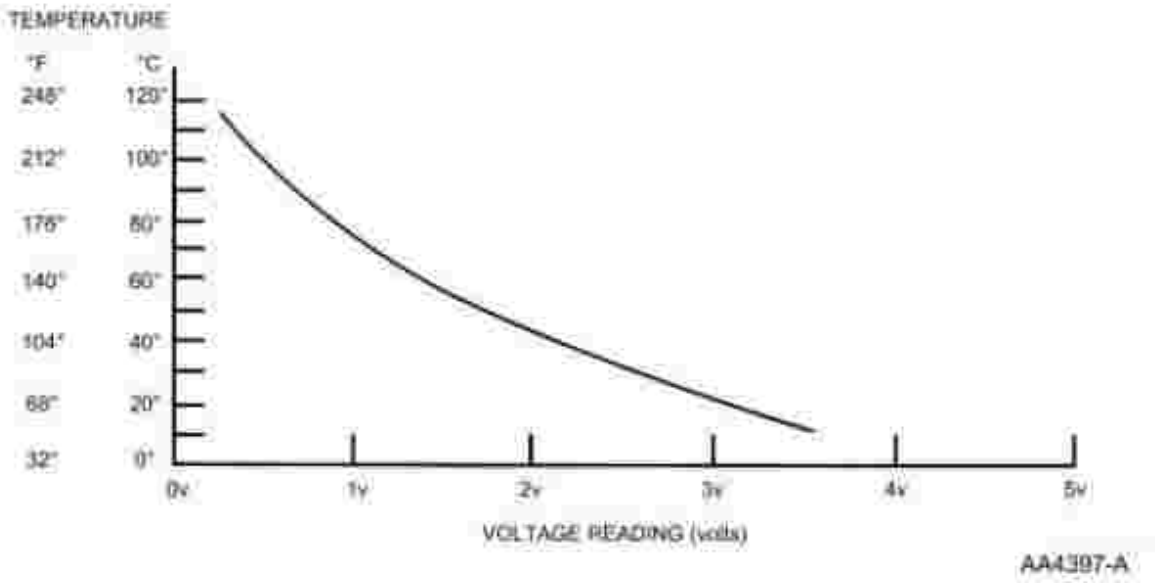

Fig. 44: Intake Air Temperature (IAT) Sensor Voltage Graph
Courtesy of FORD MOTOR CO.

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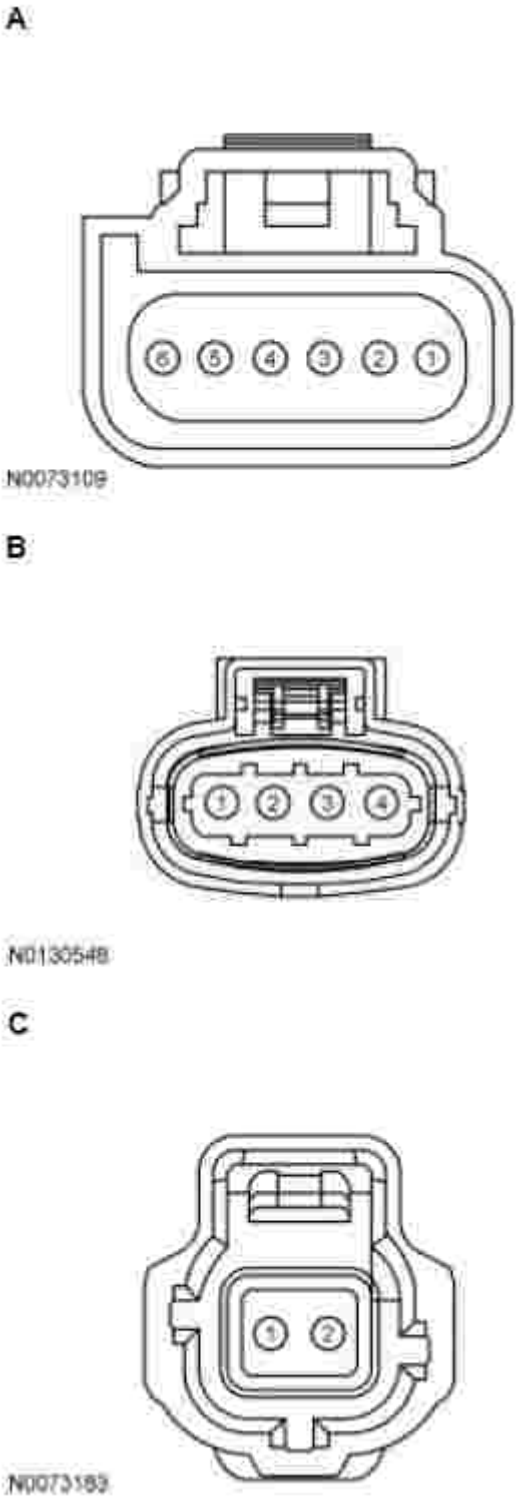

Fig. 45: Intake Air Temperature (IAT) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series, EcoSport 2.0L, Escape/Kuga 2.5L, Explorer TiVCT 3.5L, Explorer 3.7L, F-650/F-750, F-Series Super Duty, Fiesta, Focus GDI 2.0L, Ford GT, Fusion 2.5L, Mustang 5.0L, Mustang 5.2L, Transit Connect	A	4 2	SIGRTN IAT

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Vehicle	Connector	Pin	Circuit
KA	B	1 2	SIGRTN IAT
Motorhome/Stripped Chassis/Step Van	A	4 2	GND IAT
All other vehicles	C	2 1	SIGRTN IAT

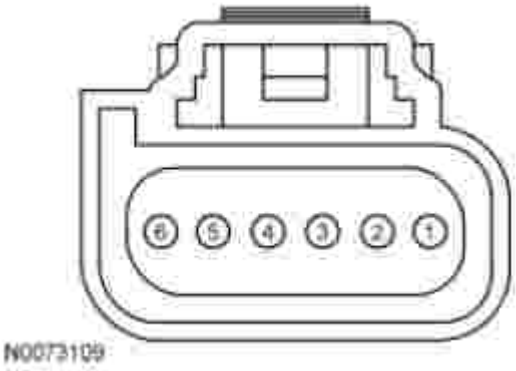

Fig. 46: Mass Air Flow Bank 2, Sensor 1/Intake Air Temperature Bank 2, Sensor 1 (MAF21/IAT21) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
4	SIGRTN (Signal Return)
2	IAT21 (Intake Air Temperature Bank 2, Sensor 1)

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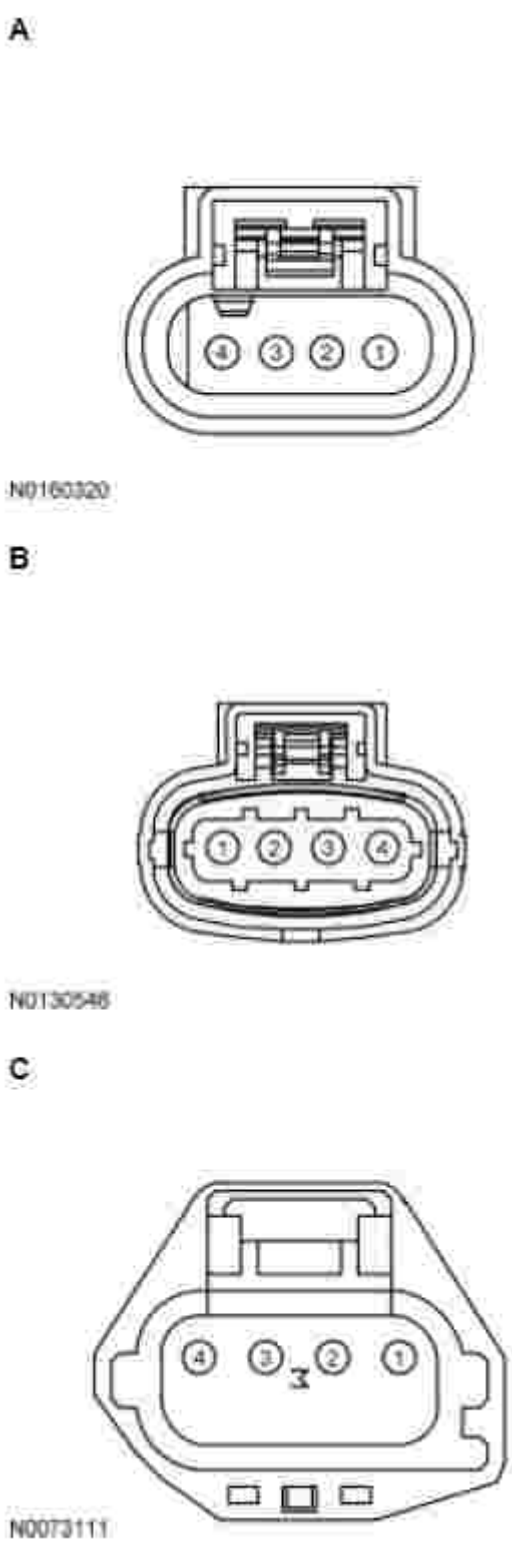

Fig. 47: Manifold Absolute Pressure Temperature (MAPT) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental, EcoSport 1.5L, Edge 3.5L, Explorer 3.5L, Explorer 3.7L, F-150 3.3L, Flex 3.5L, MKT 3.7L, MKX, Taurus 3.5L, Transit 3.7L	A	3	IAT
Ranger	C	3	IAT
All other vehicles	B	2	IAT

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Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 2.0L, EcoSport 1.0L Manual Transmission, Escape/Kuga 2.0L, Focus GTDI 2.0L, Focus 2.3L, Fusion 1.5L, Fusion 2.0L, MKC, MKZ 2.0L	198 PIN	B19 B75	SIGRTN IAT
Continental 3.7L, Edge 3.5L, F-Series Super Duty, Flex TiVCT 3.5L, MKT 3.7L, MKX 3.7L, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L	198 PIN	E29 E27	SIGRTN IAT
E-Series 6.2L	198 PIN	B30 E27	SIGRTN IAT
E-Series 6.8L, F-650/F-750, Motorhome/Stripped Chassis/Step Van, Mustang 5.2L	198 PIN	B54 E27	SIGRTN IAT
EcoSport 1.0L Automatic Transmission	198 PIN	B19 B77	SIGRTN IAT
EcoSport 1.5L Automatic Transmission	198 PIN	E35 E24	SIGRTN IAT
EcoSport 1.5L Manual Transmission	112 PIN	E4 E20	SIGRTN IAT
EcoSport 2.0L, Fiesta 1.0L, Fiesta GTDI 1.6L	198 PIN	B9 B75	SIGRTN IAT
Escape/Kuga 1.5L	198 PIN	B24 B70	SIGRTN IAT
Escape/Kuga 2.5L, Fusion 2.5L, Transit Connect	198 PIN	B54 B25	SIGRTN IAT
Expedition, F-150 3.5L, Navigator	198 PIN	E20 B34	SIGRTN IAT
Explorer TiVCT 3.5L, Explorer 3.7L	198 PIN	E29 B27	SIGRTN IAT
F-150 2.7L	306 PIN	B43 B24	SIGRTN IAT
F-150 3.3L	306 PIN	E13 E50	SIGRTN IAT
F-150 5.0L	306 PIN	E13 E52	SIGRTN IAT
Fiesta TiVCT 1.6L, Ranger	128 PIN	B38 E17	SIGRTN IAT
Focus 1.0L	198 PIN	B19 B76	SIGRTN IAT

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Vehicle	Connector	Pin	Circuit
Focus GDI	2.0L 154	PIN E36 E10	SIGRTN IAT
Ford GT	198 PIN	B9 B75 E32 B76	SIGRTN IAT SIGRTN IAT21
KA	128 PIN	T17 T10	SIGRTN IAT
Mustang 2.3L	198 PIN	B36 B56	SIGRTN IAT
Mustang 5.0L	306 PIN	B54 E24	SIGRTN IAT
All other vehicles	198 PIN	B18 B75	SIGRTN IAT

TEST PROCEDURE

DA1 PRELIMINARY DIAGNOSIS

Are DTCs P00AB, P00AC, P00AD, P0111, P0112, P0113, P0114, or P1112 present?

Yes	No
For DTCs P00AB or P0111, GO to DA7. For all others, GO to DA2.	RETURN to **SYMPTOM CHARTS** for further direction.

DA2 CHECK FOR AN OPEN

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- PCM connector disconnected.
- For DTCs P00AC, or P00AD,
- MAF21/IAT21 Sensor connector disconnected.
- Measure the resistance between:

(+) MAF21/IAT21 Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IAT21 - Pin 2	IAT21
SIGRTN - Pin 4	SIGRTN

- For Continental 3.7L, EcoSport 1.5L, F-150 3.3L, F-150 5.0L, F-Series Super Duty 6.2L, Fiesta 1.6L TIVCT, Flex 3.5L TIVCT, KA, MKT 3.7L, Taurus 3.5L TIVCT, Taurus 3.7L and Transit 3.7L,
- MAPT Sensor connector disconnected.
- Measure the resistance between:

(+) MAPT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IAT	IAT
SIGRTN	SIGRTN

- For all others,
- IAT Sensor connector disconnected.
- Measure the resistance between:

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

- For Motorhome/Stripped Chassis/Step Van,

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- Measure the resistance between:

(+) IAT Sensor Connector, Harness Side	(-)
GND	Ground

- For all others,
- Measure the resistance between:

(+) IAT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
SIGRTN	SIGRTN

Are the resistances less than 5 ohms?

Yes	No
GO to DA3.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DA3 CHECK FOR A SHORT TO GROUND

- For DTCs P00AC, or P00AD,
- Measure the resistance between:

(+) MAF21/IAT21 Sensor Connector, Harness Side	(-)
IAT21 - Pin 2	Ground

- For Continental 3.7L, EcoSport 1.5L, F-150 3.3L, F-150 5.0L, F-Series Super Duty 6.2L, Fiesta 1.6L TIVCT, Flex 3.5L TIVCT, KA, MKT 3.7L, Taurus 3.5L TIVCT, Taurus 3.7L and Transit 3.7L,
- Measure the resistance between:

(+) MAPT Sensor Connector, Harness Side	(-)
IAT	Ground

- For all others,
- Measure the resistance between:

(+) IAT Sensor Connector, Harness Side	(-)
IAT	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to DA4.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DA4 CHECK FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For DTCs P00AC, or P00AD,
- Measure the voltage between:

(+) MAF21/IAT21 Sensor Connector, Harness Side	(-)
IAT21 - Pin 2	Ground

- For Continental 3.7L, EcoSport 1.5L, F-150 3.3L, F-150 5.0L, F-Series Super Duty 6.2L, Fiesta 1.6L TIVCT, Flex 3.5L TIVCT, KA, MKT 3.7L, Taurus 3.5L TIVCT, Taurus 3.7L and Transit 3.7L,
- Measure the voltage between:

(+) MAPT Sensor Connector, Harness Side	(-)
IAT	Ground

- For all others,

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- Measure the voltage between:

(+) IAT Sensor Connector, Harness Side	(-)
IAT	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	For DTCs P00AB, P00AC, or P00AD, INSTALL a new MAF21/IAT21 sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test. For all others, GO to DA5.

DA5 INTERMITTENT CHECK

- Ignition OFF.
- PCM connector connected.
- For Continental 3.7L, EcoSport 1.5L, F-150 3.3L, F-150 5.0L, F-Series Super Duty 6.2L, Fiesta 1.6L TIVCT, Flex 3.5L TIVCT, KA, MKT 3.7L, Taurus 3.5L TIVCT, Taurus 3.7L and Transit 3.7L,
- MAPT Sensor connector connected.
- For all others,
- IAT Sensor connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the IAT (VOLT) PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness working from the sensor to the PCM.
- Lightly tap on the sensor and wiggle the harness connector to simulate road shock.

Does the IAT PID reading change?

Yes	No
REPAIR as necessary. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DA6.

DA6 CHECK THE IAT CIRCUIT VOLTAGE CYCLING INTEGRITY

- Ignition OFF.
- For Continental 3.7L, EcoSport 1.5L, F-150 3.3L, F-150 5.0L, F-Series Super Duty 6.2L, Fiesta 1.6L TIVCT, Flex 3.5L TIVCT, KA, MKT 3.7L, Taurus 3.5L TIVCT, Taurus 3.7L and Transit 3.7L,
- MAPT Sensor connector disconnected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the IAT (VOLT) PID.
- Record the IAT PID value.
- Connect a 5 amp fused jumper wire between the following:

Point A IAT Sensor Connector, Harness Side	Point B
IAT	Ground

- Record the IAT PID value.
- For all others,
- IAT Sensor connector disconnected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the IAT (VOLT) PID.
- Record the IAT PID value.

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

Point A MAPT Sensor Connector, Harness Side	Point B
IAT	Ground

- Record the IAT PID value.

Does the IAT PID change from greater than 3.0 volts to less than 0.20 volt when the jumper is connected?

Yes	No
For Continental 3.7L, EcoSport 1.5L, F-150 3.3L, F-150 5.0L, F-Series Super Duty 6.2L, Fiesta 1.6L TIVCT, Flex 3.5L TIVCT, KA, MKT 3.7L, Taurus 3.5L TIVCT, Taurus 3.7L and Transit 3.7L, INSTALL a new MAPT sensor. For all others, INSTALL a new IAT sensor. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DA8.

DA7 INTAKE AIR TEMPERATURE (IAT) SENSOR CORRELATION

NOTE: **Check temperature values while engine is at ambient temperature, cold soak the engine for a minimum of 8 hours while not in direct sunlight, if necessary.**

NOTE: **All PIDs may not be available on all vehicles.**

- Ignition OFF.
- IAT Sensor connector connected.
- Ignition ON, engine OFF.
- For Continental 2.0L, Continental 2.7L, Continental 3.0L, Edge 2.0L, Edge 2.7L, Escape/Kuga 1.5L, Escape/Kuga 2.0L, Expedition, Explorer 3.5L GTDI, F-150 2.7L, F-150 3.5L, Fiesta 1.0L, Fiesta 1.6L GTDI, Flex 3.5L GTDI, Focus 1.0L, Focus 2.0L GTDI, Ford GT, Fusion 1.5L, Fusion 2.0L, Fusion 2.7L, MKC, MKT 2.0L, MKT 3.5L, MKX 2.0L, MKX 2.7L, MKZ, Navigator, Taurus 2.0L, Taurus 3.5L GTDI and Transit 3.5L,
- Access the PCM and monitor the AAT (TEMP), CAC_T (TEMP), IAT (TEMP) and IAT2 (TEMP) PIDs.
- For all others,
- Access the PCM and monitor the AAT (TEMP), CHT (TEMP), ECT (TEMP), ECT1 (TEMP) and IAT (TEMP) PIDs.

Are the temperature readings within 17Â°C (30Â°F) of each other?

Yes	No
GO to DA8.	INSTALL a new IAT sensor. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DA8 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.
- Verify the concern is still present.

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Is the concern still present?

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

PINPOINT TESTS DC: MASS AIRFLOW (MAF) SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- mass airflow (MAF) sensor (12B579)
- harness circuits: IAT, GND, MAF, MAFRTN, SIGRTN and VPWR
- PCM (12A650)

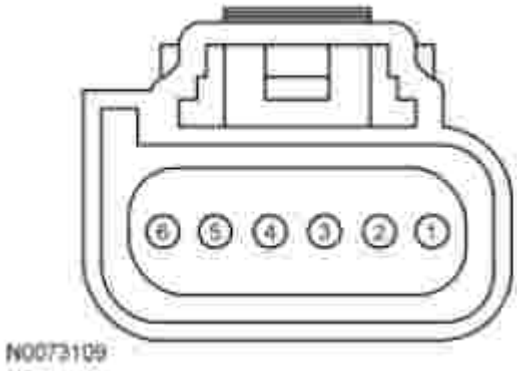

Fig. 48: Mass Airflow/Intake Air Temperature (MAF/IAT) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
MKX	A	4 3 5 6	MAFRTN MAF GND VPWR
Motorhome/Stripped Chassis/Step Van	A	5 4 3	MAF GND VPWR
All other vehicles	A	4 5 3	SIGRTN MAF VPWR

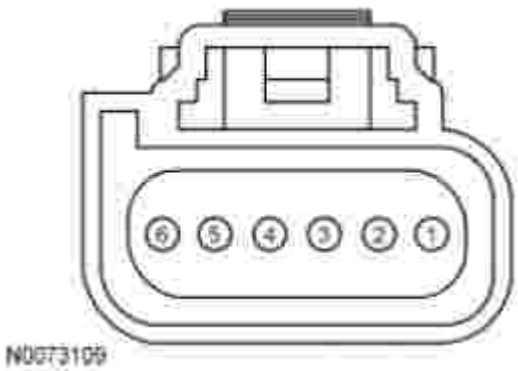

Fig. 49: Mass Air Flow Bank 2, Sensor 1/Intake Air Temperature Bank 2, Sensor 1 (MAF21/IAT21) Sensor Connector
Courtesy of FORD MOTOR CO.

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Pin	Circuit
4	SIGRTN (Signal Return)
5	MAF21 (Mass Air Flow Bank 2, Sensor 1)
3	VPWR (Vehicle Power)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
E-Series 6.2L, F-Series Super Duty	198 PIN	B30 B30 B73	SIGRTN MAFRTN MAF
EcoSport	198 PIN	B9 B9 B8	SIGRTN MAFRTN MAF
Fiesta	198 PIN	B9 B8	SIGRTN MAF
Focus	154 PIN	E36 E55	SIGRTN MAF
Ford GT	198 PIN	B9 E32 E27 B8	SIGRTN SIGRTN MAF21 MAF
Mustang 5.0L	306 PIN	B58 B36	SIGRTN MAF
All other vehicles	198 PIN	B54 B73	SIGRTN MAF

TEST PROCEDURE

DC1 VERIFY THE TYPE OF MAF SENSOR

Does the MAF/IAT sensor harness connector have 4 circuits?

Yes	No
GO to DC15.	GO to DC2.

DC2 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

Are DTCs P0101, P0102, P0103, P0104, or P1100 present?

Yes	No
GO to DC3.	For symptoms without DTCs, GO to DC3. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

DC3 CHECK THE INTAKE AIR SYSTEM FOR LEAKS, OBSTRUCTIONS, AND DAMAGE

NOTE: **Visually inspect the vehicle for aftermarket accessories and performance modifications (exhaust system, turbocharger, performance chip). Refer to ENGINE CONTROL (EC) SYSTEM , Modifications to OBD Vehicles.**

- Ignition OFF.
- Check the intake air system (air cleaner, housing, and tubes) for restrictions.
- Check for broken or loose air outlet tube clamps, cracks or holes in the air outlet tube.
- Check for worn gaskets between the MAF/IAT sensor and the air cleaner assembly.
- Check that the MAF/IAT sensor connector is seated correctly.
- Check the throttle body bore for sludge.

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- Check the positive crankcase ventilation (PCV) system for leaks and restrictions.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to DC4.

DC4 CHECK FOR VOLTAGE AT THE SENSOR

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

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

Is the voltage greater than 10.5 V?

Yes	No
GO to DC5.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DC5 CHECK FOR AN OPEN

NOTE: Only measure the circuits that apply to the vehicle being diagnosed.

- Ignition OFF.
- MAF/IAT Sensor connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

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

- Measure the resistance between:

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

Are the resistances less than 5 ohms?

Yes	No
GO to DC6.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DC6 CHECK FOR A SHORT TO GROUND

- Measure the resistance between:

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

Is the resistance greater than 10K ohms?

Yes	No
GO to DC7.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DC7 CHECK FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.

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- Measure the voltage between:

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

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to DC8.

DC8 INTERMITTENT CHECK

- Ignition OFF.
- PCM connector connected.
- MAF/IAT Sensor connector connected.
- Ignition ON, engine running.
- Run the engine up to 1, 500 RPM for 5 seconds, then bring it back to idle. Run the engine up to 1, 500 RPM for 5 seconds, then bring it back to idle.
- If the idle is not stable, refer to **NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** .
- Access the PCM and monitor the MAF (VOLT) PID.
- Lightly tap on the MAF/IAT sensor and wiggle the harness connector to simulate road shock.

Does the MAF PID go below 0.3 volt or above 4.7 volts?

Yes	No
CLEAN the MAF/IAT sensor using CRC Mass Air Flow Sensor Cleaner 05110 or equivalent. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test. If the concern is still present, INSTALL a new MAF/IAT sensor. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DC9.

DC9 CHECK THE INTAKE AIR SYSTEM FOR LEAKS

NOTE: **Pressure above 241 kPa (35 psi) can cause damage to system components. Regulate the shop air to 137.9 kPa (20 psi) before connecting to the system.**

- Ignition OFF.
- Connect the Evaporative Emission Leak Detector With On Board Nitrogen Generator 218-522C or equivalent to the intake air system.
- Fill the intake air system with smoke.
- Check the intake air system for leaks.

Are any leaks or restrictions present?

Yes	No
REPAIR the leaks or restrictions. Clear the PCM DTCs. REPEAT the self-test.	GO to DC10.

DC10 CHECK THE MAF PID

- Access the PCM and monitor the RPM (RPM) PID.
- Access the PCM and monitor the MAF (VOLT) PID.

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- Run the engine up to 1, 500 RPM for 5 seconds, then bring it back to idle. Run the engine up to 1, 500 RPM for 5 seconds, then bring it back to idle.

Is the voltage less than 0.3 V?

Yes	No
CLEAN the MAF/IAT sensor using CRC Mass Air Flow Sensor Cleaner 05110 or equivalent. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test. If the concern is still present, INSTALL a new MAF/IAT sensor. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DC11.

DC11 CHECK THE MAF CIRCUIT VOLTAGE CYCLING INTEGRITY

- Ignition ON, engine OFF.
- Access the PCM and monitor the MAF (VOLT) PID.
- 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	VPWR

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

Point A MAF/IAT Sensor Connector, Harness Side	Point B
SIGRTN	Ground

- For all others,
- Connect a 5 amp fused jumper wire between the following:

Point A MAF/IAT Sensor Connector, Harness Side	Point B
MAFRTN	Ground

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

Does the MAF PID change from greater than 4.50 volts to less than 0.20 volt when the VPWR jumper is removed?

Yes	No
CLEAN the MAF/IAT sensor using CRC Mass Air Flow Sensor Cleaner 05110 or equivalent. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test. If the concern is still present, INSTALL a new MAF/IAT sensor. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DC12.

DC12 CHECK THE FUNCTIONALITY OF THE MAF SENSOR

NOTE: **A MAF PID value of less than 0.35 volt may indicate an incorrectly installed air cleaner or a leak in the air inlet system.**

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- Ignition ON, engine running.
- Allow the engine to stabilize at the correct operating temperature.
- Access the PCM and monitor the MAF (VOLT) PID.

Is the MAF PID at idle and NEUTRAL between 0.35 volt and 1.3 volts?

Yes	No
GO to DC14.	GO to DC13.

DC13 CHECK TO ISOLATE THE MAF SENSOR FROM A LEAN DRIVEABILITY OCCURRENCE

NOTE: **On some vehicles, a fuel system DTC may be generated without a noticeable driveability concern with the MAF sensor disconnected.**

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

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

Yes	No
CLEAN the MAF/IAT sensor using CRC Mass Air Flow Sensor Cleaner 05110 or equivalent. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test. If the concern is still present, INSTALL a new MAF/IAT sensor. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DC14.

DC14 VERIFY THE DTC

Are DTCs P0171, P0172, P0174, P0175, P2195, P2196, P2197, or P2198 present?

Yes	No
GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .	RETURN to **SYMPTOM CHARTS** for further direction.

DC15 PRELIMINARY DIAGNOSIS

Are DTCs P00BC, P00BD, P00BE, P00BF, P010C, P010D, P010E, P010F, P0102, P0103 or P0104 present?

Yes	No
GO to DC16.	For symptoms without DTCs, GO to DC16. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

DC16 CHECK THE INTAKE AIR SYSTEM FOR LEAKS, OBSTRUCTIONS, AND DAMAGE

- Ignition OFF.
- Check the intake air system (air cleaner, housing, and tubes) for restrictions.
- Check for broken or loose air outlet tube clamps, cracks or holes in the air outlet tube.
- Check for worn gaskets between the MAF/IAT sensor and the air cleaner assembly.
- Check that the MAF/IAT sensor connector is seated correctly.
- Check that the MAF21/IAT21 sensor connector is seated correctly.

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- Check the throttle body bore for sludge.
- Check the crankcase ventilation system for leaks and restrictions.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to DC17.

DC17 CHECK THE VPWR TO THE MAF/IAT SENSOR

NOTE: **For EcoSport 2.0L, the MAF/IAT sensor VPWR is supplied by the fuel pump control module relay. When the ignition is in the KOEO position, the fuel pump stays on for about 5 seconds. It may be necessary to cycle the ignition from ON, to OFF, and back to the ON position, to continue testing.**

- For DTCs P00BE, P00BF, P010C, P010D, or P010E,
- MAF21/IAT21 Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) MAF21/IAT21 Sensor Connector, Harness Side	(-)
VPWR - Pin 3	Ground

- For all others,
- MAF/IAT Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

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

Is the voltage greater than 10.5 V?

Yes	No
GO to DC18.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DC18 CHECK THE MAF HARNESS FOR A OPEN

- Ignition OFF.
- PCM connector disconnected.
- For DTCs P00BE, P00BF, P010C, P010D, or P010E,
- MAF21/IAT21 Sensor connector disconnected.
- Measure the resistance between:

(+) MAF21/IAT21 Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
MAF21 - Pin 5	MAF21
SIGRTN - Pin 4	SIGRTN

- For Motorhome/Stripped Chassis/Step Van,
- MAF/IAT Sensor connector disconnected.
- Measure the resistance between:

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

- Measure the resistance between:

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

- For all others,
- MAF/IAT Sensor connector disconnected.
- Measure the resistance between:

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

Are the resistances less than 5 ohms?

Yes	No
GO to DC19.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DC19 CHECK THE MAF SIGNAL CIRCUIT FOR A SHORT

- For DTCs P00BE, P00BF, P010C, P010D, or P010E,
- Measure the resistance between:

(+) MAF21/IAT21 Sensor Connector, Harness Side	(-)
MAF21 - Pin 5	Ground

- For all others,
- Measure the resistance between:

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

Is the resistance greater than 10K ohms?

Yes	No
GO to DC20.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DC20 CHECK FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For DTCs P00BE, P00BF, P010C, P010D, or P010E,
- Measure the voltage between:

(+) MAF21/IAT21 Sensor Connector, Harness Side	(-)
MAF21 - Pin 5	Ground

- For all others,
- Measure the voltage between:

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

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	For DTCs P00BE, P00BF, P010C, P010D, or P010E, INSTALL a new MAF21/IAT21 sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test. For all others, GO to DC21.

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DC21 CHECK FOR AN INTERMITTENT CONCERN

- Ignition OFF.
- PCM connector connected.
- MAF/IAT Sensor connector connected.
- Ignition ON, engine running.
- Run the engine up to 1, 500 RPM for 5 seconds, then bring it back to idle. Run the engine up to 1, 500 RPM for 5 seconds, then bring it back to idle.
- If the idle is not stable, refer to **NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** .
- Access the PCM and monitor the MAF_HZ (FREQ) PID.
- Lightly tap on the MAF sensor and wiggle the harness connector to simulate road shock.

Does the MAF PID reading change?

Yes	No
CLEAN the MAF/IAT sensor using CRC Mass Air Flow Sensor Cleaner 05110 or equivalent. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test. If the concern is still present, INSTALL a new MAF/IAT sensor. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DC22.

DC22 CHECK THE MAF/IAT HARNESS FOR INTERMITTENT CONCERNS

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

Does the MAF PID reading change?

Yes	No
REPAIR the harness as necessary. Clear the PCM DTCs. REPEAT the self-test.	CLEAN the MAF/IAT sensor using CRC Mass Air Flow Sensor Cleaner 05110 or equivalent. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test. If the concern is still present, INSTALL a new MAF/IAT sensor. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

PINPOINT TESTS DD: FUEL PRESSURE, FUEL RAIL PRESSURE (FRP) AND FUEL RAIL PRESSURE TEMPERATURE (FRPT) SENSORS

INTRODUCTION

WARNING: **VEHICLE FUEL SYSTEMS ARE PRESSURIZED EVEN WHEN THE ENGINE IS NOT RUNNING. TO AVOID FIRE OR PERSONAL INJURY, 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. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

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

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This pinpoint test is intended to diagnose the following:

- fuel pressure sensor (9F972)
- fuel rail pressure (FRP) sensor (6B288)
- fuel rail pressure temperature (FRPT) sensor (9G756)
- harness circuits: FLP, FRP, FRP-PFI and FRT
- PCM (12A650)

Tables and Graphs

FRP SENSOR VOLTAGE AND PRESSURE SPECIFICATIONS

Voltage	Pressure, MPa (gauge)	Pressure, psi (gauge)
4.80	27.95	4054
4.50	26	3771
3.50	19.5	2828
2.50	13.0	1885
1.50	6.5	943
0.50	0	0
0.20	-1.95	-283

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	
Â°C	Â°F	Volts	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
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

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Temperature		Sensor	
Â°C	Â°F	Volts	K Ohms
0	32	4.13	95.501

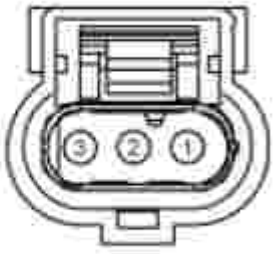

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Fig. 50: Fuel Pressure Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	FLP (Fuel Low Pressure)
2	SIGRTN (Signal Return)
3	VREF (Reference Voltage)

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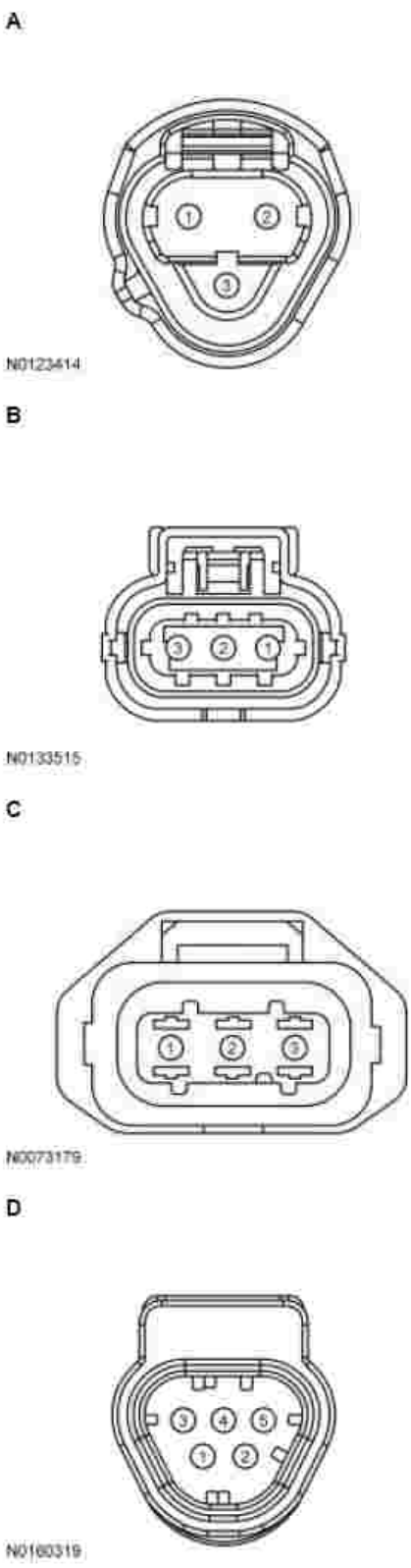

Fig. 51: Fuel Rail Pressure (FRP) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, EcoSport 2.0L, Edge 2.7L, Focus GDI 2.0L, Fusion 2.7L, MKX 2.7L, MKZ 3.0L, Transit	A	2 3 1	FRP SIGRTN VREF
EcoSport 1.0L	B	2 3 1	FRP SIGRTN VREF

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Vehicle	Connector	Pin	Circuit
Escape/Kuga 1.5L, Fusion 1.5L	C	3 2 1	FRP SIGRTN VREF
Escape/Kuga 2.0L	D	4 5 3	FRP SIGRTN VREF
Expedition, Navigator	D	5 3 4	FRP SIGRTN VREF
Explorer GTDI 3.5L, Fiesta, Flex, Focus GTDI 2.0L, Focus 1.0L, Fusion 2.0L, MKC 2.0L, MKT, MKZ 2.0L, Taurus	C	2 1 3	FRP SIGRTN VREF
F-150 2.7L, F-150 5.0L, Mustang 5.0L	B	3 2 1	FRP SIGRTN VREF
All other vehicles	D	4 3 5	FRP SIGRTN VREF

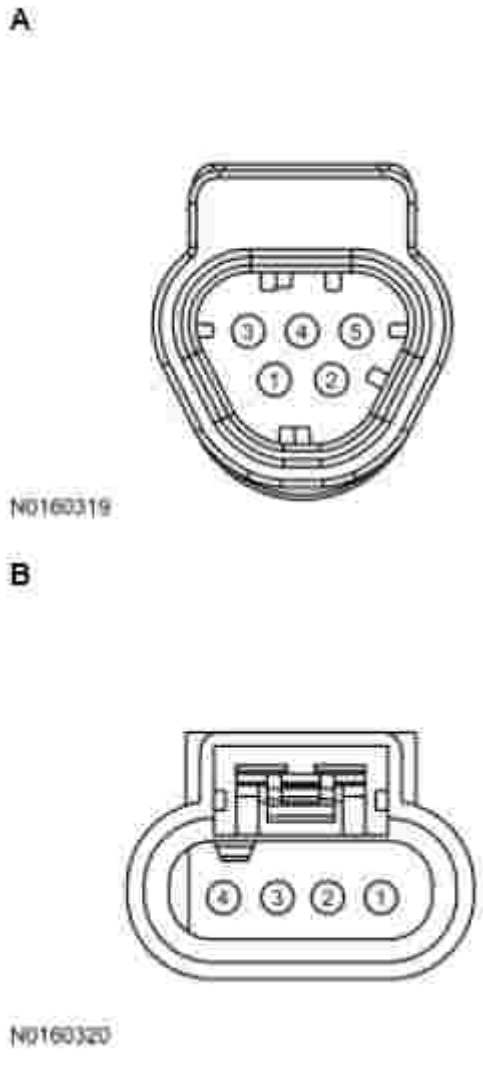

Fig. 52: Fuel Rail Pressure Temperature (FRPT) Sensor Connector
Courtesy of FORD MOTOR CO.

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Vehicle	Connector	Pin	Circuit
Expedition, Navigator	A	5 3 4 2	FRT FRP-PFI SIGRTN VREF
F-150 3.3L, F-150 5.0L	B	4 3 2 1	FRT FRP-PFI SIGRTN VREF
Mustang 5.2L	A	5 2 4 3	FRT FRP SIGRTN VREF
Mustang 5.0L	B	3 4 2 1	FRT FRP-PFI SIGRTN VREF
All other vehicles	A	5 2 4 3	FRT FRP-PFI SIGRTN VREF

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, Edge 2.7L, Fusion 2.7L, MKZ 3.0L	198 PIN	E35 B71	FRP FLP
EcoSport 1.0L Automatic Transmission, EcoSport 2.0L	198 PIN	E37	FRP
EcoSport 1.0L Manual Transmission	198 PIN	E38	FRP
Escape/Kuga 1.5L	198 PIN	E57 B62	FRP FLP
Expedition, F-150 3.5L, Navigator	198 PIN	E33 E21 E38	FRT FRP FRP-PFI
F-150 2.7L, F-150 3.3L, F-150 5.0L	306 PIN	E31 E71 E70	FRT FRP FRP-PFI
Fiesta	198 PIN	E38 B71	FRP FLP
Focus GDI 2.0L	154 PIN	E9 E7	FRP FLP
Ford GT	198 PIN	E67 E35 E37	FRT FRP FRP-PFI
Mustang 5.0L	306 PIN	E70 E71 E31	FRT FRP FRP-PFI
Mustang 5.2L	198 PIN	B44 B34	FRT FRP
Transit	198 PIN	E35	FRP
All other vehicles	198 PIN	E37 B71	FRP FLP

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TEST PROCEDURE

DD1 CHECK FOR DTCS

Are DTCs P0087, P0088, P0182, P0183, P018B, P018C, P018D, P0192 or P0193 present?

Yes	No
For DTCs P0182 or P0183, GO to DD13. For DTCs P018B, P018C or P018D, GO to DD2. For all others, GO to DD8.	RETURN to **SYMPTOM CHARTS** for further direction.

DD2 CHECK THE VREF AND SIGRTN CIRCUITS FOR AN OPEN

- Ignition OFF.
- For Expedition, F-150, Ford GT, Mustang 5.0L, and Navigator,
- FRPT Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

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

- For all others,
- Fuel Pressure Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Fuel Pressure Sensor Connector, Harness Side	(-) Fuel Pressure Sensor Connector, Harness Side
VREF - Pin 3	SIGRTN - Pin 2

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to DD3.	GO to **PINPOINT TEST C**.

DD3 CHECK THE LOW PRESSURE CIRCUITS FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- For Expedition, F-150, Ford GT, Mustang 5.0L, and Navigator,
- Measure the resistance between:

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

- For all others,
- Measure the resistance between:

(+) Fuel Pressure Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
FLP - Pin 1	FLP

Is the resistance less than 5 ohms?

Yes	No
GO to DD4.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DD4 CHECK THE LOW PRESSURE CIRCUITS FOR A SHORT TO GROUND

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- For Expedition, F-150, Ford GT, Mustang 5.0L, and Navigator,
- Measure the resistance between:

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

- For all others,
- Measure the resistance between:

(+) Fuel Pressure Sensor Connector, Harness Side	(-)
FLP - Pin 1	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to DD5.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DD5 CHECK THE LOW PRESSURE CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For Expedition, F-150, Ford GT, Mustang 5.0L, and Navigator,
- Measure the voltage between:

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

- For all others,
- Measure the voltage between:

(+) Fuel Pressure Sensor Connector, Harness Side	(-)
FLP - Pin 1	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	For DTC P018B, GO to DD7. For all others, GO to DD6.

DD6 CHECK THE LOW PRESSURE CIRCUITS FOR AN INTERMITTENT CONCERN

- Ignition OFF.
- For Expedition, F-150, Ford GT, Mustang 5.0L, and Navigator,
- FRPT Sensor connector connected.
- PCM connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the FLP_V (VOLT) 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 connector for damage or corrosion.
- For all others,
- Fuel Pressure Sensor connector connected.
- PCM connector connected.
- Ignition ON, engine OFF.

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- Access the PCM and monitor the FLP_V (VOLT) 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 connector for damage or corrosion.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new sensor in question. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to **PINPOINT TEST HC**. REFER to the appropriate Fuel Tank and Lines article. Clear the PCM DTCs. REPEAT the self-test.

DD7 COMPARE THE FLP PID TO THE MECHANICAL GAUGE

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

- Ignition OFF.
- Relieve the fuel pressure. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure.
- Mechanical fuel pressure gauge connected.
- Disable the fuel pump.
- Ignition ON, engine OFF.
- Monitor the mechanical gauge.
- Access the PCM and monitor the FLP (PRESS) PID.
- Compare the FLP PID value to the mechanical gauge.
- Ignition OFF.
- Pressurize the fuel system. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Ignition ON, engine running.
- Allow the fuel pressure to stabilize.
- Ignition OFF.
- Ignition ON, engine OFF.
- Compare the FLP PID value to the mechanical gauge.

Are the FLP PID values within 153 kPa (22 psi) of the mechanical gauge readings?

Yes	No
The system is operating correctly at this time.	GO to **PINPOINT TEST Z**.

DD8 CHECK THE VREF AND SIGRTN CIRCUITS FOR AN OPEN

- Ignition OFF.
- For Mustang 5.2L,
- FRPT Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

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

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- For all others,
- FRP Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

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

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to DD9.	GO to **PINPOINT TEST C**.

DD9 CHECK THE FRP CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- For Mustang 5.2L,
- Measure the resistance between:

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

- For all others,
- Measure the resistance between:

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

Is the resistance less than 5 ohms?

Yes	No
GO to DD10.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DD10 CHECK THE FRP CIRCUIT FOR A SHORT TO GROUND

- For Mustang 5.2L,
- Measure the resistance between:

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

- For all others,
- Measure the resistance between:

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

Is the resistance greater than 10K ohms?

Yes	No
GO to DD11.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

- **DD11 CHECK THE FRP CIRCUIT FOR A SHORT TO VOLTAGE**
  - Ignition ON, engine OFF.
  - For Mustang 5.2L,
  - Measure the voltage between:

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

- For all others,
- Measure the voltage between:

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

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	For DTCs P0087 or P0088, GO to **PINPOINT TEST Z**. For all others, GO to DD12.

- **DD12 CHECK THE FRP CIRCUIT FOR AN INTERMITTENT CONCERN**
  - Ignition OFF.
  - PCM connector connected.
  - For Mustang 5.2L,
  - FRPT Sensor connector connected.
  - For all others,
  - FRP Sensor connector connected.
  - Ignition ON, engine OFF.
  - Access the PCM and monitor the FRP (VOLT) 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 connector for damage or corrosion.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new sensor in question. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to **PINPOINT TEST HC**. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

- **DD13 CHECK THE VREF AND SIGRTN CIRCUITS FOR AN OPEN**
  - Ignition OFF.
  - FRPT Sensor connector disconnected.
  - Ignition ON, engine OFF.
  - Measure the voltage between:

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

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to DD14.	GO to **PINPOINT TEST C**.

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- **DD14 CHECK THE FRT CIRCUIT FOR AN OPEN**
  - Ignition OFF.
  - PCM connector disconnected.
  - Measure the resistance between:

(+) FRPT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
FRT	FRT

Is the resistance less than 5 ohms?

Yes	No
GO to DD15.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

- **DD15 CHECK THE FRT CIRCUIT FOR A SHORT TO GROUND**
  - Measure the resistance between:

(+) FRPT Sensor Connector, Harness Side	(-)
FRT	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to DD16.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

- **DD16 CHECK THE FRT CIRCUIT FOR A SHORT TO VOLTAGE**
  - Ignition ON, engine OFF.
  - Measure the voltage between:

(+) FRPT Sensor Connector, Harness Side	(-)
FRT	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to DD17.

- **DD17 CHECK THE FRT CIRCUIT FOR AN INTERMITTENT CONCERN**
- Ignition OFF.
- PCM connector connected.
- FRPT Sensor connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the FRT_V (VOLT) 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 connector for damage or corrosion.

Is a concern present?

Yes	No

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Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to **PINPOINT TEST HC**. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

PINPOINT TESTS DF: VEHICLE SPEED CIRCUIT (VSC) CHECK

INTRODUCTION

WARNING: **STRICT OBSERVANCE OF POSTED SPEED LIMITS AND DRIVING CONDITIONS IS MANDATORY WHEN PROCEEDING THROUGH THE FOLLOWING DRIVE CYCLES.**

FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

This pinpoint test is intended to diagnose the following:

- PCM (12A650)

TEST PROCEDURE

DF1 CHECK FOR DTCS

Is DTC U0121 present?

Yes	No
REFER to the appropriate Anti-Lock Brake System And Stability Control article, Vehicle Dynamic Systems, Symptom Charts, No communication with the ABS module.	GO to DF2.

DF2 VISUAL INSPECTION

- Carry out the ABS self-test.

Are any DTCs present?

Yes	No
REFER to the appropriate Anti-Lock Brake System And Stability Control article, Vehicle Dynamic Systems, to continue diagnosis of the ABS.	GO to DF3.

DF3 CHECK THE PCM VEHICLE SPEED SIGNAL INPUT

WARNING: **STRICT OBSERVANCE OF POSTED SPEED LIMITS AND ATTENTION TO DRIVING CONDITIONS ARE MANDATORY WHEN CARRYING OUT THE ROAD TEST. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

- Access the PCM and monitor the VSS (SPD) PID.
- Road test the vehicle while monitoring the VSS PID.

Does the VSS PID increase and decrease while driving?

Yes	No
The concern is not present at this time. CHECK for a loose connection, and damaged or corroded pins. WIGGLE the harness attempting to recreate the concern. REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to DF4.

DF4 CHECK FOR CORRECT PCM OPERATION

- Disconnect all the PCM connectors.
- Visually inspect for:

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- pushed out pins
- corrosion

- Connect all the PCM connectors and make sure they seat correctly.
- Carry out the PCM self-test.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS DG: KNOCK SENSOR (KS)

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- knock sensor bank 1, sensor 1 (KS11), knock sensor bank 1, sensor 2 (KS12), knock sensor bank 2, sensor 1 (KS21) and knock sensor bank 2, sensor 2 (KS22) (12A699)
- harness circuits: KS11, KS11RTN, KS12, KS12RTN, KS21, KS21RTN, KS22, and KS22RTN
- PCM (12A650)

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Fig. 53: Knock Sensor Bank 1, Sensor 1 (KS11) Connector (1 Of 2)
Courtesy of FORD MOTOR CO.

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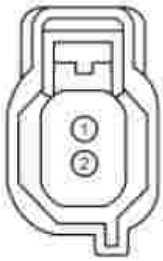

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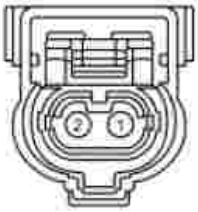

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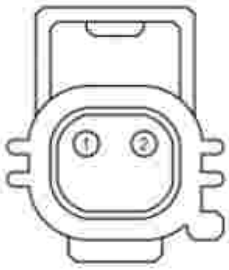

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Fig. 54: Knock Sensor Bank 1, Sensor 1 (KS11) Connector (2 Of 2)
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L	A	5 2	KS11RTN KS11

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Vehicle	Connector	Pin	Circuit
Continental 3.7L, Edge 3.5L, Expedition, Explorer GTDI 3.5L, Explorer 3.7L, F-150 3.3L, F-150 3.5L, Flex, MKT 3.5L, MKT 3.7L, MKX 3.7L, Navigator, Taurus GTDI 3.5L, Taurus 3.7L, Transit	B	2 1	KS11RTN KS11
E-Series, F-Series Super Duty 6.2L	C	2 1	KS11RTN KS11
EcoSport 1.0L	D	1 2	KS11RTN KS11
EcoSport 1.5L	E	1 2	KS11RTN KS11
Edge 2.7L, F-150 2.7L, F-650/F-750, F-Series Super Duty 6.8L, Fusion 2.7L, MKX 2.7L, MKZ 3.0L, Motorhome/Stripped Chassis/Step Van, Mustang 5.2L	F	2 1	KS11RTN KS11
Escape/Kuga 1.5L, Fiesta GTDI 1.6L, Fusion 1.5L, KA	G	2 1	KS11RTN KS11
F-150 5.0L, Mustang 5.0L	H	2 1	KS11RTN KS11
Fiesta 1.0L, Focus 1.0L	D	2 1	KS11RTN KS11
Ford GT	F	1 2	KS11RTN KS11
All other vehicles	I	1 2	KS11RTN KS11

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A

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B

N0130545

C

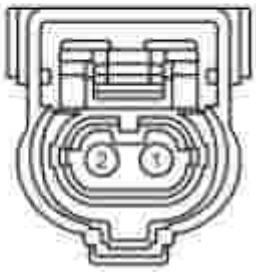

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Fig. 55: Knock Sensor Bank 1, Sensor 2 (KS12) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
Continental 2.0L, EcoSport 2.0L, Edge 2.0L, Escape/Kuga 2.0L, Explorer 2.3L, Focus, Fusion 2.0L, MKC, MKT 2.0L, MKX 2.0L, MKZ 2.0L, Mustang 2.3L, Taurus 2.0L	A	1 2	KS12RTN KS12
Escape/Kuga 1.5L	B	1 2	KS12RTN KS12
F-150 5.0L, Mustang 5.0L	C	2 1	KS12RTN KS12
Fiesta 1.6L, Fusion 1.5L, KA 1.5L	B	2 1	KS12RTN KS12

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Fig. 56: Knock Sensor Bank 2, Sensor 1 (KS21) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L	A	6 3	KS21RTN KS21
E-Series, F-Series Super Duty 6.2L	B	2 1	KS21RTN KS21

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Vehicle	Connector	Pin	Circuit
Edge 2.7L, F-150 2.7L, F-650/F-750, F-Series Super Duty 6.8L, Fusion, MKX 2.7L, MKZ, Motorhome/Stripped Chassis/Step Van, Mustang 5.2L	C	2 1	KS21RTN KS21
F-150 5.0L, Mustang 5.0L	D	2 1	KS21RTN KS21
Ford GT	C	1 2	KS21RTN KS21
All other vehicles	E	4 3	KS21RTN KS21

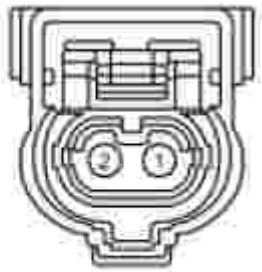

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Fig. 57: Knock Sensor Bank 2, Sensor 2 (KS22) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	KS22RTN (Knock Sensor Bank 2, Sensor 2, Signal Return)
1	KS22 (Knock Sensor Bank 2, Sensor 2)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 2.0L, EcoSport 2.0L, Edge 2.0L, Escape/Kuga 2.0L, Explorer 2.3L, Focus GTDI 2.0L, Focus 2.3L, Fusion 1.5L, Fusion 2.0L, MKC, MKT 2.0L, MKX 2.0L, MKZ 2.0L, Taurus 2.0L	198 PIN	E51 E50 E66 E65	KS12RTN KS12 KS11RTN KS11

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Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, Edge 2.7L, Explorer GTDI 3.5L, Flex GTDI 3.5L, Ford GT, Fusion 2.7L, MKT 3.5L, MKX 2.7L, MKZ 3.0L, Taurus GTDI 3.5L, Transit 3.5L	198 PIN	E51 E50 E66 E65	KS21RTN KS21 KS11RTN KS11
EcoSport 1.0L Automatic Transmission, Focus 1.0L	198 PIN	E66 E65	KS11RTN KS11
EcoSport 1.0L Manual Transmission, Fiesta 1.0L	198 PIN	E60 E59	KS11RTN KS11
EcoSport 1.5L Automatic Transmission, Escape/Kuga 2.5L, Fusion 2.5L, Transit Connect	198 PIN	E57 E58	KS11RTN KS11
EcoSport 1.5L Manual Transmission	112 PIN	E43 E31	KS11 KS11RTN
Escape/Kuga 1.5L	198 PIN	E36 E50 E24 E25	KS12RTN KS12 KS11RTN KS11
Expedition, F-150 3.5L, Navigator	198 PIN	E9 E8 E67 E68	KS21RTN KS21 KS11RTN KS11
F-150 2.7L, F-150 3.3L	306 PIN	E72 E51 E9 E30	KS21RTN KS21 KS11RTN KS11
F-150 5.0L, Mustang 5.0L	306 PIN	E79 E58 E72 E51 E74 E53 E9 E30	KS22RTN KS22 KS21RTN KS21 KS12RTN KS12 KS11RTN KS11
Fiesta GTDI 1.6L	198 PIN	E58 E57 E60 E59	KS12RTN KS12 KS11RTN KS11
Fiesta TiVCT 1.6L	128 PIN	T28 T20 T25 T17	KS12RTN KS12 KS11RTN KS11
Focus GDI 2.0L	154 PIN	E61 E85 E60 E84	KS12RTN KS12 KS11RTN KS11
KA 1.0L	128 PIN	E30 E18	KS11RTN KS11

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Vehicle	Connector	Pin	Circuit
KA 1.5L	128 PIN	E25 E13 E30 E18	KS12RTN KS12 KS11RTN KS11
Mustang 2.3L	198 PIN	E43 E42 E12 E11	KS12RTN KS12 KS11RTN KS11
Ranger	128 PIN	T25 T17	KS11RTN KS11
All other vehicles	198 PIN	E67 E68 E52 E53	KS21RTN KS21 KS11RTN KS11

TEST PROCEDURE

DG1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: **The DTC P130D may be accompanied by other DTCs. Diagnose all other DTCs first.**

Verify the KS is correctly installed before continuing diagnosis. Refer to the appropriate Electronic Engine Controls article.

Are DTCs P0325, P0326, P0327, P0328, P032A, P032C, P032D, P0330, P0331, P0332, P0333, P033A, P033C, P033D, or P130D present?

Yes	No
For DTC P130D, GO to DG6. For all others, GO to DG2.	RETURN to **SYMPTOM CHARTS** for further direction.

DG2 CHECK THE KS CIRCUIT FOR AN OPEN

- Ignition OFF.
- KS connector disconnected.
- PCM connector disconnected.
- For KS11,
- Measure the resistance between:

(+) KS11 Connector, Harness Side	(-) PCM Connector, Harness Side
KS11	KS11
KS11RTN	KS11RTN

- For KS12,
- Measure the resistance between:

(+) KS12 Connector, Harness Side	(-) PCM Connector, Harness Side
KS12	KS12
KS12RTN	KS12RTN

- For KS21,
- Measure the resistance between:

(+) KS21 Connector, Harness Side	(-) PCM Connector, Harness Side
KS21	KS21
KS21RTN	KS21RTN

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- For KS22,
- Measure the resistance between:

(+) KS22 Connector, Harness Side	(-) PCM Connector, Harness Side
KS22 - Pin 1	KS22
KS22RTN - Pin 2	KS22RTN

Are the resistances less than 5 ohms?

Yes	No
GO to DG3.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DG3 CHECK THE KS CIRCUIT FOR A SHORT TO GROUND

- For KS11,
- Measure the resistance between:

(+) KS11 Connector, Harness Side	(-)
KS11	Ground
KS11RTN	Ground

- For KS12,
- Measure the resistance between:

(+) KS12 Connector, Harness Side	(-)
KS12	Ground
KS12RTN	Ground

- For KS21,
- Measure the resistance between:

(+) KS21 Connector, Harness Side	(-)
KS21	Ground
KS21RTN	Ground

- For KS22,
- Measure the resistance between:

(+) KS22 Connector, Harness Side	(-)
KS22 - Pin 1	Ground
KS22RTN - Pin 2	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to DG4.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DG4 CHECK THE KS CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For KS11,
- Measure the voltage between:

(+) KS11 Connector, Harness Side	(-)
KS11	Ground
KS11RTN	Ground

- For KS12,

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- Measure the voltage between:

(+) KS12 Connector, Harness Side	(-)
KS12	Ground
KS12RTN	Ground

- For KS21,
- Measure the voltage between:

(+) KS21 Connector, Harness Side	(-)
KS21	Ground
KS21RTN	Ground

- For KS22,
- Measure the voltage between:

(+) KS22 Connector, Harness Side	(-)
KS22 - Pin 1	Ground
KS22RTN - Pin 2	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to DG5.

DG5 CHECK THE KS CIRCUIT FOR INTERMITTENT CONCERNS

- Ignition OFF.
- While observing the resistance, wiggle, shake, and bend small sections of the wiring harness working from the sensor to the PCM.
- For KS11,
- Measure the resistance between:

(+) KS11 Connector, Harness Side	(-) PCM Connector, Harness Side
KS11	KS11
KS11RTN	KS11RTN

- For KS12,
- Measure the resistance between:

(+) KS12 Connector, Harness Side	(-) PCM Connector, Harness Side
KS12	KS12
KS12RTN	KS12RTN

- For KS21,
- Measure the resistance between:

(+) KS21 Connector, Harness Side	(-) PCM Connector, Harness Side
KS21	KS21
KS21RTN	KS21RTN

- For KS22,
- Measure the resistance between:

(+) KS22 Connector, Harness Side	(-) PCM Connector, Harness Side
KS22 - Pin 1	KS22

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(+) KS22 Connector, Harness Side	(-) PCM Connector, Harness Side
KS22RTN - Pin 2	KS22RTN

Are the resistances less than 5 ohms?

Yes	No
INSTALL a new KS. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DG6 IDENTIFY THE TYPE OF KNOCK

NOTE: **Knock counts on a single cylinder may indicate a concern with the ignition or fuel components for the suspect cylinder. Knock counts distributed among multiple cylinders may indicate a fuel quality concern.**

- Ignition ON, engine running.
- Access the PCM and monitor the KNK_CNTR_CYL1 (MODE), KNK_CNTR_CYL2 (MODE), KNK_CNTR_CYL3 (MODE), KNK_CNTR_CYL4 (MODE), KNK_CNTR_CYL5 (MODE) and KNK_CNTR_CYL6 (MODE) PIDs.

Are the majority of the knock counts on a single cylinder?

Yes	No
DIAGNOSE ignition coil and fuel injection components for the suspect cylinder. REPAIR or INSTALL a new component as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to DG7.

DG7 CHECK THE LEARNED OCTANE ADJUSTMENT

- Access the PCM and monitor the OCTADJ_R_LRND (PER) PID.

Does the OCTADJ_R_LRND PID read between -85% to -100%?

Yes	No
DRAIN and CLEAN the fuel system, REFILL with correct grade fuel. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new KS. REFER to the appropriate Electronic Engine Controls article. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TESTS DI: DIRECT FUEL INJECTION FUEL INJECTOR

INTRODUCTION

NOTE: **Do not apply battery voltage across the fuel injector circuits. Permanent damage to the fuel injector may result.**

This pinpoint test is intended to diagnose the following:

- fuel injectors (9F593)
- harness circuits: INJ and INJRTN
- PCM (12A650)

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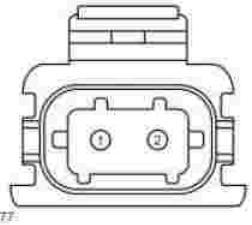
A



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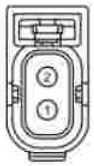

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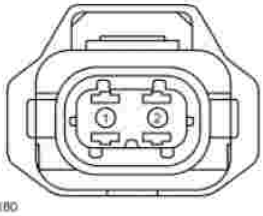

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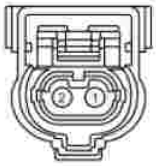

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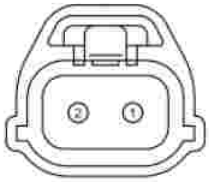

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Fig. 58: Injector (INJ) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 2.0L, Escape/Kuga 2.0L, Fiesta GTDI 1.6L, Fusion 2.0L, MKZ 2.0L	A	2 1	INJRTN INJ
EcoSport, Fiesta 1.0L, Fusion 1.5L	B	2 1	INJRTN INJ

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Vehicle	Connector	Pin	Circuit
Edge 2.0L, Escape/Kuga 1.5L, Explorer, Flex, Focus GTDI 2.0L, Focus 2.3L, MKC, MKT, MKX 2.0L, Mustang 2.3L, Taurus	C	2 1	INJRTN INJ
Expedition, F-150 3.5L, F-150 3.3L, Ford GT, Navigator	D	2 1	INJRTN INJ
All other vehicles	E	2 1	INJRTN INJ

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, Edge 2.7L, Explorer GTDI 3.5L, Flex, Ford GT, Fusion 2.7L, MKT 3.5L, MKX 2.7L, MKZ 3.0L, Taurus GTDI 3.5L, Transit	198 PIN	E94 E95 E92 E85 E88 E83 E93 E82 E89 E90 E87 E84	INJ6RTN INJ6 INJ5RTN INJ5 INJ4RTN INJ4 INJ3RTN INJ3 INJ2RTN INJ2 INJ1RTN INJ1
EcoSport 1.0L Automatic Transmission, Focus 1.0L	198 PIN	E93 E82 E89 E90 E87 E84	INJ3RTN INJ3 INJ2RTN INJ2 INJ1RTN INJ1
EcoSport 1.0L Manual Transmission, Fiesta 1.0L	198 PIN	E76 E93 E82 E92 E84 E91	INJ3RTN INJ3 INJ2RTN INJ2 INJ1RTN INJ1
Escape/Kuga 1.5L	198 PIN	E79 E78 E89 E88 E94 E93 E84 E83	INJ4RTN INJ4 INJ3RTN INJ3 INJ2RTN INJ2 INJ1RTN INJ1

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Vehicle	Connector	Pin	Circuit
Expedition, F-150 3.5L, Navigator	198 PIN	E93 E88 E81 E82 E83 E84 E92 E87 E94 E89 E91 E86	INJ6RTN INJ6 INJ5RTN INJ5 INJ4RTN INJ4 INJ3RTN INJ3 INJ2RTN INJ2 INJ1RTN INJ1
F-150 2.7L, F-150 3.3L	306 PIN	E20 E41 E64 E43 E22 E1 E65 E44 E45 E66 E23 E2	INJ6RTN INJ6 INJ5RTN INJ5 INJ4RTN INJ4 INJ3RTN INJ3 INJ2RTN INJ2 INJ1RTN INJ1
F-150 5.0L	306 PIN	E103 E124 E22 E1 E64 E43 E3 E24 E65 E44 E45 E66 E20 E41 E23 E2	INJ8RTN INJ8 INJ7RTN INJ7 INJ6RTN INJ6 INJ5RTN INJ5 INJ4RTN INJ4 INJ3RTN INJ3 INJ2RTN INJ2 INJ1RTN INJ1
Fiesta GTDI 1.6L	198 PIN	E83 E86 E82 E92 E81 E87 E84 E91	INJ4RTN INJ4 INJ3RTN INJ3 INJ2RTN INJ2 INJ1RTN INJ1
Focus GDI 2.0L	154 PIN	E27 E53 E26 E76 E25 E52 E3 E77	INJ4RTN INJ4 INJ3RTN INJ3 INJ2RTN INJ2 INJ1RTN INJ1

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Vehicle	Connector	Pin	Circuit
Fusion 1.5L	198 PIN	E92 E85 E88 E83 E93 E82 E87 E84	INJ4RTN INJ4 INJ3RTN INJ3 INJ2RTN INJ2 INJ1RTN INJ1
Mustang 2.3L	198 PIN	E89 E94 E88 E93 E77 E82 E78 E83	INJ4RTN INJ4 INJ3RTN INJ3 INJ2RTN INJ2 INJ1RTN INJ1
Mustang 5.0L	306 PIN	E20 E41 E65 E44 E64 E43 E45 E66 E22 E1 E3 E24 E103 E124 E23 E2	INJ8RTN INJ8 INJ7RTN INJ7 INJ6RTN INJ6 INJ5RTN INJ5 INJ4RTN INJ4 INJ3RTN INJ3 INJ2RTN INJ2 INJ1RTN INJ1
All other vehicles	198 PIN	E92 E85 E93 E82 E88 E83 E87 E84	INJ4RTN INJ4 INJ3RTN INJ3 INJ2RTN INJ2 INJ1RTN INJ1

TEST PROCEDURE

DI1 CHECK FOR DTCS

Are DTCs P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P02EE, P02EF, P02F0, P02F1, P02F2, P02F3, P02F4 or P02F5 present?

Yes	No
GO to DI2.	For no start, runs rough at idle or misses, GO to DI2. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

DI2 CHECK THE FUEL INJECTOR PID

- Ignition ON, engine OFF.
- Access the PCM and monitor the INJ_F (MODE) PID.

Does the INJ_F PID indicate a concern?

Yes	No

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Yes	No
GO to DI4.	GO to DI3.

DI3 CARRY OUT THE POWER BALANCE TEST

NOTE: **The IDS test referenced in this step may not be available on all vehicles. Proceed to the next step if the IDS test is not available.**

- Verify the low pressure fuel system is operating correctly. GO to **PINPOINT TEST HC** and follow the pinpoint test direction.
- Carry out the Power Balance Test. Refer to the instruction manual provided by the scan tool manufacturer.

Are the results satisfactory?

Yes	No
The system is operating correctly at this time. RETURN to **SYMPTOM CHARTS** for further direction.	GO to DI4.

DI4 CHECK THE INJ AND INJRTN CIRCUITS FOR AN OPEN

- Ignition OFF.
- INJ connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) INJ Connector, Harness Side
Suspect INJ	INJ
Suspect INJRTN	INJRTN

Are the resistances less than 5 ohms?

Yes	No
GO to DI5.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DI5 CHECK THE INJ AND INJRTN CIRCUITS FOR A SHORT TO GROUND

- Ignition OFF.
- Measure the resistance between:

(+) INJ Connector, Harness Side	(-)
INJ	Ground
INJRTN	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to DI6.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DI6 CHECK THE INJ AND INJRTN CIRCUITS FOR A SHORT TO VOLTAGE

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

(+) INJ Connector, Harness Side	(-)
INJ	Ground
INJRTN	Ground

Is any voltage present?

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Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to DI7.

DI7 CHECK FOR A SHORT BETWEEN THE INJ AND INJRTN CIRCUITS

- Ignition OFF.
- Measure the resistance between:

(+) INJ Connector, Harness Side	(-) INJ Connector, Harness Side
INJ	INJRTN

Is the resistance greater than 10K ohms?

Yes	No
GO to DI8.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DI8 CHECK THE RESISTANCE OF THE FUEL INJECTOR

- Measure the resistance between:

(+) INJ Connector, Component Side	(-) INJ Connector, Component Side
INJ	INJRTN

Is the resistance between 1 - 2 ohms?

Yes	No
GO to DI9.	INSTALL a new Fuel Injector. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DI9 CARRY OUT A THOROUGH WIGGLE TEST ON THE FUEL INJECTOR HARNESS

- Ignition OFF.
- INJ connector connected.
- PCM connector connected.
- Ignition ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the INJ_F (MODE) PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the suspected fuel injector to the PCM.

Does the INJ_F PID indicate a concern?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	For Power Balance Test results indicating a fuel injector concern, INSTALL a new fuel injector as necessary. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test. For all others, GO to DI10.

DI10 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.
- 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)**, Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. GO to **PINPOINT TEST Z**.

PINPOINT TESTS DK: ACCELERATOR PEDAL POSITION (APP) SENSOR

INTRODUCTION

NOTE: **After clearing an APP sensor diagnostic trouble code (DTC) to verify a repair or an intermittent concern, apply the accelerator pedal before carrying out the self-test. Take 10 seconds to carry out a full sweep of the accelerator pedal from fully released to fully applied and back to fully released.**

This pinpoint test is intended to diagnose the following:

- APP sensor (9F836)
- harness circuits: APP1, APP2, APPRTN1, APPRTN2, APPVREF1, APPVREF2, VPWR and GND
- PCM (12A650)

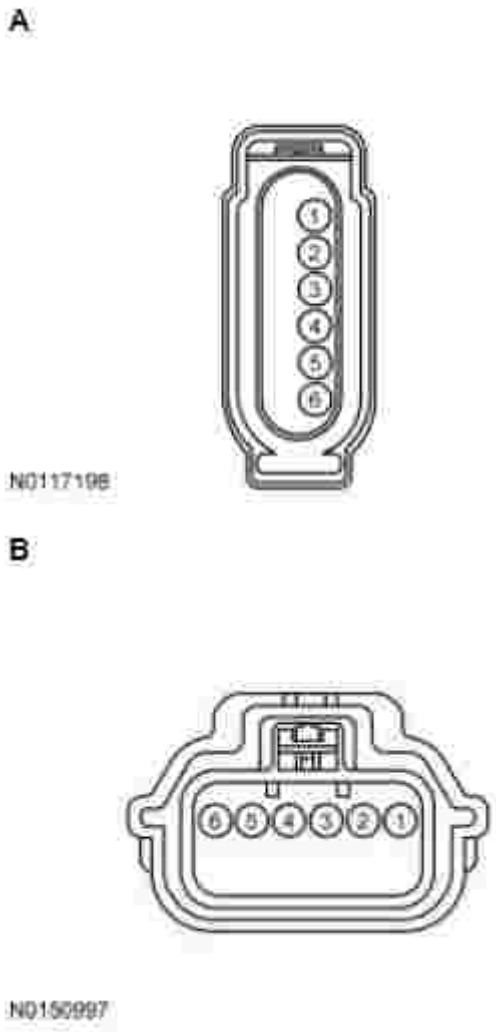

Fig. 59: Accelerator Pedal Position (APP) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
Fiesta	A	4 6 2 5 3 1	GND VPWR APP2 APP1 APPRTN2 APPVREF2
All other vehicles	B	5 2 4 6 3 1	APP2 APP1 APPRTN2 APPVREF2 APPRTN1 APPVREF1

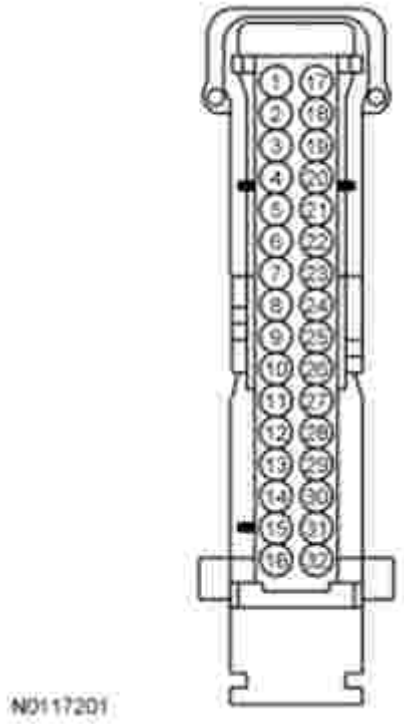

Fig. 60: Instrument Panel Cluster (IPC) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
31	APPVREF2 (Accelerator Pedal Position Reference Voltage 2)
13	APPRTN2 (Accelerator Pedal Position Return 2)
14	APP2 (Accelerator Pedal Position 2)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
Continental 3.7L, E-Series, EcoSport 1.5L Automatic Transmission, Edge 3.5L, Escape/Kuga 2.5L, Explorer TiVCT 3.5L, Explorer 3.7L, F-650/F-750, F-Series Super Duty, Flex TiVCT 3.5L, Fusion 2.5L, MKT 3.7L, MKX 3.7L, Motorhome/Stripped Chassis/Step Van, Mustang 5.2L, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L, Transit Connect	198 PIN	B60 B61	APP2 APP1
EcoSport 1.5L Manual Transmission	112 PIN	B24 B23	APP2 APP1
Escape/Kuga 1.5L	198 PIN	B47 B14	APP2 APP1
F-150 2.7L, F-150 3.3L, F-150 5.0L, Mustang 5.0L	306 PIN	B68 B56	APP2 APP1
Fiesta 1.0L, Fiesta GTDI 1.6L	198 PIN	B45	APP1
Fiesta TiVCT 1.6L	128 PIN	T12	APP1
Focus GDI 2.0L	154 PIN	B26 B52	APP2 APP1
KA	128 PIN	B8 B21	APP2 APP1
Mustang 2.3L	198 PIN	B34 B33	APP2 APP1
Ranger	128 PIN	B29 B30	APP2 APP1
All other vehicles	198 PIN	B54 B55	APP2 APP1

TEST PROCEDURE

DK1 CHECK FOR DTCS

Are DTCs P2122, P2123, P2127, P2128 or P2138 present?

Yes	No
GO to DK2.	For a lack/loss of power symptom, GO to DK2. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

DK2 CHECK THE ACCELERATOR PEDAL FOR OBSTRUCTION

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

Does the pedal move freely to the floor and back?

Yes	No

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Yes	No
For Fiesta, GO to DK4. For all others, GO to DK3.	ISOLATE and REPAIR the obstruction. Clear the PCM DTCs. REPEAT the self-test.

DK3 CHECK FOR INTERMITTENT APP SIGNAL

- Ignition ON, engine OFF.
- Access the PCM and monitor the APP1 (VOLT) and APP2 (VOLT) PIDs.
- Set the scan tool PID voltage limit values using the following chart.

PID	Minimum Volts	Maximum Volts
APP1	0.61	4.6
APP2	0.27	2.4

- Carry out a thorough wiggle test on the APP harness from the PCM connector to the APP sensor connector.

Does the PID value exceed the set limits range?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	For symptoms without DTCs, RETURN to **SYMPTOM CHARTS** for further direction. For all others, GO to DK5.

DK4 CHECK FOR INSTRUMENT PANEL CLUSTER (IPC) DTCS

- Carry out the IC (IPC) self-test.

Are any IPC DTCs present other than DTC B1029?

Yes	No
DISREGARD the current DTC at this time. DIAGNOSE the next DTC. REFER to the appropriate Instrumentation, Message Center, And Warning Chimes article.	GO to DK9.

DK5 CHECK THE APPVREF VOLTAGE TO THE APP SENSOR

- Ignition OFF.
- APP Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APPVREF1	APPRTN1
APPVREF2	APPRTN2

Are the voltages between 4.5 - 5.5 V?

Yes	No
GO to DK6.	GO to **PINPOINT TEST C**.

DK6 CHECK THE APP CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APP1	APP1
APP2	APP2

Are the resistances less than 5 ohms?

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Yes	No
GO to DK7.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DK7 CHECK THE APP CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-)
APP1	Ground
APP2	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to DK8.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DK8 CHECK THE APP CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) APP Sensor Connector, Harness Side	(-)
APP1	Ground
APP2	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to DK17.

DK9 CHECK THE VOLTAGE TO THE APP SENSOR

- Ignition OFF.
- APP Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
VPWR	GND
APPVREF2	APPRTN2

Is the VPWR voltage greater than 10.5 V and is the APPVREF2 voltage between 4.5 to 5.5 V?

Yes	No
GO to DK11.	For VPWR less than 10.5 V, GO to DK10. For all others, GO to DK14.

DK10 CHECK THE APP SENSOR GND CIRCUIT

- Ignition OFF.
- Measure the resistance between:

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

Is the resistance less than 5 ohms?

Yes	No

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Yes	No
REPAIR the open VPWR circuit. Clear the PCM DTCs. REPEAT the self-test.	REPAIR the open GND circuit. Clear the PCM DTCs. REPEAT the self-test.

DK11 CHECK THE APP1 SENSOR CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
APP1	APP1

Is the resistance less than 5 ohms?

Yes	No
GO to DK12.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DK12 CHECK THE APP1 SENSOR CIRCUIT FOR A SHORT

- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-)
APP1	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to DK13.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DK13 CHECK THE APP1 SENSOR CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) APP Sensor Connector, Harness Side	(-)
APP1	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to DK14.

DK14 CHECK THE APP2 CIRCUITS FOR AN OPEN

- Ignition OFF.
- IPC connector disconnected.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) IPC Connector, Harness Side
APP2	APP2 - Pin 14
APPRTN2	APPRTN2 - Pin 13
APPVREF2	APPVREF2 - Pin 31

Are the resistances less than 5 ohms?

Yes	No
GO to DK15.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DK15 CHECK THE APP2 CIRCUITS FOR A SHORT TO GROUND

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- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-)
APP2	Ground
APPRTN2	Ground
APPVREF2	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to DK16.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DK16 CHECK THE APP2 CIRCUITS FOR A SHORT TO VOLTAGE

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

(+) APP Sensor Connector, Harness Side	(-)
APP2	Ground
APPRTN2	Ground
APPVREF2	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to DK18.

DK17 CHECK THE APP SENSOR CIRCUITS FOR A SHORT

- Ignition OFF.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP1	APP2
APP1	APPVREF1
APP1	APPVREF2
APP1	APPRTN1
APP1	APPRTN2
APP2	APPVREF1
APP2	APPVREF2
APP2	APPRTN1
APP2	APPRTN2

Are the resistances greater than 10K ohms?

Yes	No
GO to DK19.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DK18 CHECK THE APP CIRCUITS FOR A SHORT

- Ignition OFF.
- Measure the resistance between:

(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP1	APP2
APP1	APPVREF2
APP1	APPRTN2
APP2	APPVREF2

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(+) APP Sensor Connector, Harness Side	(-) APP Sensor Connector, Harness Side
APP2	APPRTN2

Are the resistances greater than 10K ohms?

Yes	No
GO to DK19.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DK19 SIMULATE THE OPPOSITE SIGNAL

NOTE: **For Fiesta APP1 PID, insert and remove the jumper wire repeatedly to simulate a pulse width modulated (PWM) signal, while monitoring the PID on the scan tool.**

- Ignition OFF.
- PCM connector connected.
- For Fiesta,
- IPC connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the APP1 (VOLT) and APP2 (VOLT) PIDs.
- Record the APP1 and APP2 PID values.
- Connect a 5 amp fused jumper wire between the following:

Point A APP Sensor Connector, Harness Side	Point B APP Sensor Connector, Harness Side
APP1	GND
APP2	APPVREF2

- Record the APP1 and APP2 PID values.
- For all others,
- Ignition ON, engine OFF.
- Access the PCM and monitor the APP1 (VOLT) and APP2 (VOLT) PIDs.
- Record the APP1 and APP2 PID values.
- Connect a 5 amp fused jumper wire between the following:

Point A APP Sensor Connector, Harness Side	Point B APP Sensor Connector, Harness Side
APP1	APPVREF1
APP2	APPVREF2

Do the PID values change (Fiesta) or are the PID values greater than 4.5 V (all others)?

Yes	No
GO to DK20.	For Fiesta APP2 PID value does not change, GO to DK21. For all others, GO to DK22.

DK20 CHECK THE APP SENSOR

NOTE: **Take 10 seconds to carry out a full sweep of the accelerator pedal from fully released to fully applied to fully released.**

- Ignition OFF.
- PCM connector connected.
- APP Sensor connector connected.
- For Fiesta,
- IPC connector connected.
- Ignition ON, engine OFF.

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- Access the PCM and monitor the APP1 (VOLT) and APP2 (VOLT) PIDs.
- Slowly press the accelerator pedal to the fully applied position and then slowly to the fully released position.

Accelerator Pedal Position	APP1	APP2
Pedal fully released	0.61 - 0.97	0.27 - 0.53
Pedal fully applied	3.59 - 4.6	1.72 - 2.4

Are both voltage PIDs within the chart ranges?

Yes	No
Unable to duplicate the concern at this time. GO to **PINPOINT TEST Z**.	INSTALL a new APP sensor. REFER to the appropriate Acceleration Control article to INSTALL a new accelerator pedal. Clear the PCM DTCs. REPEAT the self-test.

DK21 CHECK FOR CORRECT INSTRUMENT PANEL CLUSTER (IPC) OPERATION

- Disconnect all the IPC connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the IPC connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	No
INSTALL a new IPC. REFER to the appropriate Instrumentation, Message Center, And Warning Chimes article. Clear the PCM DTCs. REPEAT the self-test.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

DK22 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.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS DL: CYLINDER HEAD TEMPERATURE (CHT) SENSOR

INTRODUCTION

NOTE: **On a typical vehicle, the CHT sensor is located in the cylinder head and the CHT2 sensor is located in the exhaust manifold.**

This pinpoint test is intended to diagnose the following:

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- cylinder head temperature (CHT) sensor (6G004)
- cylinder head temperature 2 (CHT2) sensor (6G004)
- harness circuits: CHT, CHT2, and SIGRTN
- PCM (12A650)

On applications that do not use an engine coolant temperature (ECT) sensor, the CHT sensor is used to determine the engine coolant temperature. 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 value at the same temperature. For example, at 90Â°C (194Â°F) the voltage could read either 0.60 volt or 3.71 volts. Refer to the table for the expected values.

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

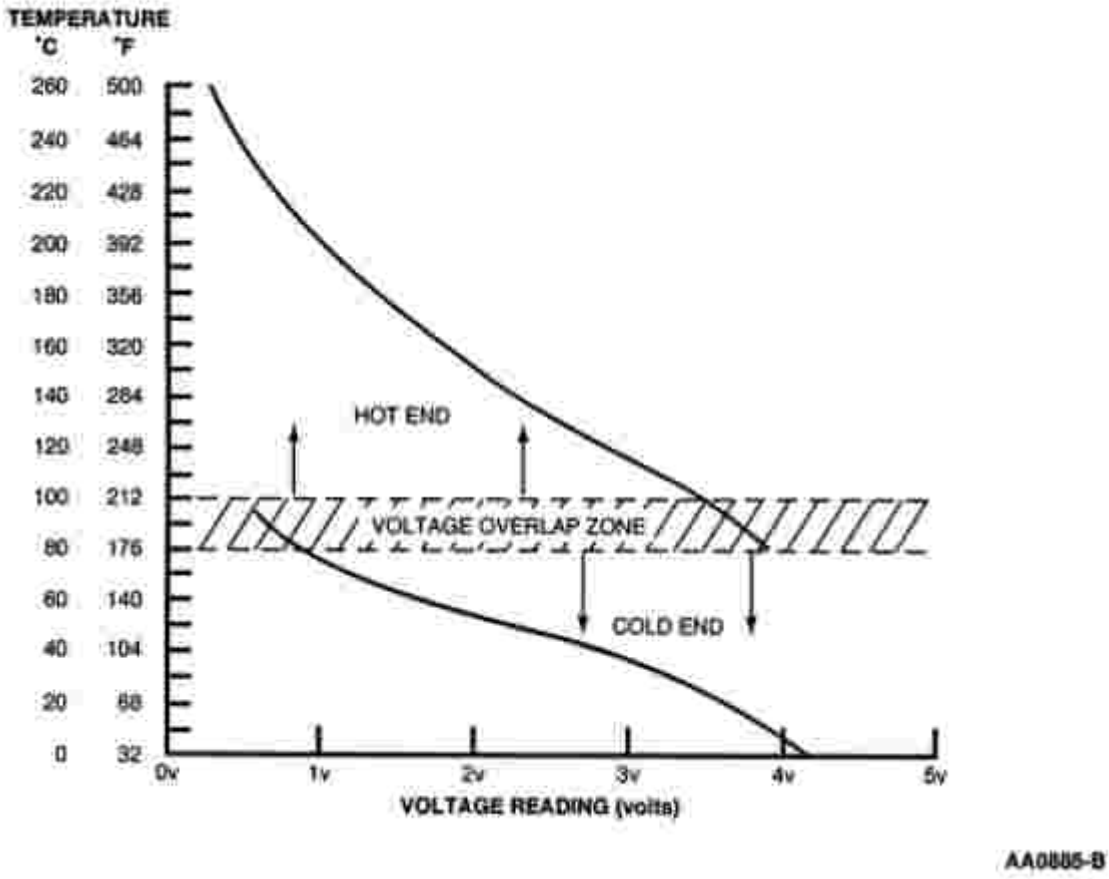

Fig. 61: Cylinder Head Temperature (CHT) Sensor Voltage Graph
Courtesy of FORD MOTOR CO.

Cylinder Head Temperature (CHT) And CHT2 Sensor Expected Values

Temperature		CHT Sensor Values		
Â°C	Â°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

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Temperature		CHT Sensor Values		
Â°C	Â°F	Cold End (volts)	Hot End (volts)	Resistance (K ohms)
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
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	Â	0.35	0.078
260	500	Â	0.33	0.067

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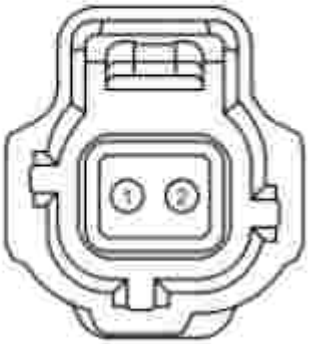

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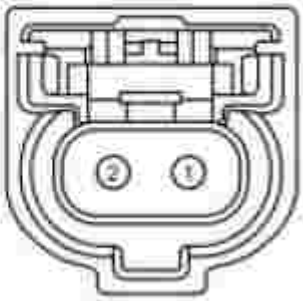

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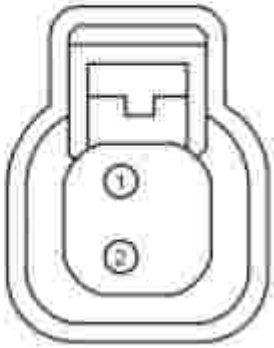

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Fig. 62: Cylinder Head Temperature (CHT) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series, Escape/Kuga, F-Series Super Duty 6.8L, Fusion 2.5L, Motorhome/Stripped Chassis/Step Van	A	2 1	SIGRTN CHT
F-150 5.0L	B	2 1	SIGRTN CHT
All other vehicles	C	2 1	SIGRTN CHT

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A

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B

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C

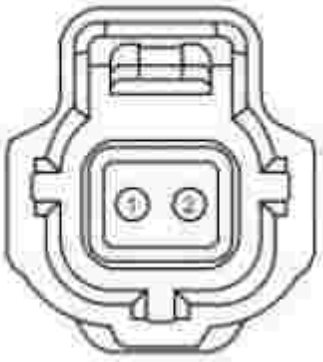

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Fig. 63: Cylinder Head Temperature 2 (CHT2) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
EcoSport 1.5L	B	2 1	SIGRTN CHT2
EcoSport 2.0L	C	2 1	SIGRTN CHT2
All other vehicles	A	2 1	SIGRTN CHT2

Powertrain Control Module (PCM) Connector

For PCM connector views or **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
Continental 3.7L, E-Series, Edge 3.5L, Explorer TiVCT 3.5L, Explorer 3.7L, F-650/F-750, F-Series Super Duty, Flex TiVCT 3.5L, MKT 3.7L, MKX 3.7L, Motorhome/Stripped Chassis/Step Van, Mustang 5.2L, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L	198 PIN	E47 E49	CHT SIGRTN
EcoSport 1.0L Manual Transmission	198 PIN	E10 E36	SIGRTN CHT2
EcoSport 1.5L Automatic Transmission	198 PIN	E35 E39	SIGRTN CHT2
EcoSport 1.5L Manual Transmission	112 PIN	E5 E21	SIGRTN CHT2
Escape/Kuga 1.5L	198 PIN	E14 E36	SIGRTN CHT2
Escape/Kuga 2.5L, Fusion 2.5L	198 PIN	E39 E35	CHT SIGRTN
Expedition, F-150 3.5L, Navigator	198 PIN	E36 E10	CHT SIGRTN
Explorer GTDI 3.5L, Flex GTDI 3.5L, MKT 3.5L, Taurus GTDI 3.5L, Transit 3.5L	198 PIN	E36 E20	CHT SIGRTN
F-150 2.7L, F-150 3.3L, F-150 5.0L, Mustang 5.0L	306 PIN	E8 E99	CHT SIGRTN
Fiesta	198 PIN	E10 E13	SIGRTN CHT2
Focus 1.0L, Focus GTDI 2.0L, Focus 2.3L, Fusion 1.5L, MKZ 2.0L	198 PIN	E20 E46	SIGRTN CHT2
Focus GDI 2.0L	154 PIN	E56 E33	CHT SIGRTN
Ford GT	198 PIN	E36 E56	CHT SIGRTN
Mustang 2.3L	198 PIN	E13 E40	SIGRTN CHT2
Transit Connect	198 PIN	E39 B35	CHT SIGRTN
All other vehicles	198 PIN	E20 E36	SIGRTN CHT2

TEST PROCEDURE

DL1 CHECK FOR DTCS

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Are DTCs P0116, P0119, P0125, P0128, P017C, P017D, P017E, P1021, P1022, P1023, P1024, P1026, P1285, P1289, P128A, or P1290 present?

Yes	No
GO to DL2.	For temperature warning indicator lamp or gauge (applications with CHT sensor only) symptom, GO to DL13. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

DL2 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. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

NOTE: **The DTC P0125 or 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 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 DTCs P0125 or P0128, GO to DL12. For all others, GO to DL3.	REFER to the appropriate Engine Cooling article to diagnose a cooling system concern. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL3 CHECK THE RESISTANCE OF THE CHT SENSOR WITH THE ENGINE OFF

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

- Ignition OFF.
- For the CHT2 sensor,
- CHT2 Sensor connector disconnected.
- Measure the resistance between:

(+) CHT2 Sensor Connector, Component Side	(-) CHT2 Sensor Connector, Component Side
CHT2	SIGRTN

- For all others,
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT	SIGRTN

Is the resistance within specification?

Yes	No

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Yes	No
GO to DL4.	INSTALL a new CHT sensor. REFER to the appropriate Electronic Engine Controls article. CLEAR the DTCs. REPEAT the self-test.

DL4 CHECK FOR AN OPEN CIRCUIT

- Ignition OFF.
- PCM connector disconnected.
- For the CHT2 sensor,
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CHT2 Sensor Connector, Harness Side
CHT2	CHT2
SIGRTN	SIGRTN

- For all others,
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) CHT Sensor Connector, Harness Side
CHT	CHT
SIGRTN	SIGRTN

Are the resistances less than 5 ohms?

Yes	No
GO to DL5.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DL5 CHECK FOR A SHORT TO GROUND

- For the CHT2 sensor,
- Measure the resistance between:

(+) CHT2 Sensor Connector, Harness Side	(-)
CHT2	Ground

- For all others,
- Measure the resistance between:

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

Are the resistances greater than 10K ohms?

Yes	No
GO to DL6.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

DL6 CHECK FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For the CHT2 sensor,
- Measure the voltage between:

(+) CHT2 Sensor Connector, Harness Side	(-)
CHT2	Ground

- For all others,
- Measure the voltage between:

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

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to DL7.

DL7 CHECK THE RESISTANCE OF THE CHT SENSOR

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

- Ignition OFF.
- CHT Sensor connector connected.
- CHT2 Sensor connector connected.
- PCM connector connected.
- Run the engine until the engine temperature stabilizes.
- Ignition OFF.
- For the CHT2 sensor,
- CHT2 Sensor connector disconnected.
- Measure the resistance between:

(+) CHT2 Sensor Connector, Component Side	(-) CHT2 Sensor Connector, Component Side
CHT2	SIGRTN

- For all others,
- CHT Sensor connector disconnected.
- Measure the resistance between:

(+) CHT Sensor Connector, Component Side	(-) CHT Sensor Connector, Component Side
CHT	SIGRTN

Is the resistance within specification?

Yes	No
For the CHT2 sensor, GO to DL8. For all others, GO to DL10.	INSTALL a new CHT sensor. REFER to the appropriate Electronic Engine Controls article. CLEAR the DTCs. REPEAT the self-test.

DL8 CHECK THE CHT2 SENSOR

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

(+) CHT2 Sensor Connector, Harness Side	(-) CHT2 Sensor Connector, Harness Side
CHT2	SIGRTN

- Observe the digital multi meter (DMM) for an indication of a concern while shaking, wiggling, and bending the CHT2 circuit between the CHT2 and the PCM. Note that voltage changes suddenly when a concern is detected.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to DL9.

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DL9 TEMPERATURE SENSOR CORRELATION

NOTE: **Cold soak the vehicle at ambient temperature for at least 6 hours while not in direct sunlight.**

NOTE: **All PID's may not be available on all vehicles.**

- Ignition OFF.
- CHT2 Sensor connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the AAT (TEMP), CHT (TEMP), CHT2 (TEMP), ECT (TEMP) and ECT1 (TEMP) PIDs.

Are the PID values within 16.67Â°C (30Â°F) of each other?

Yes	No
Unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**.	GO to **PINPOINT TEST DX**.

DL10 INTERMITTENT CHECK

- Ignition OFF.
- CHT Sensor connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the CHT (TEMP) 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 PID value?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	For DTC P1285, GO to DL11. For all others, Unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**.

DL11 CHECK THE CHT SENSOR OPERATION

NOTE: **The engine temperature warning indicator (gauge or lamp) is a warning system that gives the driver information during an engine overheating condition. The PCM monitors the CHT sensor and determines if fail-safe cooling mode is needed. If fail-safe cooling mode is needed, the PCM sends a controller area network (CAN) message to the instrument cluster to signal an overheating condition. This causes the instrument cluster indicator to illuminate and forces the temperature gauge to the H (hot) zone. DTC P1285 is stored in the PCM.**

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Carry out the PCM self-test.

Is DTC P1285 present?

Yes	No
REFER to the appropriate Engine Cooling article to diagnose the cooling system concern. Clear the PCM DTCs. REPEAT the self-test.	The system is operating correctly at this time. REPAIR any other DTCs as necessary. Clear the PCM DTCs. REPEAT the self-test.

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DL12 CHECK THE SENSOR OPERATION

- Run the engine until the engine temperature stabilizes.
- Verify the radiator hoses are hot and the cooling system is pressurized.
- Access the PCM and monitor the CHT (TEMP) PID.
- Record the PID value.

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

Yes	No
The system is operating correctly at this time. CLEAR the DTCs. REPEAT the self-test.	REFER to the appropriate Engine Cooling article, to diagnose the engine not reaching normal operating temperature. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL13 ENGINE TEMPERATURE INDICATOR LAMP ON OR TEMPERATURE GAUGE INDICATES HOT WITH NO DTCS

NOTE: **For Engine Temperature Warning Indicator system problems, refer to the appropriate Instrumentation, Message Center, And Warning Chimes article.**

- PCM connector disconnected.
- Ignition ON, engine OFF.

Does the engine temperature warning indicator lamp turn OFF (prove out) and/or the temperature gauge return to the normal zone with the PCM disconnected?

Yes	No
GO to DL14.	REFER to the appropriate Instrumentation, Message Center, And Warning Chimes article to diagnose the incorrect temperature gauge. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

DL14 ENGINE OVERHEAT CONDITION INDICATED

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. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

- Check the engine coolant level.

Is the engine coolant fill level correct?

Yes	No
REFER to the appropriate Engine Cooling article, to diagnose the engine overheating symptom. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.	REFER to the appropriate Engine Cooling article to diagnose the loss of coolant. REPAIR as necessary. CLEAR the DTCs. REPEAT the self-test.

PINPOINT TESTS DM: MANIFOLD PRESSURE SENSORS

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- manifold absolute pressure (MAP) sensor (9F479)
- manifold absolute pressure (MAP)/charge air cooler temperature (CACT) sensor (9F479)
- manifold absolute pressure (MAP)/intake air temperature 2 sensor (IAT2) sensor (9F479)

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- manifold absolute pressure and temperature (MAPT) sensor (9F479)
- turbocharger boost pressure (TCBP) sensor (9F479)
- turbocharger boost pressure (TCBP)/charge air cooler temperature (CACT) sensor (9F479)
- turbocharger inlet pressure and temperature (TCIPT) sensor (9F479)
- harness circuits: MAP, TCBP, TCIP, SIGRTN, and VREF
- PCM (12A650)

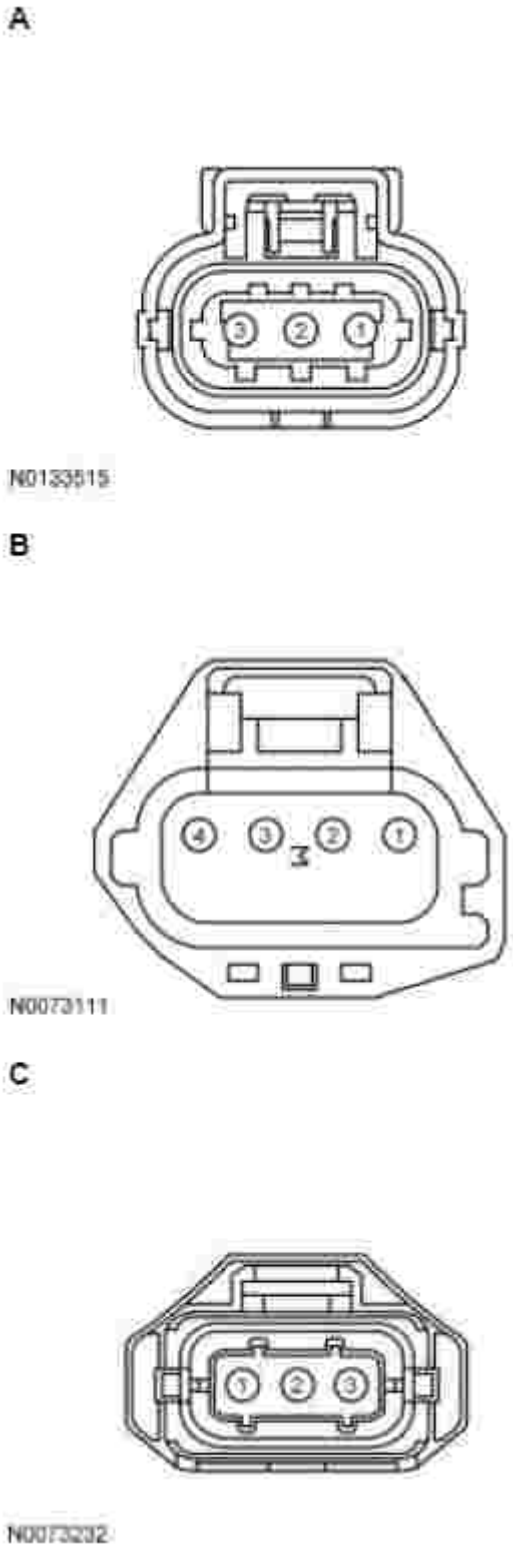

Fig. 64: Manifold Absolute Pressure (MAP) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Kuga 2.0L, Focus, MKC, MKT, Taurus	A	1 3	MAP VREF

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Vehicle	Connector	Pin	Circuit
Fusion 2.0L, MKZ	C	3 1	MAP VREF
All other vehicles	B	1 2	MAP VREF

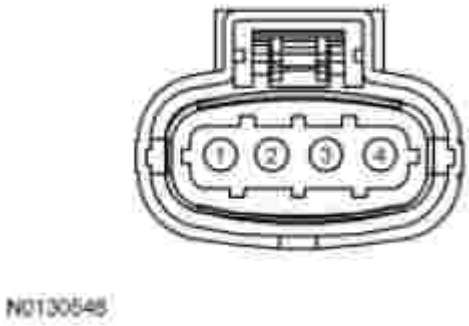

Fig. 65: Manifold Absolute Pressure/Charge Air Cooler Temperature (MAP/CACT) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	SIGRTN (Signal Return)
4	MAP (Manifold Absolute Pressure)
3	VREF (Reference Voltage)

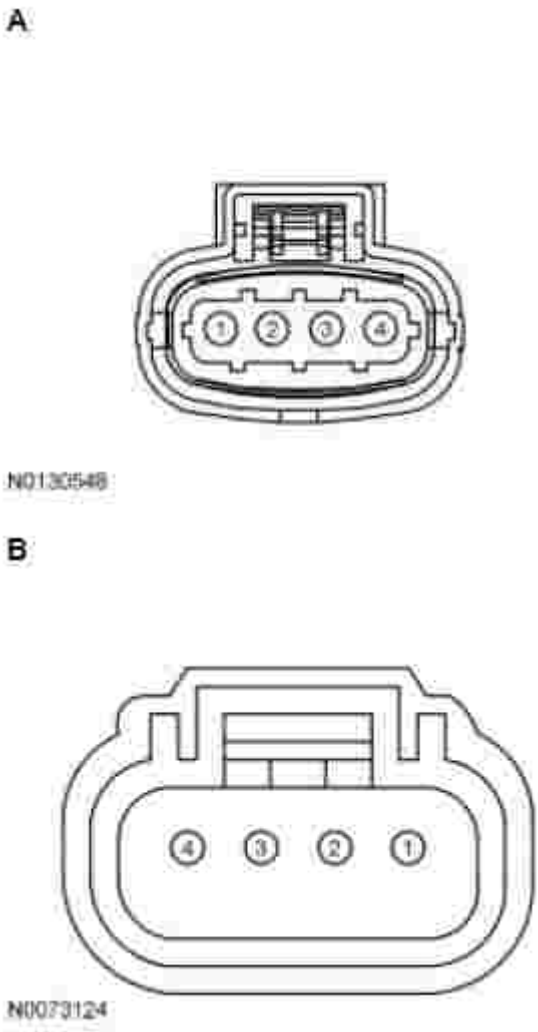

Fig. 66: Manifold Absolute Pressure/Intake Air Temperature 2 (MAP/IAT2) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
Continental 2.0L, EcoSport, Escape/Kuga, Fiesta, MKC, Mustang	A	4 1 3	MAP SIGRTN VREF
Edge 2.7L, F-150 2.7L, MKX 2.7L, Transit	B	3 4 2	MAP SIGRTN VREF
Edge 2.0L, MKX 2.0L, MKZ	A	1 4 2	MAP SIGRTN VREF
Explorer 2.3L	B	4 2 1	MAP SIGRTN VREF
Explorer 3.5L, Flex, MKT, Taurus	B	1 4 2	MAP SIGRTN VREF
All other vehicles	A	3 4 2	MAP SIGRTN VREF

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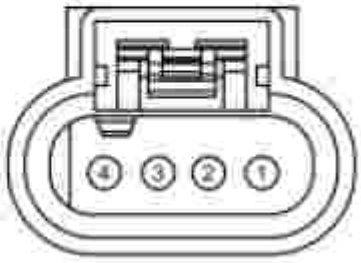

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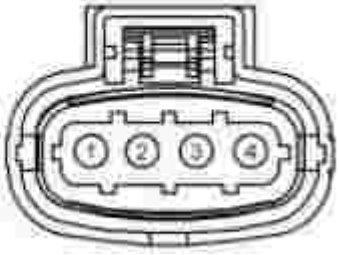

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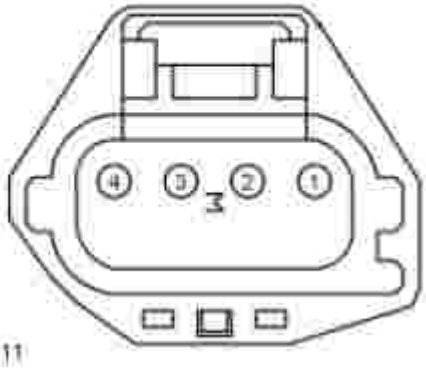

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Fig. 67: Manifold Absolute Pressure Temperature (MAPT) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental, EcoSport 1.5L, Edge 3.5L, Explorer 3.5L, Explorer 3.7L, F-150 3.3L, Flex 3.5L, MKT 3.7L, MKX, Taurus 3.5L, Transit 3.7L	A	4 1 2	SIGRTN MAP VREF

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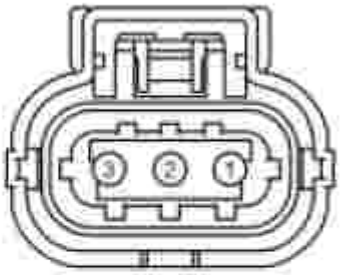
Vehicle	Connector	Pin	Circuit
Ranger	C	4 1 2	SIGRTN MAP VREF
All other vehicles	B	1 4 3	SIGRTN MAP VREF

A



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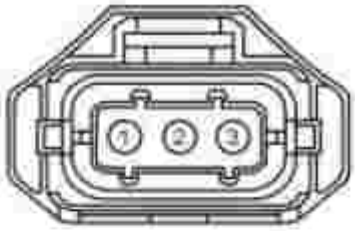

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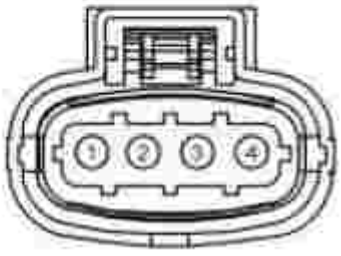
C



N0130546

Fig. 68: Turbocharger Boost Pressure (TCBP) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit

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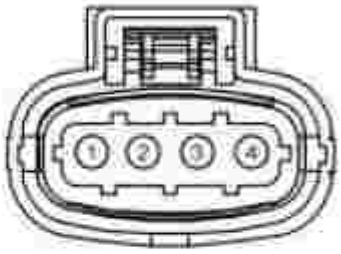
Vehicle	Connector	Pin	Circuit
Continental 2.0L, EcoSport, Explorer 2.3L, Focus 2.3L, Focus 1.0L, Mustang	A	1 2 3	TCBP SIGRTN VREF
Edge 2.0L, Escape/Kuga 1.5L, MKX 2.0L	B	3 2 1	TCBP SIGRTN VREF
Escape/Kuga 2.0L, Fiesta 1.0L, MKC	C	4 1 3	TCBP SIGRTN VREF
Fusion 1.5L	A	3 2 1	TCBP SIGRTN VREF

A



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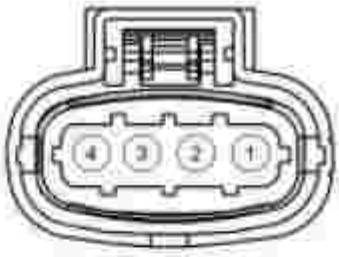

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C

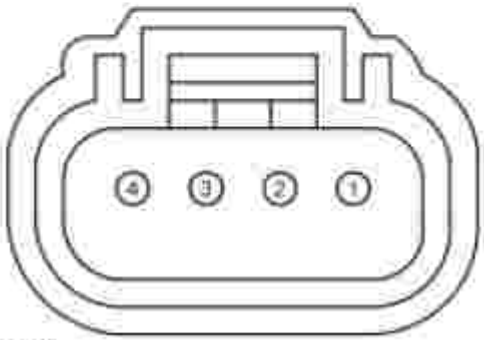

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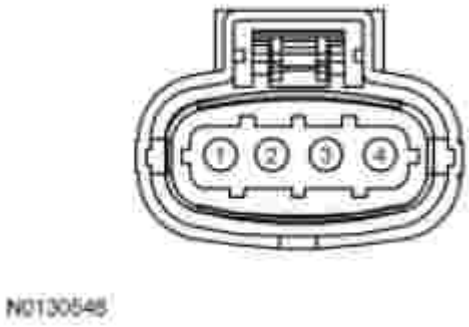
Fig. 69: Turbocharger Boost Pressure/Charge Air Cooler Temperature (TCBP/CACT) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Fiesta, Fusion 2.0L, MKC, MKZ 2.0L, Taurus 2.0L	A	4 1 3	TCBP SIGRTN VREF
Focus, MKT 2.0L	B	4 1 3	TCBP SIGRTN VREF
All other vehicles	C	1 4 2	TCBP SIGRTN VREF



N0130546

Fig. 70: Turbocharger Intake Pressure And Temperature (TCIPT) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
4	TCIP (Turbocharger Intake Pressure)
1	SIGRTN (Signal Return)
3	VREF (Reference Voltage)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 2.0L, EcoSport 1.0L Automatic Transmission, Escape/Kuga 2.0L, Explorer 2.3L, Focus 2.3L, MKC 2.3L, MKX 2.0L	198 PIN	B18 B74 E20 E33	SIGRTN TCBP SIGRTN MAP
Continental 2.7L, Continental 3.0L, Fusion 2.7L, Transit 3.5L	198 PIN	B18 B74 E20 E34	SIGRTN TCBP SIGRTN MAP
E-Series, F-Series Super Duty	198 PIN	E29 E32	SIGRTN MAP
EcoSport 1.0L Manual Transmission	198 PIN	B19 B74 E19 E35	SIGRTN TCBP SIGRTN MAP
EcoSport 1.5L Automatic Transmission	198 PIN	E35 E35 E32	SIGRTN SIGRTN MAP

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Vehicle	Connector	Pin	Circuit
EcoSport 1.5L Manual Transmission	112 PIN	E4 E16	SIGRTN MAP
Edge 2.0L	198 PIN	B18, B7 B74 E20 E33	SIGRTN TCBP SIGRTN MAP
Edge 2.7L	198 PIN	B18, B7 B74 E20 E34	SIGRTN TCBP SIGRTN MAP
Escape/Kuga 1.5L	198 PIN	E13 E15 E13 E60	SIGRTN TCBP SIGRTN MAP
Escape/Kuga 2.5L, Fusion 2.5L	198 PIN	E35 E32	SIGRTN MAP
Expedition, F-150 3.5L, Navigator	198 PIN	B30 B74 E10 E17	SIGRTN TCBP SIGRTN MAP
Explorer GTDI 3.5L, Flex GTDI 3.5L, MKT 3.5L, MKX 2.7L, MKZ 3.0L, Taurus GTDI 3.5L	198 PIN	B18 B74 E20 E33	SIGRTN TCBP SIGRTN MAP
F-150 2.7L	306 PIN	E121 E94 E13 E52	SIGRTN TCBP SIGRTN MAP
F-150 3.3L	306 PIN	E13 E52	SIGRTN MAP
F-150 5.0L	306 PIN	E13 E50	SIGRTN MAP
Fiesta 1.0L	198 PIN	B19 B74 E19 E35	SIGRTN TCBP SIGRTN MAP
Fiesta GTDI 1.6L	198 PIN	B19 B74 E19 E35	SIGRTN TCBP SIGRTN MAP
Fiesta TiVCT 1.6L	128 PIN	B38 B26	SIGRTN MAP
Focus 1.0L	198 PIN	B18 B74 E20 E33	SIGRTN TCBP SIGRTN MAP
Focus GTDI 2.0L, MKT 2.0L, Taurus 2.0L	198 PIN	B18 B74 E20 E33	SIGRTN TCBP SIGRTN MAP
Ford GT	198 PIN	B18 B70 E20 B74 E20 E33	SIGRTN TCIP SIGRTN TCBP SIGRTN MAP

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Vehicle	Connector	Pin	Circuit
Fusion 1.5L	198 PIN	E20 B74 E20 E33	SIGRTN TCBP SIGRTN MAP
Fusion 2.0L, MKZ 2.0L	198 PIN	B19 B74 E20 E33	SIGRTN TCBP SIGRTN MAP
KA	128 PIN	T17 T9	SIGRTN MAP
MKC 2.0L	198 PIN	B18 B74 E20 E33 E20 E33	SIGRTN TCBP SIGRTN MAP SIGRTN MAP
MKX 3.7L	198 PIN	E29 E32 E29 E32	SIGRTN MAP SIGRTN MAP
Mustang	198 PIN	B18 B74 E20 E53	SIGRTN TCBP SIGRTN MAP
Ranger	128 PIN	B38 B26	SIGRTN MAP
Transit Connect	198 PIN	B35 E32	SIGRTN MAP
All other vehicles	198 PIN	E29 E32	SIGRTN MAP

TEST PROCEDURE

DM1 CHECK FOR DTCS

NOTE: **This pinpoint test is designed to diagnose multiple components in the same test steps, only measure the circuits that apply to the vehicle and the component being diagnosed.**

NOTE: **Diagnose circuit concerns before range or performance concerns.**

Are DTCs P0106, P0107, P0108, P0109, P012B, P012C, P012D, P012E, P0236, P0237, P0238, or P025E present?

Yes	No
For Escape 2.5L and Fusion 2.5L, GO to DM3. For all others, GO to DM2.	For symptoms without DTCs, GO to DM2. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

DM2 MONITOR THE MAP PID

- Ignition ON, engine OFF.
- For the TCBP or TCBP/CACT sensor,
- Access the PCM and monitor the TCBP_V (VOLT) PID.
- For the TCIPT sensor,
- Access the PCM and monitor the TURBO_INLET_V (VOLT) PID.
- For all others,
- Access the PCM and monitor the MAP_V (VOLT) PID.

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Is the voltage between 0.05 - 4.95 V?

Yes	No
For DTCs P0106, P012B or P0236, GO to DM8. For all others, GO to DM7.	GO to DM3.

DM3 CHECK THE VOLTAGE BETWEEN THE VREF AND SIGRTN CIRCUITS

- Ignition OFF.
- For the MAP sensor,
- MAP Sensor connector disconnected.
- Measure the voltage between:

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

- For the MAP/CACT sensor,
- MAP/CACT Sensor connector disconnected.
- Measure the voltage between:

(+) MAP/CACT Sensor Connector, Harness Side	(-) MAP/CACT Sensor Connector, Harness Side
VREF - Pin 3	SIGRTN

- For the MAP/IAT2 sensor,
- MAP/IAT2 Sensor connector disconnected.
- Measure the voltage between:

(+) MAP/IAT2 Sensor Connector, Harness Side	(-) MAP/IAT2 Sensor Connector, Harness Side
VREF	SIGRTN

- For the MAPT sensor,
- MAPT Sensor connector disconnected.
- Measure the voltage between:

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

- For the TCBP sensor,
- TCBP Sensor connector disconnected.
- Measure the voltage between:

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

- For the TCBP/CACT sensor,
- TCBP/CACT Sensor connector disconnected.
- Measure the voltage between:

(+) TCBP/CACT Sensor Connector, Harness Side	(-) TCBP/CACT Sensor Connector, Harness Side
VREF	SIGRTN

- For the TCIPT sensor,
- TCIPT Sensor connector disconnected.

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- Measure the voltage between:

(+) TCIPT Sensor Connector, Harness Side	(-) TCIPT Sensor Connector, Harness Side
VREF - Pin 3	SIGRTN - Pin 1

- Ignition ON, engine OFF.

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to DM4.	GO to **PINPOINT TEST C**.

DM4 CHECK FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- For the MAP sensor,
- Measure the resistance between:

(+) MAP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
MAP	MAP
SIGRTN	SIGRTN

- For the MAP/CACT sensor,
- Measure the resistance between:

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

- For the MAP/IAT2 sensor,
- Measure the resistance between:

(+) MAP/IAT2 Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
MAP	MAP
SIGRTN	SIGRTN

- For the MAPT sensor,
- Measure the resistance between:

(+) MAPT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
MAP	MAP
SIGRTN	SIGRTN

- For the TCBP sensor,
- Measure the resistance between:

(+) TCBP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
TCBP	TCBP
SIGRTN	SIGRTN

- For the TCBP/CACT sensor,
- Measure the resistance between:

(+) TCBP/CACT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
TCBP	TCBP
SIGRTN	SIGRTN

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- For the TCIPT sensor,
- Measure the resistance between:

(+) TCIPT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
TCIP - Pin 4	TCIP
SIGRTN - Pin 1	SIGRTN

Are the resistances less than 5 ohms?

Yes	No
GO to DM5.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DM5 CHECK FOR A SHORT TO SIGRTN OR GROUND

- For the MAP sensor,
- Measure the resistance between:

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

- Measure the resistance between:

(+) MAP Sensor Connector, Harness Side	(-) MAP Sensor Connector, Harness Side
MAP	SIGRTN

- For the MAP/CACT sensor,
- Measure the resistance between:

(+) MAP/CACT Sensor Connector, Harness Side	(-)
MAP - Pin 4	Ground

- Measure the resistance between:

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

- For the MAP/IAT2 sensor,
- Measure the resistance between:

(+) MAP/IAT2 Sensor Connector, Harness Side	(-)
MAP	Ground

- Measure the resistance between:

(+) MAP/IAT2 Sensor Connector, Harness Side	(-) MAP/IAT2 Sensor Connector, Harness Side
MAP	SIGRTN

- For the MAPT sensor,
- Measure the resistance between:

(+) MAPT Sensor Connector, Harness Side	(-)
MAP	Ground

- Measure the resistance between:

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

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(+) MAPT Sensor Connector, Harness Side	(-) MAPT Sensor Connector, Harness Side
MAP	SIGRTN

- For the TCBP sensor,
- Measure the resistance between:

(+) TCBP Sensor Connector, Harness Side	(-)
TCBP	Ground

- Measure the resistance between:

(+) TCBP Sensor Connector, Harness Side	(-) TCBP Sensor Connector, Harness Side
TCBP	SIGRTN

- For the TCBP/CACT sensor,
- Measure the resistance between:

(+) TCBP/CACT Sensor Connector, Harness Side	(-)
TCBP	Ground

- Measure the resistance between:

(+) TCBP/CACT Sensor Connector, Harness Side	(-) TCBP/CACT Sensor Connector, Harness Side
TCBP	SIGRTN

- For the TCIPT sensor,
- Measure the resistance between:

(+) TCIPT Sensor Connector, Harness Side	(-)
TCIP - Pin 4	Ground

- Measure the resistance between:

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

Are the resistances greater than 10K ohms?

Yes	No
GO to DM6.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DM6 CHECK FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For the MAP sensor,
- Measure the voltage between:

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

- For the MAP/CACT sensor,
- Measure the voltage between:

(+) MAP/CACT Sensor Connector, Harness Side	(-)
MAP	Ground

- For the MAP/IAT2 sensor,

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- Measure the voltage between:

(+) MAP/IAT2 Sensor Connector, Harness Side	(-)
MAP	Ground

- For the MAPT sensor,
- Measure the voltage between:

(+) MAPT Sensor Connector, Harness Side	(-)
MAP	Ground

- For the TCBP sensor,
- Measure the voltage between:

(+) TCBP Sensor Connector, Harness Side	(-)
TCBP	Ground

- For the TCBP/CACT sensor,
- Measure the voltage between:

(+) TCBP/CACT Sensor Connector, Harness Side	(-)
TCBP	Ground

- For the TCIPT sensor,
- Measure the voltage between:

(+) TCIPT Sensor Connector, Harness Side	(-)
TCIP - Pin 4	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	For Escape 2.5L and Fusion 2.5L, INSTALL a new MAP sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test. For all others, GO to DM7.

DM7 CHECK THE CIRCUITS FOR INTERMITTENT CONCERNS

NOTE: **All PIDS may not be available on all vehicles.**

- Ignition ON, engine OFF.
- For the MAP, MAP/CACT, MAP/IAT2, or MAPT sensor,
- Access the PCM and monitor the MAP_V (VOLT) PID.
- For the TCBP or TCBP/CACT sensor,
- Access the PCM and monitor the TCBP_V (VOLT) PID.
- For the TCIPT sensor,
- Access the PCM and monitor the TURBO_INLET_V (VOLT) PID.
- Wiggle the harness connector to simulate road shock.

Does a sudden change in voltage occur while monitoring the PID?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**.

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DM8 MAP VOLTAGE

- Ignition ON, engine OFF.
- For the TCIPT sensor,
- Access the PCM and monitor the TURBO_INLET_V (VOLT) PID.
- For all others,
- Access the PCM and monitor the MAP_V (VOLT) PID.
- Record the PID value.
- Ignition ON, engine running.
- Record the PID value.

Does the PID value change?

Yes	No
GO to DM9.	INSTALL a new sensor in question. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

DM9 CHECK FOR KOEO BARO, MAP, TCBP VALUE CORRELATIONS

NOTE: **All PIDS may not be available on all vehicles.**

- Ignition ON, engine OFF.
- Access the PCM and monitor the BARO (PRESS), MAP (PRESS), TCBP (PRESS) and TURBO_INLET (PRESS) PIDs.

Is the suspect sensor PID reading within 10.35 kPa (1.5 psi) of the other sensors?

Yes	No
GO to **PINPOINT TEST Z**.	For the BARO sensor, GO to **PINPOINT TEST DO**. For all others, CHECK the sensor in question for contamination or obstructions. REPAIR as necessary. If no concerns are present, INSTALL a new sensor in question. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

PINPOINT TESTS DN: PRESSURE AND TEMPERATURE SENSORS

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- intake air temperature 2 (IAT2) sensor (12A697)
- manifold absolute pressure (MAP)/charge air cooler temperature (CACT) sensor (9F479)
- manifold absolute pressure (MAP)/intake air temperature 2 (IAT2) sensor (9F479)
- turbocharger boost pressure (TCBP)/charge air cooler temperature (CACT) sensor (9F479)
- harness circuits: IAT2, CACT, SIGRTN and VREF
- PCM (12A650)

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

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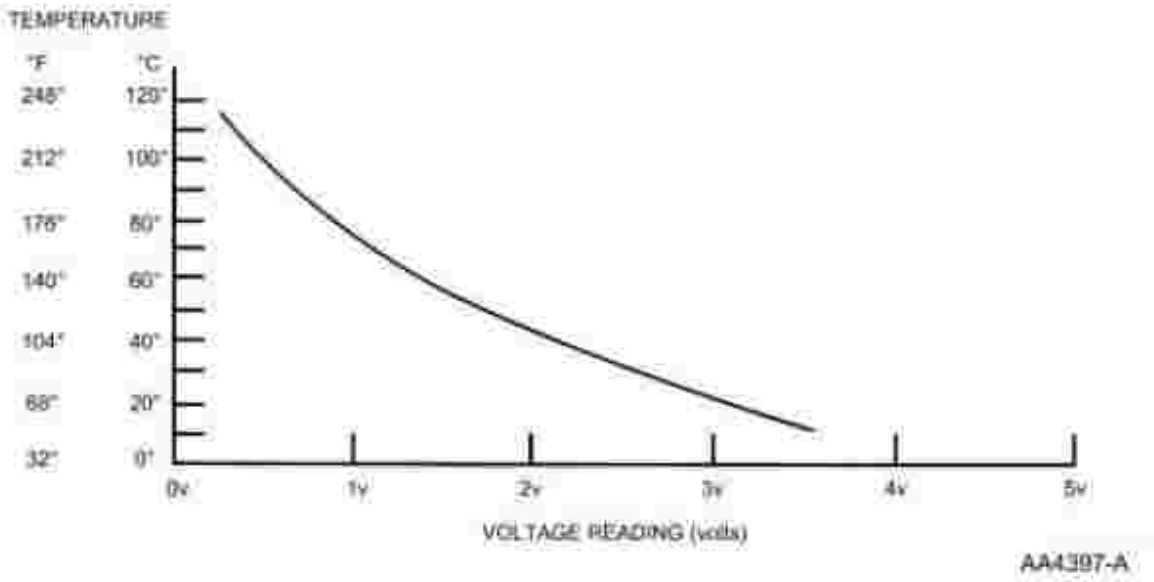

Fig. 71: Pressure And Temperature Sensors Voltage Graph
Courtesy of FORD MOTOR CO.

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values
Â°C	Â°F	Resistance (K ohms)
120	248	1.18
110	230	1.55
100	212	2.07
90	194	2.80
80	176	3.84
70	158	5.37
60	140	7.70
50	122	10.97
40	104	16.15
30	86	24.27
20	68	37.30
10	50	58.75
0	32	95.85
-10	14	160.31

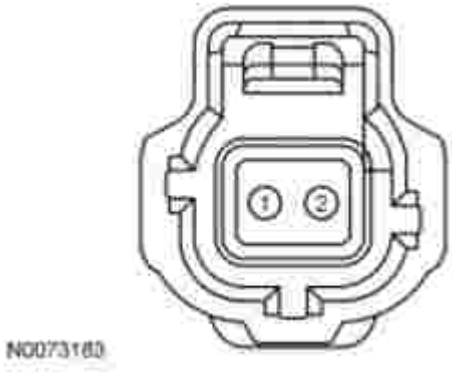

Fig. 72: Intake Air Temperature 2 (IAT2) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
1	IAT2 (Intake Air Temperature 2)

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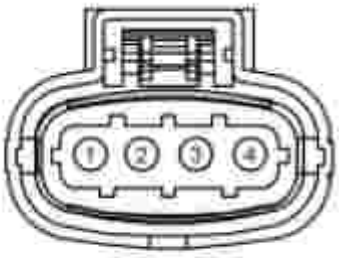

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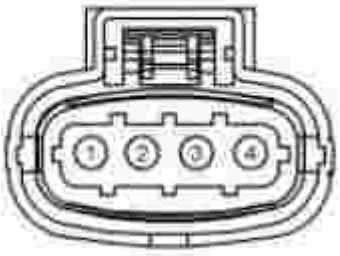
Fig. 73: Manifold Absolute Pressure/Charge Air Cooler Temperature (MAP/CACT) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	SIGRTN (Signal Return)
2	CACT (Charge Air Cooler Temperature)

A



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B

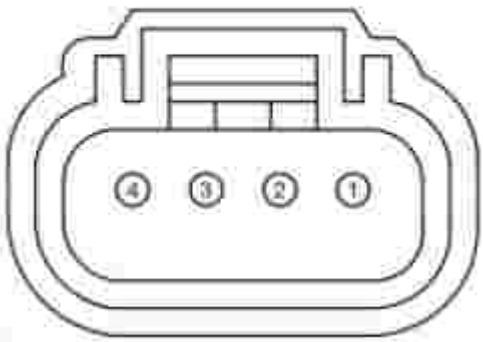

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Fig. 74: Manifold Absolute Pressure/Intake Air Temperature 2 (MAP/IAT2) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 2.0L, EcoSport, Escape/Kuga, Fiesta, MKC, Mustang	A	1 2	SIGRTN IAT2
Edge 2.7L, F-150 2.7L, MKX 2.7L, Transit	B	4 1	SIGRTN IAT2

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Vehicle	Connector	Pin	Circuit
Edge 2.0L, MKX 2.0L, MKZ	A	4 3	SIGRTN IAT2
Explorer 2.3L	B	2 3	SIGRTN IAT2
Explorer 3.5L, Flex, MKT, Taurus	B	4 3	SIGRTN IAT2
All other vehicles	A	4 1	SIGRTN IAT2

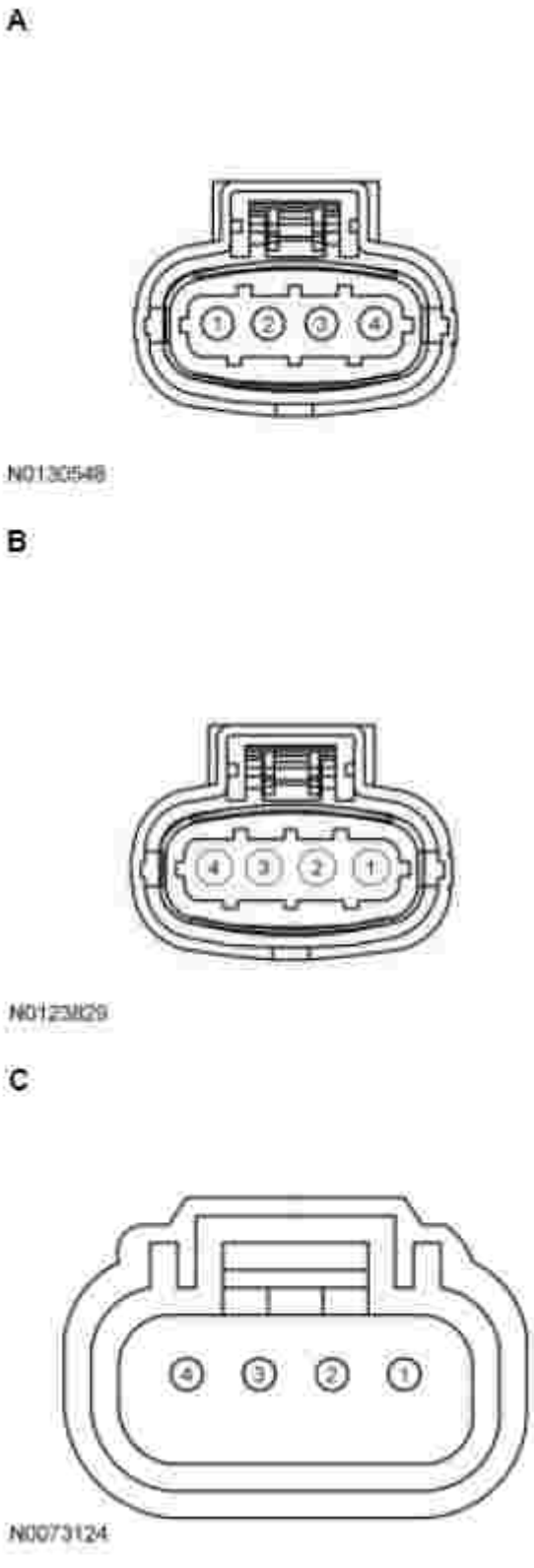

Fig. 75: Turbocharger Boost Pressure/Charge Air Cooler Temperature (TCBP/CACT) Sensor Connector
Courtesy of FORD MOTOR CO.

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Vehicle	Connector	Pin	Circuit
Fiesta, Fusion 2.0L, MKC, MKZ 2.0L, Taurus 2.0L	A	1 2	SIGRTN CACT
Focus, MKT 2.0L	B	1 2	SIGRTN CACT
All other vehicles	C	4 3	SIGRTN CACT

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, Fusion 2.7L, Transit	198 PIN	B18 B32 E20 E33	SIGRTN CACT SIGRTN IAT2
EcoSport 1.0L Automatic Transmission	198 PIN	E20 B75	SIGRTN IAT2
EcoSport 1.0L Manual Transmission	198 PIN	E19 B32	SIGRTN IAT2
Edge 2.7L	198 PIN	B18, B7 B32 E20 E33	SIGRTN CACT SIGRTN IAT2
Escape/Kuga 1.5L	198 PIN	E13 E30 E14 E44	SIGRTN CACT SIGRTN IAT2
Expedition, F-150 3.5L, Navigator	198 PIN	B30 B35 E10 E52	SIGRTN CACT SIGRTN IAT2
Explorer GTDI 3.5L, Flex, MKT 3.5L, MKX 2.7L, MKZ 3.0L, Taurus GTDI 3.5L	198 PIN	B18 B32 E20 E34	SIGRTN CACT SIGRTN IAT2
F-150 2.7L	306 PIN	E121 B32 E13 E50 E13	SIGRTN CACT SIGRTN IAT2 SIGRTN
Fiesta 1.0L	198 PIN	E19 B32	SIGRTN CACT
Fiesta GTDI 1.6L, Fusion 2.0L, MKZ 2.0L	198 PIN	B19 B32	SIGRTN CACT
Focus 1.0L, Focus GTDI 2.0L, MKT 2.0L, Taurus 2.0L	198 PIN	B18 B32	SIGRTN CACT

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Vehicle	Connector	Pin	Circuit
Ford GT	198 PIN	E20 B53 E20 E34	SIGRTN CACT SIGRTN IAT2
Fusion 1.5L	198 PIN	E20 B32 E20 E34	SIGRTN CACT SIGRTN IAT2
MKC 2.0L	198 PIN	B18 B32 E20 E34 E20	SIGRTN CACT SIGRTN IAT2 SIGRTN
Mustang	198 PIN	E20 E52	SIGRTN IAT2
All other vehicles	198 PIN	E20 E34	SIGRTN IAT2

TEST PROCEDURE

DN1 CHECK FOR DTCS

NOTE: **This pinpoint test is designed to diagnose multiple components in the same test steps, only measure the circuits that apply to the vehicle and the component being diagnosed.**

NOTE: **Diagnose circuit concerns before range or performance concerns.**

Are DTCs P007B, P007C, P007D, P0096, P0097, P0098, or P00CE present?

Yes	No
GO to DN2.	For symptoms without DTCs, GO to DN2. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

DN2 MONITOR THE PID

- Ignition ON, engine OFF.
- For the IAT2 or MAP/IAT2 sensor,
- Access the PCM and monitor the IAT2 (VOLT) PID.
- For the MAP/CACT or TCBP/CACT sensor,
- Access the PCM and monitor the CAC_V (VOLT) PID.

Are the voltages between 0.5 - 4.95 V?

Yes	No
GO to DN6.	GO to DN3.

DN3 CHECK THE CIRCUITS FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- For the IAT2 sensor,
- IAT2 Sensor connector disconnected.
- Measure the resistance between:

(+) IAT2 Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IAT2 - Pin 1	IAT2
SIGRTN - Pin 2	SIGRTN

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- For the MAP/CACT sensor,
- MAP/CACT Sensor connector disconnected.
- Measure the resistance between:

(+) MAP/CACT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
CACT - Pin 2	CACT
SIGRTN - Pin 1	SIGRTN

- For the MAP/IAT2 sensor,
- MAP/IAT2 Sensor connector disconnected.
- Measure the resistance between:

(+) MAP/IAT2 Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IAT2	IAT2
SIGRTN	SIGRTN

- For the TCBP/CACT sensor,
- TCBP/CACT Sensor connector disconnected.
- Measure the resistance between:

(+) TCBP/CACT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
CACT	CACT
SIGRTN	SIGRTN

Are the resistances less than 5 ohms?

Yes	No
GO to DN4.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DN4 CHECK THE SIGNAL CIRCUIT FOR A SHORT TO GROUND

- For the IAT2 sensor,
- Measure the resistance between:

(+) IAT2 Sensor Connector, Harness Side	(-)
IAT2 - Pin 1	Ground

- For the MAP/CACT sensor,
- Measure the resistance between:

(+) MAP/CACT Sensor Connector, Harness Side	(-)
CACT	Ground

- For the MAP/IAT2 sensor,
- Measure the resistance between:

(+) MAP/IAT2 Sensor Connector, Harness Side	(-)
IAT2	Ground

- For the TCBP/CACT sensor,
- Measure the resistance between:

(+) TCBP/CACT Sensor Connector, Harness Side	(-)
CACT	Ground

Is the resistance greater than 10K ohms?

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Yes	No
GO to DN5.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DN5 CHECK FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For the IAT2 sensor,
- Measure the voltage between:

(+) IAT2 Sensor Connector, Harness Side	(-)
IAT2 - Pin 1	Ground

- For the MAP/CACT sensor,
- Measure the voltage between:

(+) MAP/CACT Sensor Connector, Harness Side	(-)
CACT	Ground

- For the MAP/IAT2 sensor,
- Measure the voltage between:

(+) MAP/IAT2 Sensor Connector, Harness Side	(-)
IAT2	Ground

- For the TCBP/CACT sensor,
- Measure the voltage between:

(+) TCBP/CACT Sensor Connector, Harness Side	(-)
CACT	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to DN6.

DN6 INTERMITTENT CHECK

- Ignition OFF.
- PCM connector connected.
- IAT2 Sensor connector connected.
- MAP/CACT Sensor connector connected.
- MAP/IAT2 Sensor connector connected.
- TCBP/CACT Sensor connector connected.
- Ignition ON, engine OFF.
- For the MAP/CACT or TCBP/CACT sensor,
- Access the PCM and monitor the CAC_V (VOLT) PID.
- For the IAT2 or MAP/IAT2 sensor,
- Access the PCM and monitor the IAT2 (VOLT) PID.
- Lightly tap on the sensor in question and wiggle the harness connector to simulate road shock.

Is there a large change in the voltage reading?

Yes	No

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Yes	No
REPAIR as necessary. If no concerns are present, INSTALL a new sensor in question. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.	GO to DN7.

DN7 SIMULATE THE OPPOSITE SIGNAL TO THE PCM

- Ignition OFF.
- IAT2 Sensor connector disconnected.
- MAP/CACT Sensor connector disconnected.
- MAP/IAT2 Sensor connector disconnected.
- TCBP/CACT Sensor connector disconnected.
- Ignition ON, engine OFF.
- For the MAP/CACT or TCBP/CACT sensor,
- Access the PCM and monitor the CAC_V (VOLT) PID.
- For the IAT2 or MAP/IAT2 sensor,
- Access the PCM and monitor the IAT2 (VOLT) PID.

Is the voltage greater than 4.2 V?

Yes	No
For DTCs P007B, P0096 or P00CE, GO to DN8. For all others, UNABLE to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**.	GO to DN10.

DN8 TEMPERATURE SENSOR CORRELATION

- Ignition OFF.
- IAT2 Sensor connector connected.
- MAP/CACT Sensor connector connected.
- MAP/IAT2 Sensor connector connected.
- TCBP/CACT Sensor connector connected.
- Cold soak the vehicle at ambient temperature for at least 6 hours.
- Ignition ON, engine OFF.
- Access the PCM and monitor the CAC_T (TEMP), IAT (TEMP) and IAT2 (TEMP) PIDs.

Are the IAT, CACT and IAT2 temperature readings within 16.67Â°C (30Â°F) of each other?

Yes	No
GO to DN9.	For the IAT sensor, GO to **PINPOINT TEST DA**. For all others, CHECK the sensor in question for contamination or obstructions. REPAIR as necessary. If no concerns are present, INSTALL a new sensor in question. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

DN9 TEMPERATURE SENSOR CORRELATION AT OPERATING TEMPERATURE

- Ignition ON, engine running.
- Allow the engine to idle at the normal operating temperature.
- Access the PCM and monitor the CAC_T (TEMP), IAT (TEMP) and IAT2 (TEMP) PIDs.
- Drive the vehicle at a steady speed of 88 km/h (55 mph) for a minimum of 6 minutes.

Does the IAT temperature exceed 65.5Â°C (150Â°F), or does the CACT temperature exceed 104.4Â°C (220Â°F), or does the IAT2 temperature exceed 115.6Â°C (240Â°F)?

Yes	No

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Yes	No
CHECK the charge air cooler (CAC) for debris and obstructed air flow. REPAIR as necessary. If no concerns are present, INSTALL a new sensor in question. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.	GO to DN10.

DN10 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.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS DO: BAROMETRIC PRESSURE (BARO) SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- BARO sensor
- PCM (12A650)

BARO Sensor Transfer Function

Volts	Pressure in kPa	Pressure in psi	Pressure in in-Hg
0.3	7.6	1.1	2.2
0.5	12.7	1.84	3.8
2.64	60	8.7	17.7
4.54	115	16.68	34
4.75	120.3	17.45	35.5
4.8	121.6	17.66	35.9

TEST PROCEDURE

DO1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

Are DTCs P2227, P2228, P2229, or P2230 present?

Yes	No
GO to DO2.	RETURN to **SYMPTOM CHARTS** for further direction.

DO2 CHECK BARO SENSOR OPERATION

NOTE: **Most local weather reports include a barometric pressure that is corrected to factor in sea level. However, the BARO PID indicates the barometric pressure for the actual vehicle altitude. Local weather conditions (high or low pressure) may change the local barometric pressure by several inches of mercury.**

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- Ignition ON, engine OFF.
- Access the PCM and monitor the BARO (PRESS) PID.
- Record the BARO PID value.
- Verify that the BARO PID value is approximately the same as the daily barometric pressure from your local weather report.

Does the BARO PID value compare with the reported barometric pressure?

Yes	No
The system is operating correctly at this time. Clear the PCM DTCs. REPEAT the self-test.	GO to DO3.

DO3 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.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS DP: OUTPUT SHAFT SPEED (OSS) SENSOR/VEHICLE SPEED SENSOR (VSS)

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- OSS (7F293)
- harness circuits: OSS, PWRGND, SIGRTN and VBPWR
- PCM (12A650)

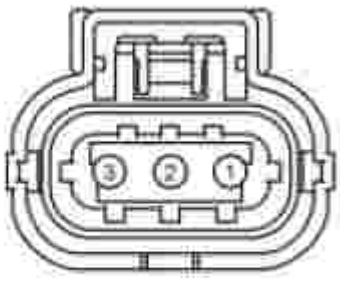

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Fig. 76: Output Shaft Speed (OSS) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
3	SIGRTN (Signal Return)
2	OSS (Output Shaft Speed)
1	VBPWR (Vehicle Buffered Power)

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TEST PROCEDURE

DP1 CHECK FOR DTCS

NOTE: **For vehicles with automatic transmission and OSS sensor DTCs, refer to the appropriate Automatic Transmission article, Diagnostic Trouble Code (DTC) Charts.**

Are DTCs P0500, P0503, P0720, P0721, P0722, P0723, P1500, P1502, P1900, P1934 or P193F present?

Yes	No
GO to DP2.	RETURN to **SYMPTOM CHARTS** for further direction.

DP2 VERIFY THE DRIVE CYCLE

- Access the PCM and monitor the OSS_SRC (RPM) PID.
- Access the PCM and monitor the VSS (SPD) PID.
- Drive the vehicle.
- Monitor both of the PIDs in all transmission gear ranges while increasing and decreasing the speed.

Do both PID readings increase and decrease with engine and vehicle speed?

Yes	No
GO to DP3.	GO to DP4.

DP3 VISUAL INSPECTION

- OSS Sensor connector disconnected.
- Inspect the OSS sensor harness for damage.
- Inspect the OSS harness connector for damage and correct seating.
- Carry out a thorough wiggle test on the OSS harness.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to **PINPOINT TEST Z**.

DP4 CHECK VOLTAGE TO THE OSS SENSOR

- Ignition OFF.
- OSS Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

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

Is the voltage greater than 10.5 V?

Yes	No
GO to DP5.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DP5 CHECK THE OSS CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- OSS Sensor connector disconnected.

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- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) OSS Sensor Connector, Harness Side
OSS	OSS - Pin 2
SIGRTN	SIGRTN - Pin 3

Are the resistances less than 5 ohms?

Yes	No
GO to DP6.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DP6 CHECK THE OSS CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

(+) OSS Sensor Connector, Harness Side	(-)
OSS - Pin 2	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to DP7.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DP7 CHECK THE OSS CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- OSS Sensor connector disconnected.
- Measure the voltage between:

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

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	REMOVE the OSS sensor and INSPECT the target wheel. REPAIR as necessary. If OK, INSTALL a new OSS. REFER to the appropriate Manual Transmission article. Clear the PCM DTCs. REPEAT the self-test.

PINPOINT TESTS DR: CAMSHAFT POSITION (CMP) SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- CMP sensor (6B288 or 12K073)
- harness circuits: CMP, SIGRTN, VBPWR or VREF
- PCM (12A650)

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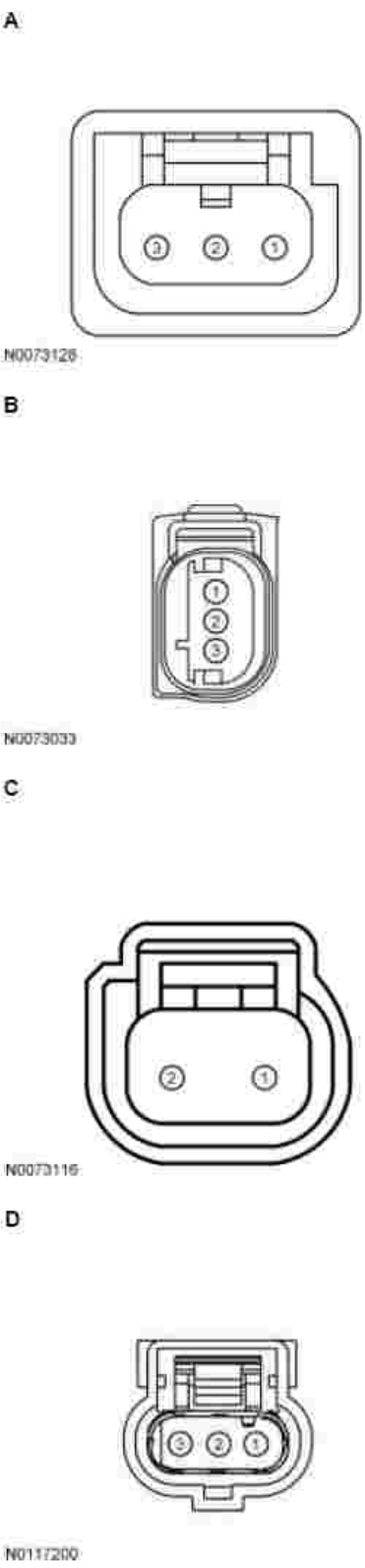

Fig. 77: Camshaft Position Bank 1 Sensor 1 (CMP11) Sensor Connector (1 Of 2)
Courtesy of FORD MOTOR CO.

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E

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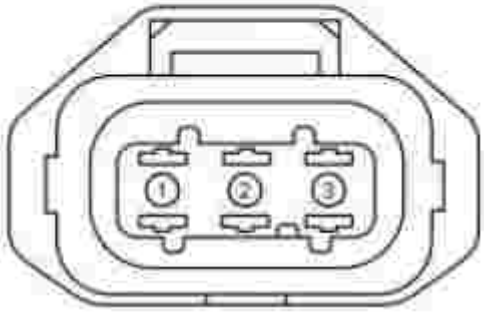
F



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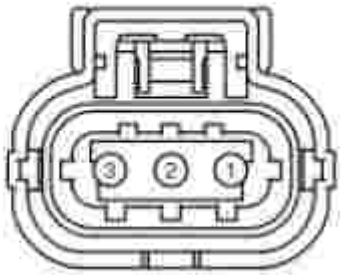

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Fig. 78: Camshaft Position Bank 1 Sensor 1 (CMP11) Sensor Connector (2 Of 2)
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 2.0L, EcoSport 2.0L, Edge 2.0L, Escape/Kuga 2.0L, Explorer 2.3L, Focus 2.0L, Focus 2.3L, Fusion 2.0L, MKC, MKT 2.0L, MKX 2.0L, MKZ 2.0L, Mustang 2.3L, Taurus 2.0L	A	1 2 3	VREF SIGRTN CMP11

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Vehicle	Connector	Pin	Circuit
E-Series 6.2L, F-Series Super Duty 6.2L	B	3 2 1	VBPWR SIGRTN CMP11
E-Series 6.8L, F-650/F-750, F-Series Super Duty 6.8L, Flex TiVCT 3.5L, MKT 3.7L, Motorhome/Stripped Chassis/Step Van, Taurus 3.7L	C	1 2	SIGRTN CMP11
EcoSport 1.5L, F-150 5.0L, Mustang 5.0L	D	1 2 3	VREF SIGRTN CMP11
EcoSport 1.0L, Fiesta TiVCT 1.6L, Focus 1.0L, Ranger	D	1 3 2	VREF SIGRTN CMP11
Escape/Kuga 2.5L, Fusion 2.5L, Transit Connect	E	1 3 2	VBPWR SIGRTN CMP11
Escape/Kuga 1.5L, Fiesta GTDI 1.6L, Fusion 1.5L	F	3 1 2	VREF SIGRTN CMP11
Expedition, F-150 3.3L, F-150 3.5L, F-150 2.7L, Navigator	D	3 2 1	VREF SIGRTN CMP11
Fiesta 1.0L, KA	G	1 3 2	VREF SIGRTN CMP11
Mustang 5.2L	B	1 3 2	VBPWR SIGRTN CMP11
All other vehicles	D	3 2 1	VBPWR SIGRTN CMP11

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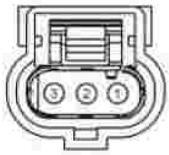
A



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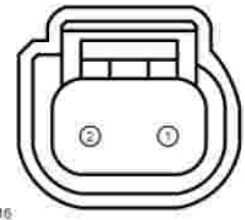

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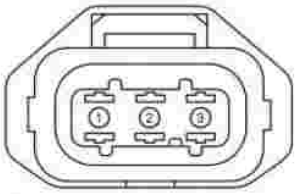

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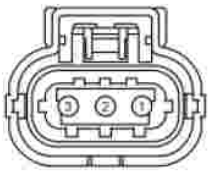

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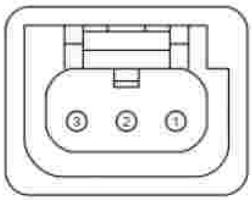

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Fig. 79: Camshaft Position Bank 1 Sensor 2 (CMP12) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, Edge 2.7L, Ford GT, Fusion 2.7L, MKX 2.7L, MKZ 3.0L, Transit 3.5L	A	3 2 1	VBPWR SIGRTN CMP12

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Vehicle	Connector	Pin	Circuit
Continental 3.7L, Edge 3.5L, Explorer 3.7L, Explorer 3.5L, Flex, MKT 3.7L, MKX 3.7L, Mustang 5.2L, Taurus 3.5L, Taurus 3.7L, Transit 3.7L	B	1 2	SIGRTN CMP12
EcoSport 1.5L, F-150 5.0L, Mustang 5.0L	A	1 2 3	VREF SIGRTN CMP12
EcoSport 1.0L, Fiesta TiVCT 1.6L, Focus 1.0L	A	1 3 2	VREF SIGRTN CMP12
Escape/Kuga 1.5L, Fiesta GTDI 1.6L, Fusion 1.5L	C	3 1 2	VREF SIGRTN CMP12
Expedition, F-150 2.7L, F-150 3.3L, F-150 3.5L, Navigator	A	3 2 1	VREF SIGRTN CMP12
Fiesta 1.0L, KA	D	1 3 2	VREF SIGRTN CMP12
All other vehicles	E	1 2 3	VREF SIGRTN CMP12

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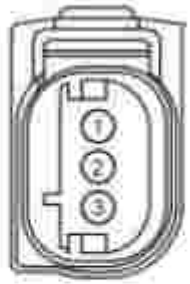
A



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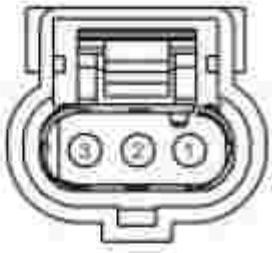

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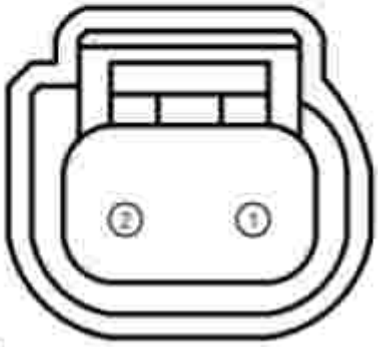

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Fig. 80: Camshaft Position Bank 2 Sensor 1 (CMP21) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series, F-Series Super Duty	A	3 2 1	VBPWR SIGRTN CMP21
Expedition, F-150 2.7L, F-150 3.3L, F-150 3.5L, Navigator	B	3 2 1	VREF SIGRTN CMP21
F-150 5.0L	B	1 2 3	VREF SIGRTN CMP21

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Vehicle	Connector	Pin	Circuit
Flex TiVCT 3.5L, MKT 3.7L	C	1 2	SIGRTN CMP21
Mustang 5.0L	A	1 2 3	VREF SIGRTN CMP21
Mustang 5.2L	A	1 3 2	VBPWR SIGRTN CMP21
All other vehicles	B	3 2 1	VBPWR SIGRTN CMP21

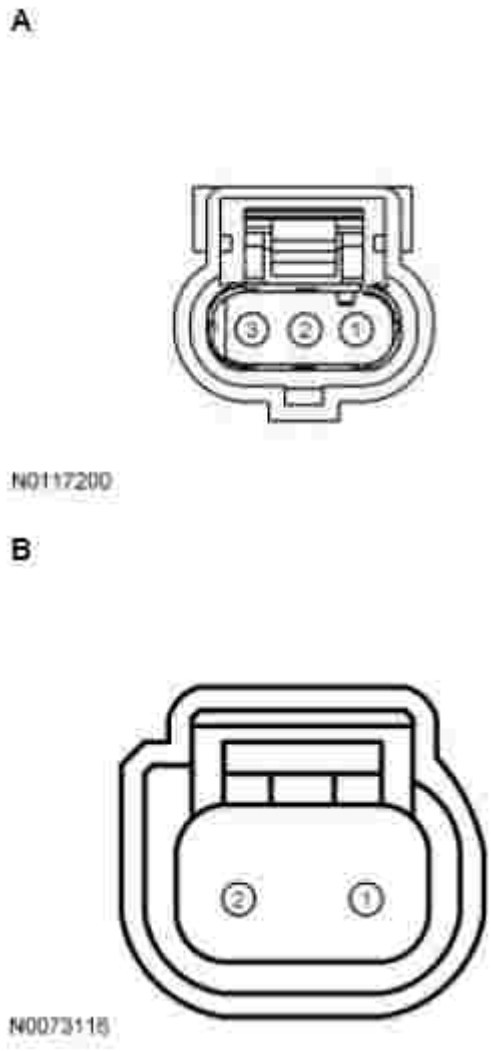

Fig. 81: Camshaft Position Bank 2 Sensor 2 (CMP22) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, Edge 2.7L, Ford GT, Fusion, MKX 2.7L, MKZ, Transit 3.5L	A	3 2 1	VBPWR SIGRTN CMP22
Expedition, F-150 2.7L, F-150 3.3L, F-150 3.5L, Navigator	A	3 2 1	VREF SIGRTN CMP22

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Vehicle	Connector	Pin	Circuit
F-150 5.0L, Mustang 5.0L	A	1 2 3	VREF SIGRTN CMP22
All other vehicles	B	1 2	SIGRTN CMP22

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L	198 PIN	E22 E54 E28 E53	VBPWR CMP12 CMP11 SIGRTN
Continental 3.7L, Edge 3.5L, Explorer TiVCT 3.5L, Explorer 3.7L, Flex TiVCT 3.5L, MKT 3.7L, MKX 3.7L, Mustang 5.2L, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L	198 PIN	E17 E41 E42 E55 E56 E40, E49, E54	VBPWR CMP22 CMP21 CMP12 CMP11 SIGRTN
E-Series 6.2L, F-Series Super Duty 6.2L	198 PIN	E17 E42 E56 E49	VBPWR CMP21 CMP11 SIGRTN
E-Series 6.8L, F-650/F-750	198 PIN	E55 E54	CMP11 SIGRTN
EcoSport 1.0L Manual Transmission, Fiesta 1.0L, Fiesta GTDI 1.6L	198 PIN	E7 E37 E36 E20	VREF CMP12 CMP11 SIGRTN
EcoSport 1.5L Automatic Transmission	198 PIN	E28 E30 E45 E29	VREF CMP12 CMP11 SIGRTN
EcoSport 1.5L Manual Transmission	112 PIN	E11 E33 E34 E38	VREF CMP12 CMP11 SIGRTN
Edge 2.7L, Ford GT, Fusion 2.7L, MKX 2.7L, MKZ 3.0L, Transit 3.5L	198 PIN	E22 E70 E26 E54 E28 E53	VBPWR CMP22 CMP21 CMP12 CMP11 SIGRTN
Escape/Kuga 1.5L	198 PIN	E11 E22 E23 E29	VREF CMP12 CMP11 SIGRTN
Escape/Kuga 2.5L, Fusion 2.5L, Transit Connect	198 PIN	E17 E45 E35	VBPWR CMP11 SIGRTN

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Vehicle	Connector	Pin	Circuit
Expedition, F-150 3.5L, Navigator	198 PIN	E3 E69 E26 E54 E40 E29	VREF CMP22 CMP21 CMP12 CMP11 SIGRTN
Explorer GTDI 3.5L, Flex GTDI 3.5L, MKT 3.5L, Taurus GTDI 3.5L	198 PIN	E22 E26 E28 E53	VBPWR CMP21 CMP11 SIGRTN
F-150 2.7L, F-150 3.3L, F-150 5.0L	306 PIN	E118 E77 E75 E54 E76 E47, E91	VREF CMP22 CMP21 CMP12 CMP11 SIGRTN
F-Series Super Duty 6.8L, Motorhome/Stripped Chassis/Step Van	198 PIN	E46 E29	CMP11 SIGRTN
Fiesta TiVCT 1.6L	128 PIN	T13 T19 T21 T27, T29	VREF CMP12 CMP11 SIGRTN
Focus GDI 2.0L	154 PIN	E15, E16 E79 E80 E44, E47	VREF CMP12 CMP11 SIGRTN
KA	128 PIN	T28, T30 T11 T12 T21, T22	VREF CMP12 CMP11 SIGRTN
Mustang 2.3L	198 PIN	E19 E28 E27 E14	VREF CMP12 CMP11 SIGRTN
Mustang 5.0L	306 PIN	E118 E17 E77 E75 E54 E76 E47, E91	VREF VBPWR CMP22 CMP21 CMP12 CMP11 SIGRTN
Ranger	128 PIN	T18 T21 T29	VREF CMP11 SIGRTN
All other vehicles	198 PIN	E6 E54 E28 E53	VREF CMP12 CMP11 SIGRTN

TEST PROCEDURE

DR1 CHECK FOR DTCS

Are DTCs P0340, P0341, P0344, P0345, P0346, P0349, P0365, P0366, P0369, P0390, P0391, or P0394 present?

Yes	No

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Yes	No
For vehicles with DTCs and a no crank or no start symptom, GO to DR5. For all others, GO to DR2.	For symptoms without DTCs, GO to DR2. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

DR2 INSPECT THE HARNESS

- Ignition OFF.
- Check the harness for routing, alterations, incorrect shielding, or electrical interference from other systems.
- Check the CMP connector for damage or corrosion.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to DR3.

DR3 CLEAR AND ATTEMPT TO RETRIEVE THE DTC

NOTE: **Consider the ignition system, alternator noise, radio frequency interference and crankshaft position (CKP) sensor concerns if DTCs P0340, P0341, P0344, P0345, P0346, P0349, P0365, P0366, P0369, P0390, P0391, or P0394 are present.**

NOTE: **For vehicles with variable camshaft timing (VCT), concerns with the engine oil level, oil filter, oil contamination, or the VCT system may cause camshaft positioning errors.**

- Ignition ON, engine OFF.
- Clear the PCM DTCs.
- Ignition ON, engine running.
- Increase engine speed to greater than 1, 500 RPM for 10 seconds. Repeat this 3 times.
- Carry out the PCM self-test.

Are DTCs P0340, P0341, P0344, P0345, P0346, P0349, P0365, P0366, P0369, P0390, P0391 or P0394 present?

Yes	No
GO to DR4.	For symptoms without DTCs, RETURN to **SYMPTOM CHARTS** for further direction. For all others, GO to **PINPOINT TEST Z**.

DR4 CHECK THE GENERATOR FOR EXCESSIVE ELECTRICAL NOISE

NOTE: **If the generator/regulator is electrically noisy, the noise decreases when the B+ connector is disconnected.**

- Ignition ON, engine running.
- Monitor the generator for an audible electric noise.
- Ignition OFF.
- Generator/regulator B+ connector disconnected.
- Ignition ON, engine running.
- With the engine running, determine if the generator noise remains steady, decreases or increases in volume.

Does the generator noise remain steady when the B+ connector is disconnected?

Yes	No

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Yes	No
GO to DR5.	REFER to the appropriate Charging System article, to DIAGNOSE the generator is noisy symptom.

DR5 CHECK THE VOLTAGE TO THE CMP SENSOR

NOTE: **Diagnose the suspect CMP sensor indicated by the DTC. For 2 pin VR type CMP sensor DTCs, GO to DR6.**

- Ignition OFF.
- Generator/regulator B+ connector connected.
- CMP Sensor connector disconnected.
- Ignition ON, engine OFF.
- For the VBPWR CMP sensors,
- Measure the voltage between:

(+) CMP Sensor Connector, Harness Side	(-)
VBPWR	Ground

- For VREF CMP sensors,
- Measure the voltage between:

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

Is the voltage greater than 10.5 V on the VBPWR circuit or is the voltage between 4.5 and 5.5 V on the VREF circuit?

Yes	No
GO to DR7.	For Continental 2.0L, EcoSport, Edge 2.0L, Escape/Kuga 1.5L, Escape/Kuga 2.0L, Expedition, Explorer 2.3L, F-150, Fiesta, Focus, Fusion 1.5L, Fusion 2.0L, KA, MKC, MKT 2.0L, MKZ 2.0L, Mustang 2.3L, Mustang 5.0L, Navigator, Ranger, and Taurus 2.0L, GO to **PINPOINT TEST C**. For all others, REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DR6 CHECK THE CMP SENSOR RESISTANCE

NOTE: **Diagnose the suspect CMP sensor indicated by the DTC.**

- Ignition OFF.
- CMP Sensor connector disconnected.

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- Measure the resistance between:

(+) CMP Sensor Connector, Component Side	(-) CMP Sensor Connector, Component Side
CMP	SIGRTN

Is the resistance between 250 to 2000 ohms?

Yes	No
GO to DR7.	INSTALL a new CMP sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

DR7 CHECK THE CMP SENSOR CIRCUITS FOR AN OPEN

- PCM connector disconnected.
- Measure the resistance between:

(+) CMP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
CMP	CMP
SIGRTN	SIGRTN

Are the resistances less than 5 ohms?

Yes	No
GO to DR8.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DR8 CHECK THE CMP CIRCUIT FOR A SHORT

- Measure the resistance between:

(+) CMP Sensor Connector, Harness Side	(-) CMP Sensor Connector, Harness Side
CMP	SIGRTN

- Measure the resistance between:

(+) CMP Sensor Connector, Harness Side	(-)
CMP	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to DR9.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DR9 CHECK THE CMP CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) CMP Sensor Connector, Harness Side	(-)
CMP	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	For E-Series 6.8L, F-650/F-750, F-Series Super Duty 6.8L, KA 1.5L, and Motorhome/Stripped Chassis/Step Van, GO to DR11. For all others, GO to DR10.

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DR10 CHECK FOR VARIABLE CAMSHAFT TIMING (VCT) CONCERNS

NOTE: **Only diagnose the bank indicated by the DTC.**

- CMP Sensor connector connected.
- PCM connector connected.
- Check the VCT system for correct operation.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to DR11.

DR11 CHECK THE CMP SENSOR OPERATION

- Ignition OFF.
- CMP Sensor connector connected.
- PCM connector connected.
- Ignition ON, engine running.
- Access the PCM and monitor the SYNC (MODE) PID.

Does the engine start and does the SYNC PID read YES?

Yes	No
GO to DR12.	INSTALL a new CMP sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

DR12 CHECK FOR DTCS

- Carry out the PCM self-test.

Are any DTCs present?

Yes	No
INSTALL a new CMP sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. Clear the PCM DTCs. REPEAT the self-test.

PINPOINT TESTS DS: EXHAUST GAS RECIRCULATION TEMPERATURE (EGRT) SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- harness circuits: EGRT12, and SIGRTN
- exhaust gas recirculation temperature bank 1, sensor 2 (EGRT12)

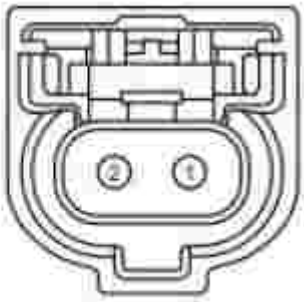

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Fig. 82: Exhaust Gas Recirculation Temperature Bank 1, Sensor 2 (EGRT12) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
1	EGRT12 (Exhaust Gas Recirculation Temperature Bank 1, Sensor 2)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Connector	Pin	Circuit
306	PIN E99 E96	SIGRTN EGRT12

TEST PROCEDURE

DS1 CHECK FOR DTCS

Are DTCs P041B, P041C or P041D present?

Yes	No
GO to DS2.	For symptoms without DTCs, GO to DS2. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

DS2 CHECK THE EGRT12 SENSOR

- Inspect the EGRT12 sensor circuits at the sensor and the PCM.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to DS3.

DS3 CHECK FOR AN OPEN

- Ignition OFF.
- EGRT12 Sensor connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) EGRT12 Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
EGRT12 - Pin 1	EGRT12 - Pin E96
SIGRTN - Pin 2	SIGRTN - Pin E99

Are the resistances less than 5 ohms?

Yes	No
GO to DS4.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DS4 CHECK FOR A SHORT TO GROUND

- Measure the resistance between:

(+) EGRT12 Sensor Connector, Harness Side	(-)
EGRT12 - Pin 1	Ground

Is the resistance greater than 10K ohms?

Yes	No

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Yes	No
GO to DS5.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DS5 CHECK FOR A SHORT TO VOLTAGE

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

(+) EGRT12 Sensor Connector, Harness Side	(-)
EGRT12 - Pin 1	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to DS6.

DS6 CHECK THE EGRT SENSOR OPERATION

- Ignition OFF.
- EGRT12 Sensor connector connected.
- PCM connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the EGRT12 (TEMP) PID.
- Record the PID value.
- Drive the vehicle while monitoring the PID.
- Engine at normal operating temperature.
- Record the PID value.

Does the PID value increase?

Yes	No
For symptoms without DTCs, RETURN to **SYMPTOM CHARTS** for further direction. For all others, GO to **PINPOINT TEST Z**.	INSTALL a new EGRT sensor. REFER to the appropriate Engine Emission Control article. Clear the PCM DTCs. REPEAT the self-test.

PINPOINT TESTS DT: EXHAUST PRESSURE (EP) SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- harness circuits: EP, SIGRTN, VREF
- EP sensor (9J460)
- PCM (12A650)

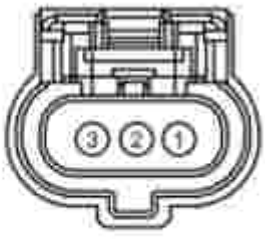

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Fig. 83: Exhaust Pressure (EP) Sensor Connector
Courtesy of FORD MOTOR CO.

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Pin	Circuit
3	EP (Exhaust Pressure)
2	SIGRTN (Signal Return)
1	VREF (Reference Voltage)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Connector	Pin	Circuit
306 PIN	E97	EP

TEST PROCEDURE

DT1 CHECK FOR DTCS

Is DTC P0471, P0472 or P0473 present?

Yes	No
GO to DT2.	RETURN to **SYMPTOM CHARTS** for further direction.

DT2 CHECK FOR VOLTAGE AT THE SENSOR

- Ignition OFF.
- EP Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

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

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to DT3.	GO to **PINPOINT TEST C**.

DT3 CHECK FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) EP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
EP - Pin 3	EP - Pin E97

Is the resistance less than 5 ohms?

Yes	No
GO to DT4.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DT4 CHECK FOR A SHORT BETWEEN CIRCUITS

- Measure the resistance between:

(+) EP Sensor Connector, Harness Side	(-)
EP - Pin 3	Ground

- Measure the resistance between:

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

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(+) EP Sensor Connector, Harness Side	(-) EP Sensor Connector, Harness Side
EP - Pin 3	VREF - Pin 1
EP - Pin 3	SIGRTN - Pin 2

Are the resistances greater than 10K ohms?

Yes	No
GO to DT5.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DT5 CHECK FOR A SHORT TO VOLTAGE

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

(+) EP Sensor Connector, Harness Side	(-)
EP - Pin 3	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to DT6.

DT6 INTERMITTENT CHECK

- EP Sensor connector connected.
- PCM connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the EBP_V (VOLT) PID.
- While observing the PID, carry out the following:
- Wiggle the harness connector to simulate road shock.
- Wiggle the EP sensor connector.
- Look for sudden changes in the voltage when the harness and connector are wiggled or when the EP sensor is tapped.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	CHECK the EP sensor and tube for restrictions. REPAIR as necessary. If no concern is present, INSTALL a new EP sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

PINPOINT TESTS DV: THROTTLE BODY ASSEMBLY ELECTRONIC THROTTLE CONTROL (ETC)

INTRODUCTION

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. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

This pinpoint test is intended to diagnose the following:

- electronic throttle body (ETB) (9F991)
- electronic throttle body throttle position sensor (ETBTPS) (9E928)
- harness circuits: ETCRTN, ETCREF, TP, TP1, TP2, TACM+, and TACM-PCM (12A650)

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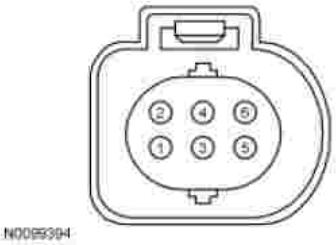

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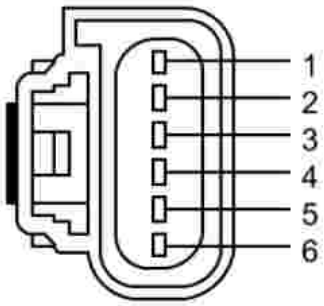

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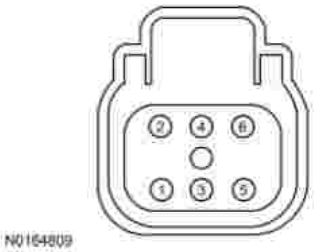

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Fig. 84: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 6.8L, Explorer GTDI 3.5L, F-650/F-750, F-Series Super Duty 6.8L, Flex GTDI 3.5L, MKT 3.5L, Motorhome/Stripped Chassis/Step Van, Taurus GTDI 3.5L	A	1 4 3 2	TP2 TP1 ETCRTN ETCREF
EcoSport 1.5L, EcoSport 1.0L, Escape/Kuga 1.5L, Fusion 1.5L	B	5 2 3 1	TP2 TP1 ETCRTN ETCREF

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Vehicle	Connector	Pin	Circuit
Expedition, F-150, Mustang 5.0L, Mustang 2.3L, Navigator	C	3 4 5	TP ETCRTN ETCREF
Fiesta 1.0L, Focus 1.0L, KA 1.0L	B	2 5 3 1	TP2 TP1 ETCRTN ETCREF
Fiesta 1.6L	D	4 1 2 6	TP2 TP1 ETCRTN ETCREF
KA 1.5L	B	4 1 2 6	TP2 TP1 ETCRTN ETCREF
All other vehicles	C	6 3 4 5	TP2 TP1 ETCRTN ETCREF

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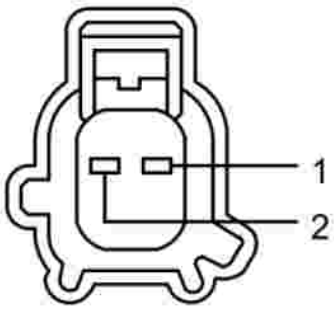

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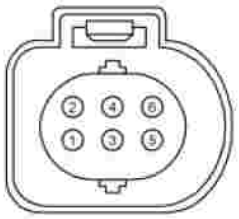

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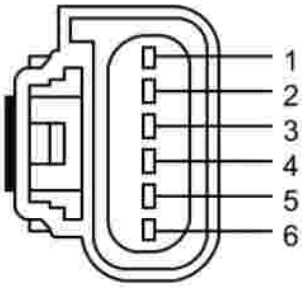

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Fig. 85: Electronic Throttle Body Throttle Actuator Control Motor (ETBTACM) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 6.8L, Explorer GTDI 3.5L, F-650/F-750, F-Series Super Duty 6.8L, Flex GTDI 3.5L, MKT 3.5L, Motorhome/Stripped Chassis/Step Van, Taurus GTDI 3.5L	A	2 1	TACMTACM+

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Vehicle	Connector	Pin	Circuit
EcoSport 1.5L, EcoSport 1.0L, Escape/Kuga 1.5L, Fiesta 1.0L, Focus 1.0L, Fusion 1.5L, KA 1.0L	B	4 6	TACMTACM+
Fiesta 1.6L	C	3 5	TACMTACM+
KA 1.5L	B	3 5	TACMTACM+
All other vehicles	D	2 1	TACMTACM+

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 3.7L, E-Series, Edge 3.5L, Explorer TiVCT 3.5L, Explorer 3.7L, F-650/F-750, F-Series Super Duty, Flex TiVCT 3.5L, MKT 3.7L, MKX 3.7L, Motorhome/Stripped Chassis/Step Van, Mustang 5.2L, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L	198 PIN	E8 E23 B97, B99 B100, B102, B103, B5 E81 E82 E9 E10	ETCREF ETCRTN VPWR PWRGND TACMTACM+ TP2 TP1
EcoSport 1.0L Manual Transmission	198 PIN	E5 E18 B101, B102, B103 B96, B97, B98, B99 E89 E94 E34 E33	ETCREF ETCRTN VPWR PWRGND TACMTACM+ TP2 TP1
EcoSport 1.5L Automatic Transmission, Escape/Kuga 2.5L	198 PIN	E8 E23 B97, B99 B100, B102, B103, B5 E49 E50 E9 E10	ETCREF ETCRTN VPWR PWRGND TACMTACM+ TP2 TP1
EcoSport 1.5L Manual Transmission	112 PIN	E8 E6 B55, B56 B49, B50, B51 E55 E56 E19 E18	ETCREF ETCRTN VPWR PWRGND TACMTACM+ TP2 TP1

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Vehicle	Connector	Pin	Circuit
Escape/Kuga 1.5L	198 PIN	E10 E12 B101, B102, B103 B96, B97, B98, B99 E87 E92 E43 E58	ETCREF ETCRTN VPWR PWRGND TACMTACM+ TP2 TP1
Expedition, F-150 3.5L, Navigator	198 PIN	E4 E35 B101, B102, B103 B96, B97, B98, B99 E80 E79 E1	ETCREF ETCRTN VPWR PWRGND TACMTACM+ TP
Explorer GTDI 3.5L	198 PIN	E35 E4 B101, B102, B103 B96, B97, B98, B99 E91 E86 E52 E68	ETCREF ETCRTN VPWR PWRGND TACMTACM+ TP2 TP1
F-150 2.7L, F-150 3.3L, F-150 5.0L, Mustang 5.0L	306 PIN	E117 E114 B1, B16, B2 B46, B47, B61, B62, B76, B77 E85 E106 E12	ETCREF ETCRTN VPWR PWRGND TACMTACM+ TP
Fiesta 1.0L, Fiesta GTDI 1.6L	198 PIN	E5 E18 B101, B102, B103 B96, B97, B99 E89 E94 E34 E33	ETCREF ETCRTN VPWR PWRGND TACMTACM+ TP2 TP1
Fiesta TiVCT 1.6L	128 PIN	E28 E4 B11, B12, E13, E37 B35, B36, B47, B48 E36 E48 E27 E16	ETCREF ETCRTN VPWR PWRGND TACMTACM+ TP2 TP1
Focus GDI 2.0L	154 PIN	E19 E58 B5, B6 B1, B2, B4 E50 E74 E81 E6	ETCREF ETCRTN VPWR PWRGND TACMTACM+ TP2 TP1

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Vehicle	Connector	Pin	Circuit
Fusion 2.5L	198 PIN	E8 E23 B97, B99 B50, B69, B70 E49 E50 E9 E10	ETCREF ETCRTN VPWR PWRGND TACMTACM+ TP2 TP1
KA	128 PIN	T27 T19 B36, E24 B48, E12, T23, T31, T32 T15 T7 T1 T25	ETCREF ETCRTN VPWR PWRGND TACMTACM+ TP2 TP1
Mustang 2.3L	198 PIN	E10 E16 B101, B102, B103 B96, B97, B98, B99 E51 E50 E54	ETCREF ETCRTN VPWR PWRGND TACMTACM+ TP
Ranger	128 PIN	E28 E4 B11, B12 B35, B36, B47, B48 E36 E48 E16 E27	ETCREF ETCRTN VPWR PWRGND TACMTACM+ TP2 TP1
Transit Connect	198 PIN	E8 E23 B97, B99 B100, B102, B103, B5 E49 E30 E9 E10	ETCREF ETCRTN VPWR PWRGND TACMTACM+ TP2 TP1
All other vehicles	198 PIN	E7 E31 B101, B102, B103 B96, B97, B98, B99 E91 E86 E52 E68	ETCREF ETCRTN VPWR PWRGND TACMTACM+ TP2 TP1

TEST PROCEDURE

DV1 CHECK FOR DTCS

NOTE: **If DTC P0068 is present, diagnose all other DTCs first.**

Are DTCs P0068, P0120, P0121, P0122, P0123, P0124, P0221, P0222, P0223, P1584, P1588, P2100, P2101, P2107, P2109, P2111, P2112, P2118, P2119, P2135, P2163, P2176, U0606, U210F or U2110 present?

Yes	No

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Yes	No
For DTC P0068, GO to DV3. For DTCs P2100 or P2107, GO to DV2. For all others, GO to DV5.	RETURN to **SYMPTOM CHARTS** for further direction.

DV2 REPEAT THE KOEO OR KOER SELF-TEST

NOTE: **DTC P2107 may set when a failure mode effects management (FMEM) action is taken.**

- Ignition ON, engine OFF.
- Carry out the PCM self-test.

Are any DTCs present other than P2100 or P2107?

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 DV5.

DV3 CHECK FOR LEAKS

- Inspect the entire intake air system from the air cleaner housing to the intake manifold for leaks such as:
  - loose connections on the intake air tube at the air cleaner housing or throttle body
  - cracked or punctured intake air tube
  - hoses connecting to the intake air tube
  - hoses connecting to the throttle body
  - obstructions, restrictions, or damage
- Inspect the entire length of all the vacuum hoses for:
  - correct connections
  - damage or cracks
  - damaged or cracked vacuum tees
- Inspect the intake manifold or gasket for leaks.
- Verify the integrity of the positive crankcase ventilation (PCV) system.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to DV4.

DV4 CHECK FOR INTAKE AIR LEAKS

- Ignition ON, engine running.
- Listen for air noise around the mass airflow (MAF) sensor (if equipped) and throttle body assembly.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to DV5.

DV5 CHECK 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. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

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NOTE: **Make sure the ETB harness connector is connected correctly.**

- Ignition OFF.
- Remove the inlet tube from the throttle body.
- Visually inspect the air induction system for obstructions.
- Visually inspect for throttle plate obstructions or engine deposits.
- Check the ETB harness and connectors for the following:
- damaged connectors
- crossed TACM circuits
- pushed out pins
- corrosion
- incorrect connections

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	For DTC P0068, GO to DV16. For DTC P2118, GO to DV12. For all others, GO to DV6.

DV6 CHECK THE VREF VOLTAGE TO TP

NOTE: **In the following measurement note the polarity of the probes.**

- Ignition OFF.
- ETBTPS connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) ETBTPS Connector, Harness Side	(-) ETBTPS Connector, Harness Side
ETCREF	ETCRTN

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to DV7.	GO to **PINPOINT TEST C**.

DV7 CHECK THE TP CIRCUIT FOR AN OPEN OR CROSSED SENSOR WIRES

- Ignition OFF.
- PCM connector disconnected.
- For Expedition, F-150, Mustang 2.3L, Mustang 5.0L and Navigator,
- Measure the resistance between:

(+) ETBTPS Connector, Harness Side	(-) PCM Connector, Harness Side
TP	TP

- For all others,
- Measure the resistance between:

(+) ETBTPS Connector, Harness Side	(-) PCM Connector, Harness Side
TP1	TP1
TP2	TP2

Are the resistances less than 5 ohms?

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Yes	No
GO to DV8.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DV8 CHECK THE TP CIRCUIT FOR A SHORT TO GROUND

- For Expedition, F-150, Mustang 2.3L, Mustang 5.0L and Navigator,
- Measure the resistance between:

(+) ETBTPS Connector, Harness Side	(-)
TP	Ground

- For all others,
- Measure the resistance between:

(+) ETBTPS Connector, Harness Side	(-)
TP1	Ground
TP2	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to DV9.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DV9 CHECK THE TP CIRCUITS FOR A SHORT TOGETHER

- For Expedition, F-150, Mustang 2.3L, Mustang 5.0L and Navigator,
- Measure the resistance between:

(+) ETBTPS Connector, Harness Side	(-) ETBTPS Connector, Harness Side
TP	ETCREF
TP	ETCRTN

- For all others,
- Measure the resistance between:

(+) ETBTPS Connector, Harness Side	(-) ETBTPS Connector, Harness Side
TP1	TP2
TP1	ETCREF
TP1	ETCRTN
TP2	ETCREF
TP2	ETCRTN

Are the resistances greater than 10K ohms?

Yes	No
GO to DV10.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DV10 CHECK THE TP CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For Expedition, F-150, Mustang 2.3L, Mustang 5.0L and Navigator,
- Measure the voltage between:

(+) ETBTPS Connector, Harness Side	(-)
TP	Ground

- For all others,
- Measure the voltage between:

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(+) ETBTPS Connector, Harness Side	(-)
TP1	Ground
TP2	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	For DTCs P1584, P1588, P2100, P2101, P2107, P2109, P2111, P2112, P2119, P2163 or P2176, GO to DV11. For all others, GO to DV16.

DV11 CHECK THE TACM HARNESS FOR AN OPEN

- Ignition OFF.
- ETBTACM connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-) PCM Connector, Harness Side
TACM+	TACM+
TACM-	TACM-

Are the resistances less than 5 ohms?

Yes	No
GO to DV12.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DV12 CHECK THE TACM+ AND TACM-CIRCUITS FOR A SHORT TO GROUND

- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-)
TACM+	Ground
TACM-	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to DV13.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DV13 CHECK THE HARNESS FOR A SHORT TO GND, PWR, ETCREF, AND ETCRTN

- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-) PCM Connector, Harness Side
TACM+	PWRGND
TACM+	VPWR
TACM+	ETCRTN
TACM+	ETCREF
TACM-	PWRGND
TACM-	ETCRTN
TACM-	VPWR
TACM-	ETCREF

Are the resistances greater than 10K ohms?

Yes	No
GO to DV14.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

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DV14 CHECK FOR TACM HARNESS CIRCUITS SHORTED TOGETHER

- Measure the resistance between:

(+) ETBTACM Connector, Harness Side	(-) ETBTACM Connector, Harness Side
TACM+	TACM Gasoline

Is the resistance greater than 10K ohms?

Yes	No
For DTC P2118, GO to DV16. For all others, GO to DV15.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DV15 CHECK THE TACM FOR A SHORT OR OPEN

- Measure the resistance between:

(+) ETBTACM Connector, Component Side	(-) ETBTACM Connector, Component Side
TACM+	TACM-

Is the resistance between 1 - 90 ohms (Fiesta 1.6L, Focus 1.6L, and KA 1.5L) or 1 - 900 ohms (all others)?

Yes	No
GO to DV16.	INSTALL a new ETB. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. Clear the PCM DTCs. REPEAT the self-test.

DV16 CHECK THE THROTTLE POSITION (TP) OPEN AND CLOSED VOLTAGES

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. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

NOTE: **Certain failure mode effects management (FMEM) operating strategies maintain limited vehicle function in the event of a PCM, harness, or component concern and may prevent the throttle plate from opening. If the throttle plate does not open, follow the NO answer.**

NOTE: **Make sure the accelerator pedal is not applied during the fully released voltage measurements.**

- Ignition OFF.
- ETBTPS connector connected.
- PCM connector connected.
- Ignition ON, engine OFF.
- For Expedition, F-150, Mustang 2.3L, Mustang 5.0L and Navigator,
- Access the PCM and monitor the TP1 (PER) PID.
- Press the accelerator pedal to the floor and release.

Electronic Throttle Control Throttle Position Sensor Signal Percentages

Vehicle	TP1
Pedal fully released	14.6 - 20.0
Pedal fully applied	86.8 - 93.5

- For all others,
- Access the PCM and monitor the TP1 (VOLT) and TP2 (VOLT) PIDs.

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- Press the accelerator pedal to the floor and release.

Electronic Throttle Control Throttle Position Sensor Signal Voltages

Vehicle	Accelerator Pedal Position	TP1	TP2
Fiesta 1.6L, Focus 1.6L, KA 1.5L	Pedal fully released	3.76 - 4.84	0.19 - 1.19
Fiesta 1.6L, Focus 1.6L, KA 1.5L	Pedal fully applied	0.16 - 1.24	3.76 - 4.84
Continental 2.0L, Continental 2.7L, Continental 3.0L, EcoSport 2.0L, Edge 2.0L, Edge 2.7L, Escape/Kuga 2.0L, Explorer 2.3L, Focus 2.0L, Focus 2.3L, Fusion 2.0L, Fusion 2.7L, MKC, MKX 2.0L, MKX 2.7L, MKZ 2.0L, MKZ 3.0L	Pedal fully released	3.7 - 4.7	0.3 - 1.16
Continental 2.0L, Continental 2.7L, Continental 3.0L, EcoSport 2.0L, Edge 2.0L, Edge 2.7L, Escape/Kuga 2.0L, Explorer 2.3L, Focus 2.0L, Focus 2.3L, Fusion 2.0L, Fusion 2.7L, MKC, MKX 2.0L, MKX 2.7L, MKZ 2.0L, MKZ 3.0L	Pedal fully applied	0.3 - 1.0	4.0 - 4.7
F-Series Super Duty 6.2L	Pedal fully released	3.95 - 4.4	0.6 - 1.05
F-Series Super Duty 6.2L	Pedal fully applied	0.35 - 0.7	4.3 - 4.65
EcoSport 1.0L, EcoSport 1.5L, Escape/Kuga 1.5L, Fiesta 1.0L, Focus 1.0L, Fusion 1.5L, KA 1.0L	Pedal fully released	3.5 - 4.6	0.4 - 1.5
EcoSport 1.0L, EcoSport 1.5L, Escape/Kuga 1.5L, Fiesta 1.0L, Focus 1.0L, Fusion 1.5L, KA 1.0L	Pedal fully applied	0.9 - 1.6	3.4 - 4.1
MKT 2.0L, Taurus 2.0L	Pedal fully released	3.84 - 4.54	0.46 - 1.16
MKT 2.0L, Taurus 2.0L	Pedal fully applied	0.3 - 1.0	4.1 - 4.7
Ford GT, Mustang 5.2L	Pedal fully released	3.2 - 3.67	1.34 - 1.81
Ford GT, Mustang 5.2L	Pedal fully applied	0.20 - 0.36	4.40 - 4.64
All others	Pedal fully released	3.7 - 4.7	0.3 - 1.9
All others	Pedal fully applied	0.7 - 2.9	4.1 - 4.7

Is the percentage PID within range for the Expedition, F-150, Mustang 2.3L, Mustang 5.0L and Navigator or are both voltage PIDs within the chart ranges for all others?

Yes	No

Yes	No
For DTC P0068, GO to DV19. For all others, unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**.	For DTCs P2101, P2107 or P2118, GO to **Pinpoint Test Z**. For DTCs P1584, P1588, P2109, P2163 or P2176, INSTALL a new ETB. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. Clear the PCM DTCs. REPEAT the self-test. For DTCs P2111, P2112 or P2119, INSTALL a new ETBTPS. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. Clear the PCM DTCs. REPEAT the self-test. For all others, GO to DV17.

DV17 CHECK FOR AN INTERMITTENT CONCERN

- Ignition ON, engine OFF.
- For Expedition, F-150, Mustang 2.3L, Mustang 5.0L and Navigator,
- Access the PCM and monitor the TP_A_RCNT_F (MODE) PID.
- For all others,
- Access the PCM and monitor the TP1 (VOLT) and TP2 (VOLT) PIDs.
- Wiggle, shake, and bend the harness from the TP to the PCM.

Does the TP_A__RCNT_F PID value change (Expedition, F-150, Mustang 2.3L, Mustang 5.0L and Navigator) or does the TP1 and TP2 PID voltages change (all others)?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	For Expedition, F-150, Mustang 2.3L, Mustang 5.0L and Navigator, INSTALL a new ETBTPS. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. Clear the PCM DTCs. REPEAT the self-test. For all others, GO to DV18.

DV18 CHECK THE TP SIGNAL

- Ignition ON, engine OFF.
- Access the PCM and monitor the TP1 (VOLT) and TP2 (VOLT) PIDs.
- Monitor the TP1 and TP2 PID voltages while disconnecting the ETBTPS connector.
- ETBTPS connector disconnected.

Do the TP1 and TP2 PID voltages change?

Yes	No
GO to DV20.	GO to **PINPOINT TEST Z**.

DV19 CHECK FOR SELF-TEST DTCS

NOTE: **After retrieving the continuous memory DTCs, diagnose any non-ETC related DTCs before continuing.**

- Ignition ON, engine OFF.
- Clear the PCM DTCs.
- Drive the vehicle while exercising the throttle.
- Carry out the PCM self-test.

Is DTC P0068 present?

Yes	No

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Yes	No
For vehicles with a MAF sensor, CHECK the MAF sensor and connector for damage and corrosion. REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test. For all others, CHECK the MAP sensor and connector for damage and corrosion. REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**.

DV20 CHECK FOR CORRECT OPERATION

- Ignition OFF.
- Disconnect all the PCM connectors.
- Disconnect the ETBTPS connector.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and the ETBTPS connector. Make sure the connectors are seated correctly.
- Carry out the PCM self-test.
- Verify the concern is still present.

Is the concern still present?

Yes	No
INSTALL a new ETBTPS. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. Clear the PCM DTCs. REPEAT the self-test.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS DW: HEATED OXYGEN SENSOR (HO2S)

INTRODUCTION

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.**

This pinpoint test is intended to diagnose the following:

- exhaust leaks
- HO2S (9G444)
- harness circuits: HO2S11, HO2S12, HO2S22, HTR12, HTR22, VPWR and SIGRTN
- PCM (12A650)

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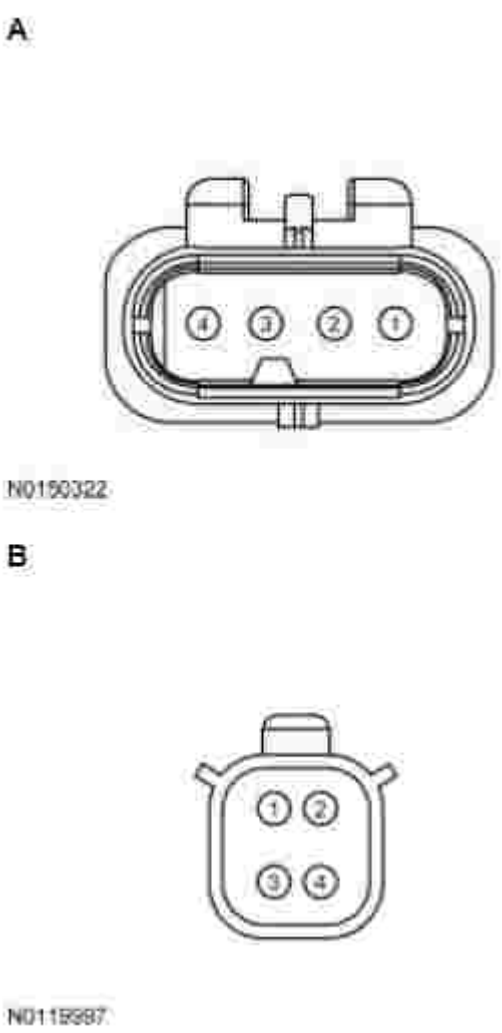

Fig. 86: Heated Oxygen Sensor Bank 1, Sensor 1 (HO2S11) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
EcoSport	A	1 2 3 4	HTR11 VPWR SIGRTN HO2S11
All other vehicles	B	2 1 3 4	HTR11 VPWR SIGRTN HO2S11

The pin numbering for the connector is in reference to the connector lock tab. Not all connector key combinations are show.

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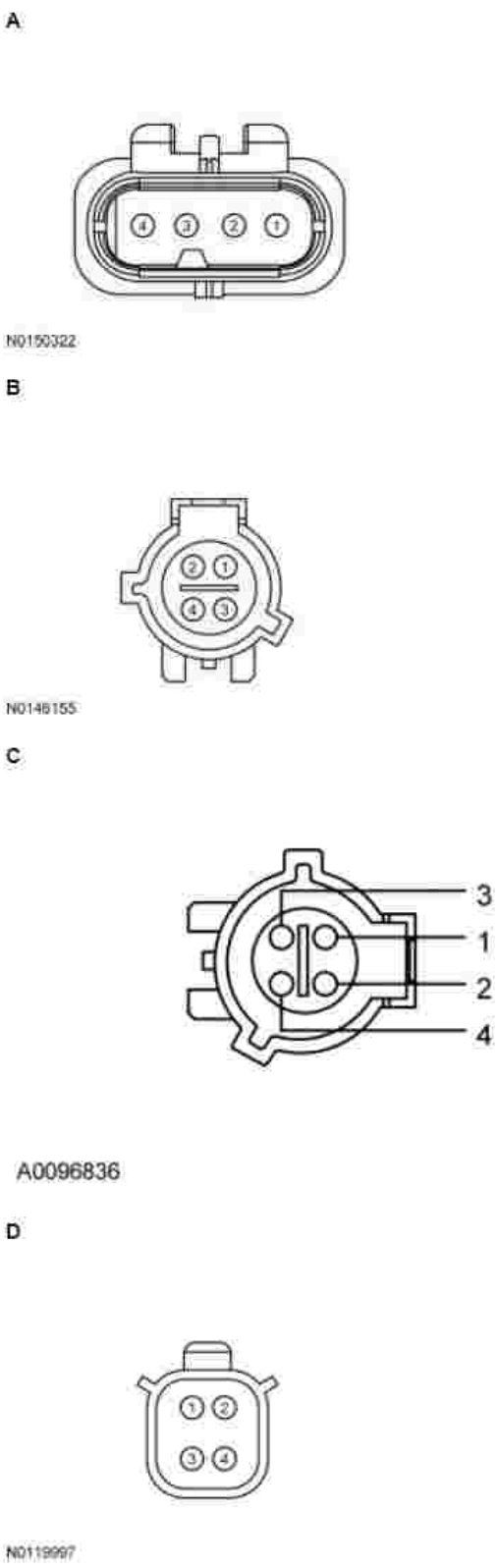

Fig. 87: Heated Oxygen Sensor Bank 1, Sensor 2 (HO2S12) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 2.0L, Edge 2.0L, Escape/Kuga 1.5L, Expedition, Explorer 2.3L, Focus 1.0L, Focus 2.3L, Ford GT, Fusion 1.5L, MKX 2.0L, Navigator	A	2 1 3 4	HTR12 VPWR SIGRTN HO2S12

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Vehicle	Connector	Pin	Circuit
EcoSport, F-150, Mustang 2.3L, Mustang 5.0L	A	1 2 3 4	HTR12 VPWR SIGRTN HO2S12
Fiesta GTDI 1.6L	B	2 1 3 4	HTR12 VPWR SIGRTN HO2S12
Fiesta TiVCT 1.6L	C	1 2 4 3	HTR12 VPWR SIGRTN HO2S12
KA 1.5L	C	2 1 4 3	HTR12 VPWR SIGRTN HO2S12
All other vehicles	D	2 1 3 4	HTR12 VPWR SIGRTN HO2S12

The pin numbering for the connector is in reference to the connector lock tab. Not all connector key combinations are shown.

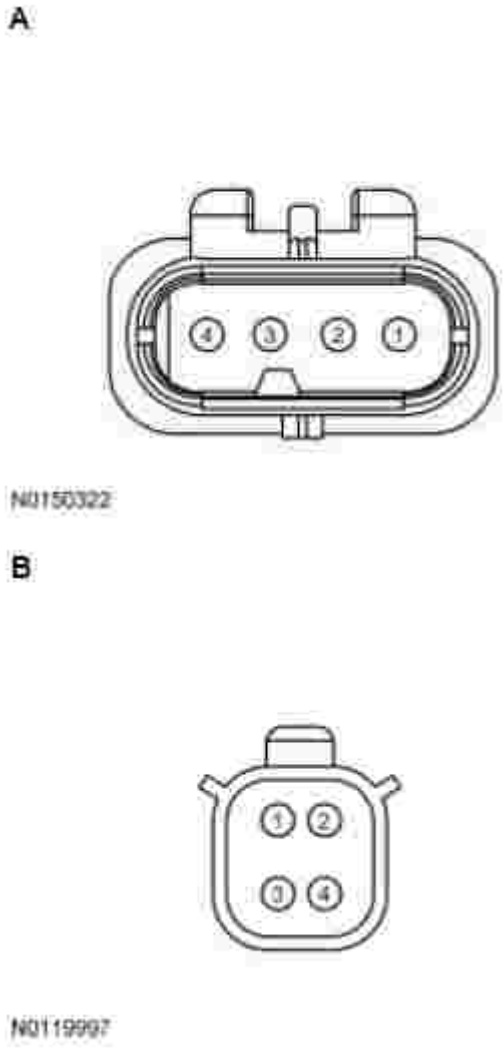

Fig. 88: Heated Oxygen Sensor Bank 2, Sensor 2 (HO2S22) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
Expedition, Ford GT, Navigator	A	2 1 3 4	HTR22 VPWR SIGRTN HO2S22
F-150, Mustang 5.0L	A	1 2 3 4	HTR22 VPWR SIGRTN HO2S22
All other vehicles	B	2 1 3 4	HTR22 VPWR SIGRTN HO2S22

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, Edge 2.7L, Explorer GTDI 3.5L, Flex GTDI 3.5L, Ford GT, Fusion 2.7L, MKT 3.5L, MKX 2.7L, MKZ 3.0L, Taurus GTDI 3.5L, Transit 3.5L	198 PIN	B61 B1 B37 B56 B38 B57	HTR22 HTR12 SIGRTN HO2S22 SIGRTN HO2S12
Continental 3.7L, E-Series, Edge 3.5L, Explorer TiVCT 3.5L, Explorer 3.7L, F-Series Super Duty 6.2L, Flex TiVCT 3.5L, MKT 3.7L, MKX 3.7L, Motorhome/Stripped Chassis/Step Van, Mustang 5.2L, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L	198 PIN	E83 E78 B90 B91 B71 B72	HTR22 HTR12 SIGRTN HO2S22 SIGRTN HO2S12
EcoSport 1.0L Manual Transmission, Fiesta 1.0L, Fiesta GTDI 1.6L	198 PIN	B1 B37 B57	HTR12 SIGRTN HO2S12
EcoSport 1.5L Automatic Transmission	198 PIN	E92 E93 B53 B72 B51 B70	HTR12 HTR11 SIGRTN HO2S12 SIGRTN HO2S11
EcoSport 1.5L Manual Transmission	112 PIN	E49 E50 E1 E14 E2 E29	HTR12 HTR11 SIGRTN HO2S12 SIGRTN HO2S11

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Vehicle	Connector	Pin	Circuit
Escape/Kuga 1.5L	198 PIN	B100 B73 B74	HTR12 SIGRTN HO2S12
Escape/Kuga 2.5L	198 PIN	E92 B71 E72	HTR12 SIGRTN HO2S12
Expedition, F-150 3.5L, Navigator	198 PIN	B78 B1 B94 B95 B75 B76	HTR22 HTR12 SIGRTN HO2S22 SIGRTN HO2S12
F-150 2.7L, F-150 3.3L, F-150 5.0L, Mustang 5.0L	306 PIN	T16 T77 T85 T26 T84 T10	HTR22 HTR12 SIGRTN HO2S22 SIGRTN HO2S12
F-650/F-750, F-Series Super Duty 6.8L	198 PIN	E78 B71 B72	HTR12 SIGRTN HO2S12
Fiesta TiVCT 1.6L	128 PIN	E35 E9 E21	HTR12 SIGRTN HO2S12
Focus GDI 2.0L	154 PIN	B20 B21 B48	HTR12 SIGRTN HO2S12
Focus GTDI 2.0L	198 PIN	B1 B37 B56	HTR12 SIGRTN HO2S12
Fusion 2.5L, Transit Connect	198 PIN	E92 B71 B72	HTR12 SIGRTN HO2S12
KA	128 PIN	E36 E20 E8 E19 E7 E20	HTR12 HTR11 SIGRTN HO2S12 SIGRTN HO2S11
MKC	198 PIN	B1 B38 B56	HTR12 SIGRTN HO2S12
Mustang 2.3L	198 PIN	E81 E13 E26	HTR12 SIGRTN HO2S12
Ranger	128 PIN	E47 E23 E9 E20 E6 E21	HTR12 HTR11 SIGRTN HO2S12 SIGRTN HO2S11
All other vehicles	198 PIN	B1 B38 B57	HTR12 SIGRTN HO2S12

TEST PROCEDURE

DW1 CHECK FOR DTCS

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Are DTCs P0030, P0036, P0037, P0038, P0041, P0053, P0054, P0056, P0060, P00D2, P0130, P0131, P0132, P0133, P0134, P0135, P0136, P0137, P0138, P0139, P013A, P013B, P013C, P013E, P0140, P0141, P014A, P0157, P0158, P0159, P0161, P2A01 or P2A04 present?

Yes	No
For DTCs P013A or P013C, GO to DW6. For all others, GO to DW2.	RETURN to **SYMPTOM CHARTS** for further direction.

DW2 VISUALLY INSPECT THE HO2S HARNESS

- Ignition OFF.
- Verify the HO2S connectors are connected to the correct engine bank.
- Visually inspect for:
- crossed sensor wires
- pinched, shorted or corroded wiring and pins
    - oil or water contamination
    - damaged HO2S

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	For DTC P0041, GO to DW3. For DTCs P013E or P014A, GO to DW6. For DTCs P0137 or P0157, GO to DW9. For DTCs P0030, P0036, P0037, P0038, P0053, P0054, P0056, P0060, P0135, P0141 or P0161, GO to DW15. For all others, GO to DW5.

DW3 CARRY OUT THE KOER SELF-TEST

- Engine at normal operating temperature.
- Carry out the PCM KOER self-test.

Is DTC P0041 present?

Yes	No
GO to DW9.	GO to DW4.

DW4 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 consumption
- glycol leaking internally in the engine
- 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)** . REPEAT the self-test.	GO to DW5.

DW5 CHECK FOR UNMETERED AIR LEAKS

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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
  - hoses connecting to the throttle body
  - intake manifold gasket leaks
  - positive crankcase ventilation (PCV) system
  - the vacuum lines are disconnected
  - incorrectly seated engine oil dipstick, tube or oil fill cap

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)** . REPEAT the self-test.	For DTCs P0130, P0131, P0132, P0133 or P0134, GO to DW8. For all others, GO to DW6.

DW6 CHECK FOR EXHAUST SYSTEM CONCERNS

NOTE: **Pressure above 241 kPa (35 psi) can cause damage to system components. Regulate the shop air to 34.4 kPa (5 psi) before connecting to the system.**

NOTE: **The DTCs P013A and P013E refer to the HO2S12 sensor and DTCs P013C and P014A refer to the HO2S22 sensor that are located after the catalyst. Before installing a new HO2S12 sensor or HO2S22 sensor, refer to the 4 pin HO2S sensor connector view at the beginning of this pinpoint test to verify the correct HO2S sensor replacement.**

- Pressurize the exhaust system at the exhaust pipe outlet with 34.4 kPa (5 psi) regulated shop air.
- Check the exhaust system for leaks using a soap and water solution.
- Apply the soap and water solution to the following areas:
  - exhaust flanges and gaskets
  - universal HO2S and mounting surface
  - downstream HO2S and mounting surface
  - exhaust system in between the universal HO2S and rear HO2S
- Check the exhaust flange bolts for correct torque.
- Check the rear HO2S for correct torque.

Is a concern present?

Yes	No
For DTCs P013A or P013C, REPAIR as necessary. CARRY OUT the HO2S and Catalyst OBD Monitor Drive Cycle Procedures. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . Clear the PCM DTCs. REPEAT the self-test. If DTCs P013A or P013C are retrieved again, GO to DW7. For DTCs P013E or P014A, REPAIR as necessary. CARRY OUT the HO2S and Catalyst OBD Monitor Drive Cycle Procedures. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . Clear the PCM DTCs. REPEAT the self-test. For all others, REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	For DTCs P013A or P013C, GO to DW7. For DTCs P013E or P014A, INSTALL a new HO2S. REFER to the appropriate Electronic Engine Controls article. CARRY OUT the HO2S and Catalyst OBD Monitor Drive Cycle Procedures. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . Clear the PCM DTCs. REPEAT the self-test. For all others, GO to DW8.

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DW7 CHECK THE CATALYTIC CONVERTER

NOTE: **Internal damage 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.**

NOTE: **The DTCs P013A and P013E refer to the HO2S12 sensor and DTCs P013C and P014A refer to the HO2S22 sensor that are located after the catalyst. Before installing a new HO2S12 sensor or HO2S22 sensor, refer to the 4 pin HO2S sensor connector view at the beginning of this pinpoint test to verify the correct HO2S sensor replacement.**

- Inspect the catalyst substrate for damage.

Is a concern present?

Yes	No
INSTALL a new monitored catalyst only, for the bank referenced. Do not install a new unmonitored catalyst unless it is repaired as an assembly. REFER to the appropriate Exhaust System article. CARRY OUT the HO2S and Catalyst OBD Monitor Drive Cycle Procedures. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new HO2S. REFER to the appropriate Electronic Engine Controls article. CARRY OUT the HO2S and Catalyst OBD Monitor Drive Cycle Procedures. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . Clear the PCM DTCs. REPEAT the self-test.

DW8 CHECK FOR FUEL SELECTION CONCERNS

- Verify with the customer that flex fuel is not being used on a non-flex fuel vehicle.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	For DTCs P0130, P0131, P0132, P0133 or P0134, GO to DW11. For all others, GO to DW9.

DW9 CHECK THE SENSOR

NOTE: **The HO2S heaters must be ON for 2 minutes before continuing diagnosis.**

- Ignition ON, engine running.
- Allow the engine to idle until the HO2S heater PID indicates ON for 2 minutes.
- For the HO2S12,
- Access the PCM and monitor the HTR12 (MODE) PID.
- Access the PCM and control the EQRAT11_DSD (RATIO) PID.
- Command the PID to 13:1.
- Access the PCM and monitor the O2S12 (VOLT) PID.
- Record the PID value.
- For the HO2S22,
- Access the PCM and monitor the HTR22 (MODE) PID.
- Access the PCM and control the EQRAT21_DSD (RATIO) PID.
- Command the PID to 13:1.
- Access the PCM and monitor the O2S22 (VOLT) PID.

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- Record the PID value.

Is the PID voltage approximately 0.8V?

Yes	No
GO to DW10.	GO to DW12.

DW10 CARRY OUT A THOROUGH WIGGLE TEST ON THE HO2S HARNESS

NOTE: **The HO2S heaters must be ON for 2 minutes before continuing diagnosis.**

- For the HO2S12,
- Access the PCM and monitor the HTR12 (MODE) PID.
- Access the PCM and control the EQRAT11_DSD (RATIO) PID.
- Command the PID to 13:1.
- Access the PCM and monitor the O2S12 (VOLT) PID.
- Carry out a thorough wiggle test on the HO2S12 harness.
- For the HO2S22,
- Access the PCM and monitor the HTR22 (MODE) PID.
- Access the PCM and control the EQRAT21_DSD (RATIO) PID.
- Command the PID to 13:1.
- Access the PCM and monitor the O2S22 (VOLT) PID.
- Carry out a thorough wiggle test on the HO2S22 harness.

Does the voltage change during the wiggle test?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	For DTC P00D2, GO to DW15. For all others, GO to **PINPOINT TEST Z**.

DW11 CARRY OUT A WIGGLE TEST ON THE HO2S HARNESS

- Ignition ON, engine OFF.
- Access the PCM and monitor the O2S11 (VOLT) PID.
- Carry out a thorough wiggle test on the HO2S11 harness.

Does the voltage change during the wiggle test?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to DW12.

DW12 CHECK THE HO2S CIRCUITS FOR AN OPEN

NOTE: **Check both halves of the HO2S connector for any water contamination.**

- Ignition OFF.
- PCM connector disconnected.
- For the HO2S11,
- HO2S11 connector disconnected.
- Measure the resistance between:

(+) HO2S11 Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S11	HO2S11
SIGRTN	SIGRTN

- For the HO2S12,

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- HO2S12 connector disconnected.
- Measure the resistance between:

(+) HO2S12 Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S12	HO2S12
SIGRTN	SIGRTN

- For the HO2S22,
- HO2S22 connector disconnected.
- Measure the resistance between:

(+) HO2S22 Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S22	HO2S22
SIGRTN	SIGRTN

Are the resistances less than 5 ohms?

Yes	No
GO to DW13.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DW13 CHECK THE HO2S CIRCUIT FOR A SHORT

- For the HO2S11,
- Measure the resistance between:

(+) HO2S11 Connector, Harness Side	(-) HO2S11 Connector, Harness Side
HO2S11	SIGRTN
HO2S11	VPWR

- Measure the resistance between:

(+) HO2S11 Connector, Harness Side	(-)
HO2S11	Ground

- For the HO2S12,
- Measure the resistance between:

(+) HO2S12 Connector, Harness Side	(-) HO2S12 Connector, Harness Side
HO2S12	SIGRTN
HO2S12	VPWR

- Measure the resistance between:

(+) HO2S12 Connector, Harness Side	(-)
HO2S12	Ground

- For the HO2S22,
- Measure the resistance between:

(+) HO2S22 Connector, Harness Side	(-) HO2S22 Connector, Harness Side
HO2S22	SIGRTN
HO2S22	VPWR

- Measure the resistance between:

(+) HO2S22 Connector, Harness Side	(-)
HO2S22	Ground

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Are the resistances greater than 10K ohms?

Yes	No
GO to DW14.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DW14 CHECK THE HO2S CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For the HO2S11,
- Measure the voltage between:

(+) HO2S11 Connector, Harness Side	(-)
HO2S11	Ground

- For the HO2S12,
- Measure the voltage between:

(+) HO2S12 Connector, Harness Side	(-)
HO2S12	Ground

- For the HO2S22,
- Measure the voltage between:

(+) HO2S22 Connector, Harness Side	(-)
HO2S22	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	For DTC P00D2, GO to DW15. For DTCs P0041, P0133, P0134, P0139, P0159, P2A01 or P2A04, GO to **PINPOINT TEST Z**. For all others, INSTALL a new HO2S. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DW15 CHECK FOR VPWR

NOTE: **Diagnose the suspect sensor indicated by the DTC.**

- Ignition OFF.
- For the HO2S11,
- HO2S11 connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) HO2S11 Connector, Harness Side	(-)
VPWR	Ground

- For the HO2S12,
- HO2S12 connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) HO2S12 Connector, Harness Side	(-)

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(+) HO2S12 Connector, Harness Side	(-)
VPWR	Ground

- For the HO2S22,
- HO2S22 connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) HO2S22 Connector, Harness Side	(-)
VPWR	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to DW16.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DW16 CHECK THE HO2S HEATER CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- For the HO2S11,
- Measure the resistance between:

(+) HO2S11 Connector, Harness Side	(-) PCM Connector, Harness Side
HTR11	HTR11

- For the HO2S12,
- Measure the resistance between:

(+) HO2S12 Connector, Harness Side	(-) PCM Connector, Harness Side
HTR12	HTR12

- For the HO2S22,
- Measure the resistance between:

(+) HO2S22 Connector, Harness Side	(-) PCM Connector, Harness Side
HTR22	HTR22

Is the resistance less than 5 ohms?

Yes	No
GO to DW17.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DW17 CHECK THE HO2S HEATER FOR SHORT CIRCUITS

- For the HO2S11,
- Measure the resistance between:

(+) HO2S11 Connector, Harness Side	(-)
HTR11	Ground

- Measure the resistance between:

(+) HO2S11 Connector, Harness Side	(-) HO2S11 Connector, Harness Side
HTR11	VPWR
HTR11	SIGRTN
HTR11	HO2S11

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- For the HO2S12,
- Measure the resistance between:

(+) HO2S12 Connector, Harness Side	(-)
HTR12	Ground

- Measure the resistance between:

(+) HO2S12 Connector, Harness Side	(-) HO2S12 Connector, Harness Side
HTR12	VPWR
HTR12	SIGRTN
HTR12	HO2S12

- For the HO2S22,
- Measure the resistance between:

(+) HO2S22 Connector, Harness Side	(-)
HTR22	Ground

- Measure the resistance between:

(+) HO2S22 Connector, Harness Side	(-) HO2S22 Connector, Harness Side
HTR22	VPWR
HTR22	SIGRTN
HTR22	HO2S22

Are the resistances greater than 10K ohms?

Yes	No
GO to DW18.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DW18 CHECK THE INTERNAL RESISTANCE OF THE HO2S HEATER

- For the HO2S11,
- Measure the resistance between:

(+) HO2S11 Connector, Component Side	(-) HO2S11 Connector, Component Side
HTR11	VPWR

- For the HO2S12,
- Measure the resistance between:

(+) HO2S12 Connector, Component Side	(-) HO2S12 Connector, Component Side
HTR12	VPWR

- For the HO2S22,
- Measure the resistance between:

(+) HO2S22 Connector, Component Side	(-) HO2S22 Connector, Component Side
HTR22	VPWR

Is the resistance between 2 - 30 ohms?

Yes	No
GO to DW19.	INSTALL a new HO2S. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

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DW19 CHECK THE HEATER CIRCUIT FOR AN INTERNAL SHORT TO GROUND

- For the HO2S11,
- Measure the resistance between:

(+) HO2S11 Connector, Component Side	(-) HO2S11 Connector, Component Side
HTR11	SIGRTN

- Measure the resistance between:

(+) HO2S11 Connector, Component Side	(-)
HTR11	Ground

- For the HO2S12,
- Measure the resistance between:

(+) HO2S12 Connector, Component Side	(-) HO2S12 Connector, Component Side
HTR12	SIGRTN

- Measure the resistance between:

(+) HO2S12 Connector, Component Side	(-)
HTR12	Ground

- For the HO2S22,
- Measure the resistance between:

(+) HO2S22 Connector, Component Side	(-) HO2S22 Connector, Component Side
HTR22	SIGRTN

- Measure the resistance between:

(+) HO2S22 Connector, Component Side	(-)
HTR22	Ground

Is the resistance greater than 10K ohms?

Yes	No
For DTC P00D2, GO to **PINPOINT TEST Z**. For all others, GO to DW20.	INSTALL a new HO2S. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DW20 CHECK FOR CORRECT OPERATION

- Ignition OFF.
- Disconnect all the PCM connectors.
- Disconnect the HO2S12 and the HO2S22 connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and the HO2S12 and the HO2S22 connectors. Make sure the connectors are seated correctly.
- Carry out the PCM self-test.
- Verify the concern is still present.

Is the concern still present?

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Yes	No
INSTALL a new HO2S in question. REFER to the appropriate Electronic Engine Controls article. **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** . RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS DX: ENGINE COOLANT TEMPERATURE (ECT) SENSOR

INTRODUCTION

NOTE: **Engine coolant temperature must be greater than 10Â°C (50Â°F) to pass the KOEO self-test and greater than 82Â°C (180Â°F) to pass the KOER self-test.**

This pinpoint test is intended to diagnose the following:

- ECT sensor (12A648)
- harness circuits: ECT and SIGRTN
- powertrain control module (PCM) (12A650)

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

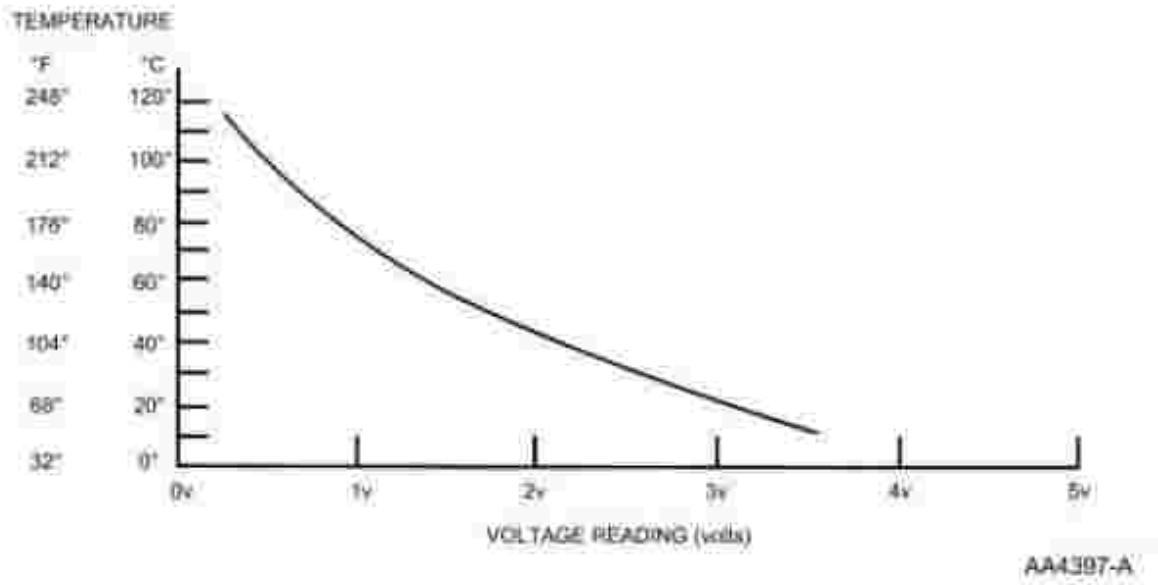

Fig. 89: Engine Coolant Temperature (ECT) Sensor Voltage Graph
Courtesy of FORD MOTOR CO.

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature		Temperature Sensor Values
Â°C	Â°F	Resistance (K ohms)
120	248	1.18
110	230	1.55
100	212	2.07
90	194	2.80
80	176	3.84
70	158	5.37
60	140	7.70
50	122	10.97
40	104	16.15

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Temperature		Temperature Sensor Values
Â°C	Â°F	Resistance (K ohms)
30	86	24.27
20	68	37.30
10	50	58.75
0	32	95.85
-10	14	160.31

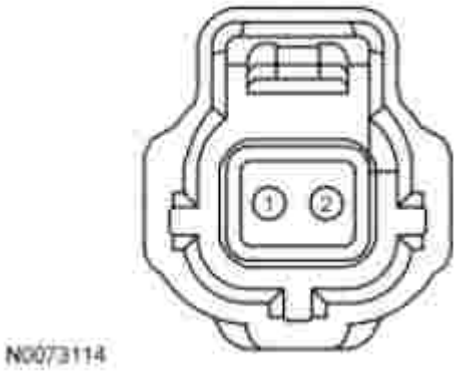

Fig. 90: Engine Coolant Temperature (ECT) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
1	ECT (Engine Coolant Temperature)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, Edge 2.7L, Fusion 2.7L, MKX 2.7L, MKZ 3.0L	198 PIN	E20 E37	SIGRTN ECT
EcoSport 1.0L Automatic Transmission	198 PIN	E20 E35	SIGRTN ECT
EcoSport 1.0L Manual Transmission, Fiesta 1.0L, Fiesta GTDI 1.6L	198 PIN	E10 E23	SIGRTN ECT
EcoSport 1.5L Automatic Transmission	198 PIN	E12 E33	SIGRTN ECT
EcoSport 1.5L Manual Transmission	112 PIN	E3 E23	SIGRTN ECT
Escape/Kuga 1.5L	198 PIN	E14 E59	SIGRTN ECT
F-150	306 PIN	E92 E29	SIGRTN ECT
Fiesta TiVCT 1.6L, Ranger	128 PIN	E3 E31	SIGRTN ECT
Focus 1.0L, Focus GTDI 2.0L, Focus 2.3L, Fusion 1.5L, MKZ 2.0L	198 PIN	E20 E36	SIGRTN ECT

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Vehicle	Connector	Pin	Circuit
Focus GDI 2.0L	154 PIN	E33 E12	SIGRTN ECT
KA	128 PIN	E15 E27	SIGRTN ECT
Mustang	198 PIN	E13 E38	SIGRTN ECT
All other vehicles	198 PIN	E20 E46	SIGRTN ECT

TEST PROCEDURE

DX1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

Are DTCs P0116, P0117, P0118, P0119, P011E, P0125, P0128, P1117, or P111B present?

Yes	No
For DTCs P0125, P0128 or P111B, GO to DX10. For all others, GO to DX2.	For symptoms without DTCs, GO to DX2. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

DX2 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. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

NOTE: **Verify cooling fan operation before proceeding with this test.**

- Check the cooling system for any loss of coolant or overheating concerns.

Is the cooling system OK?

Yes	No
GO to DX3.	REFER to the appropriate Engine Cooling article for cooling system diagnosis. Clear the PCM DTCs. REPEAT the self-test.

DX3 CHECK THE RESISTANCE OF THE ECT SENSOR WITH THE ENGINE OFF

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

- Ignition OFF.
- ECT Sensor connector disconnected.
- Measure the resistance between:

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

Is the resistance within specification?

Yes	No
GO to DX4.	INSTALL a new ECT sensor. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM), REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

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DX4 CHECK FOR AN OPEN CIRCUIT

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

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

Are the resistances less than 5 ohms?

Yes	No
GO to DX5.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DX5 CHECK FOR A SHORT CIRCUIT

- Measure the resistance between:

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

- Measure the resistance between:

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

Are the resistances greater than 10K ohms?

Yes	No
GO to DX6.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DX6 CHECK FOR A SHORT TO VOLTAGE

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

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

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to DX7.

DX7 INTERMITTENT CHECK

NOTE: **All PIDs may not be available on all vehicles.**

- Ignition OFF.
- PCM connector connected.
- ECT Sensor connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the ECT (TEMP) and ECT1 (TEMP) PIDs.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- Lightly tap on the ECT sensor and wiggle the harness and connector to simulate road shock.

Does the PID reading change?

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Yes	No
REPAIR as necessary or INSTALL a new ECT sensor. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM), REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DX8.

DX8 CHECK ENGINE COOLANT TEMPERATURE AND AMBIENT AIR TEMPERATURE CORRELATION

NOTE: **Check temperature values while engine is at ambient temperature, cold soak the engine for a minimum of 6 hours if necessary. Make sure the vehicle has not been in direct sunlight.**

NOTE: **All PIDs may not be available on all vehicles.**

- Access the PCM and monitor the AAT (TEMP), ECT (TEMP) and ECT1 (TEMP) PIDs.

Are the temperature readings within 18Â°C (32.2Â°F) of each other?

Yes	No
GO to DX9.	INSTALL a new ECT sensor. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM), REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DX9 CHECK THE ECT CIRCUIT VOLTAGE CYCLING INTEGRITY

NOTE: **All PIDs may not be available on all vehicles.**

- Ignition OFF.
- ECT Sensor connector disconnected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the ECT (TEMP) and ECT1 (TEMP) PIDs.
- Record the PID value.
- Connect a 5 amp fused jumper wire between the following:

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

- Record the PID value.

Does the PID value change when the jumper is connected?

Yes	No
INSTALL a new ECT sensor. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM), REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DX12.

DX10 CHECK FOR OTHER DTCS

- Carry out the PCM self-test.

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** .	GO to DX11.

DX11 CHECK FOR COOLING SYSTEM CONCERNS

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- Verify the engine cooling system is operating correctly. Refer to the appropriate Engine Cooling article.
- Check for:
  - the engine overheats
  - the engine does not reach normal operating temperature

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to DX12.

DX12 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.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS DY: ENGINE OIL TEMPERATURE (EOT) SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- engine overheating concerns
- vehicle driving conditions

TEST PROCEDURE

DY1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

Is DTC P0298 present?

Yes	No
GO to DY2.	RETURN to **SYMPTOM CHARTS** for further direction.

DY2 ENGINE OIL OVER TEMPERATURE CONDITION

NOTE: **The engine oil temperature protection strategy in the PCM has been activated. This protects the engine against mechanical damage due to overheating.**

- Check for an overheating condition and base engine concerns.

Are there any overheating or base engine concerns?

Yes	No

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Yes	No
ISOLATE the concern. REPAIR as necessary. REFER to the appropriate Engine Cooling article to diagnose the overheat symptom. Clear the PCM DTCs. REPEAT the self-test.	GO to DY3.

DY3 IDENTIFY THE CUSTOMER'S DRIVING HABITS

- Identify the customer's driving habits.
- Access the freeze frame data (if available) and record the DTC concern conditions.

Does the vehicle appear to have been driven in an incorrect transmission gear or at high RPM for an extended period?

Yes	No
ADVISE the customer that incorrect transmission gear selection and high RPM for an extended period initializes the engine protection strategy. Clear the PCM DTCs. REPEAT the self-test.	GO to DY4.

DY4 TYPE OF ENGINE COOLANT SENSOR

NOTE: **The PCM uses an oil algorithm to infer actual temperature based on input from the engine temperature sensor.**

Is the vehicle equipped with a cylinder head temperature (CHT) sensor?

Yes	No
GO to **PINPOINT TEST DL**.	GO to **PINPOINT TEST DX**.

PINPOINT TESTS DZ: UNIVERSAL HEATED OXYGEN SENSOR (HO2S)

INTRODUCTION

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.**

NOTE: **Only diagnose the suspect universal HO2S indicated by the DTC.**

This pinpoint test is intended to diagnose the following:

- universal HO2S (9Y460)
- harness circuits: UO2S, UO2SGREF, UO2SHTR, UO2SPC, UO2SPCT, and VPWR
- PCM (12A650)

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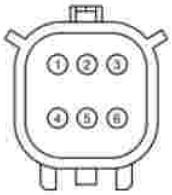
A



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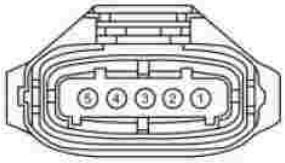

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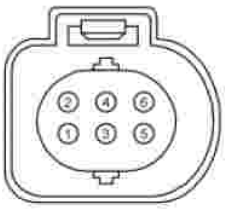

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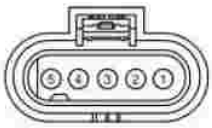

N0177516

E

N0164809

Fig. 91: Universal HO2S Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
Continental 3.7L, E-Series, Edge 3.5L, Explorer 3.7L, Explorer TiVCT 3.5L, F-650/F-750, F-Series Super Duty 6.8L, Flex TiVCT 3.5L, Fusion 2.5L, MKT 3.7L, MKX 3.7L, Motorhome/Stripped Chassis/Step Van, Mustang 5.2L, Taurus 3.7L, Taurus TiVCT 3.5L, Transit 3.7L, Transit Connect	A	6 1 5 4 2	UO2SPC VPWR UO2SGREF UO2S UO2SHTR
Escape/Kuga 2.5L	B	3 4 1 2 5	UO2SPC VPWR UO2SGREF UO2S UO2SHTR
Escape/Kuga 1.5L	C	6 2 4 1 5 3	UO2SPCT UO2SPC VPWR UO2SGREF UO2S UO2SHTR
F-150 3.3L, F-150 5.0L, Mustang 5.0L	D	3 4 1 2 5	UO2SPC VPWR UO2SGREF UO2S UO2SHTR
Fiesta GTDI 1.6L	E	5 1 4 2 6 3	UO2SPCT UO2SPC VPWR UO2SGREF UO2S UO2SHTR
All other vehicles	C	5 1 4 2 6 3	UO2SPCT UO2SPC VPWR UO2SGREF UO2S UO2SHTR

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, Edge 2.7L, Explorer GTDI 3.5L, Flex GTDI 3.5L, Ford GT, Fusion 2.7L, MKT 3.5L, MKX 2.7L, MKZ 3.0L, Taurus GTDI 3.5L, Transit 3.5L	198 PIN	E64 E62 E49 E47 E14 E15 E63 E61 E48 E46	UO2S11 UO2S21 UO2SGREF11 UO2SGREF21 UO2SHTR11 UO2SHTR21 UO2SPC11 UO2SPC21 UO2SPCT11 UO2SPCT21
Continental 3.7L, E-Series, Edge 3.5L, Explorer TiVCT 3.5L, Explorer 3.7L, F-650/F-750, F-Series Super Duty 6.8L, Flex TiVCT 3.5L, MKT 3.7L, MKX 3.7L, Motorhome/Stripped Chassis/Step Van, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L	198 PIN	E50 E51 E20 E21 E79 E84 E35 E36	UO2S11 UO2S21 UO2SGREF11 UO2SGREF21 UO2SHTR11 UO2SHTR21 UO2SPC11 UO2SPC21
EcoSport 1.0L Manual Transmission, Fiesta 1.0L, Fiesta GTDI 1.6L	198 PIN	E26 E25 E1 E39 E40	UO2S11 UO2SGREF11 UO2SHTR11 UO2SPC11 UO2SPCT11
Escape/Kuga 1.5L	198 PIN	E51 E37 E76 E52 E53	UO2S11 UO2SGREF11 UO2SHTR11 UO2SPC11 UO2SPCT11
Escape/Kuga 2.5L	198 PIN	E27 E26 E69 E23	UO2S11 UO2SGREF11 UO2SHTR11 UO2SPC11
Expedition, F-150 3.5L, Navigator	198 PIN	E64 E66 E49 E51 E44 E11 E62 E63 E47 E48	UO2S11 UO2S21 UO2SGREF11 UO2SGREF21 UO2SHTR11 UO2SHTR21 UO2SPC11 UO2SPC21 UO2SPCT11 UO2SPCT21

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Vehicle	Connector	Pin	Circuit
F-150 2.7L	306 PIN	T59 T60 T44 T45 T76 T46 T29 T30 T14 T15	UO2S11 UO2S21 UO2SGREF11 UO2SGREF21 UO2SHTR11 UO2SHTR21 UO2SPC11 UO2SPC21 UO2SPCT11 UO2SPCT21
F-150 3.3L, F-150 5.0L, Mustang 5.0L	306 PIN	T59 T60 T44 T45 T76 T46 T29 T30	UO2S11 UO2S21 UO2SGREF11 UO2SGREF21 UO2SHTR11 UO2SHTR21 UO2SPC11 UO2SPC21
F-Series Super Duty 6.2L	198 PIN	E50 E51 E20 E21 E79 E84 E35 E36 E65 E66	UO2S11 UO2S21 UO2SGREF11 UO2SGREF21 UO2SHTR11 UO2SHTR21 UO2SPC11 UO2SPC21 UO2SPCT11 UO2SPCT21
Fiesta TiVCT 1.6L	128 PIN	E7 E19 E47 E8 E20	UO2S11 UO2SGREF11 UO2SHTR11 UO2SPC11 UO2SPCT11
Focus GDI 2.0L	154 PIN	E89 E65 E72 E64 E88	UO2S11 UO2SGREF11 UO2SHTR11 UO2SPC11 UO2SPCT11
Fusion 2.5L, Transit Connect	198 PIN	E36 E21 E93 E6	UO2S11 UO2SGREF11 UO2SHTR11 UO2SPC11
Mustang 2.3L	198 PIN	E31 E32 E76 E33 E34	UO2S11 UO2SGREF11 UO2SHTR11 UO2SPC11 UO2SPCT11
Mustang 5.2L	198 PIN	E51 E50 E21 E20 E84 E79 E36 E35	UO2S11 UO2S21 UO2SGREF11 UO2SGREF21 UO2SHTR11 UO2SHTR21 UO2SPC11 UO2SPC21

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Vehicle	Connector	Pin	Circuit
All other vehicles	198 PIN	E64 E49 E14 E63 E48	UO2S11 UO2SGREF11 UO2SHTR11 UO2SPC11 UO2SPCT11

TEST PROCEDURE

DZ1 CHECK FOR DTCS

Are DTCs P0030, P0040, P0050, P0053, P0059, P0130, P0131, P0132, P0133, P0134, P0135, P0150, P0151, P0152, P0153, P0154, P0155, P1127, P164A, P164B, P2096, P2097, P2098, P2099, P2237, P2240, P2243, P2247, P2251, P2254, P2626, P2627, P2628, P2629, P2630, or P2631 present?

Yes	No
For DTC P0040, GO to DZ2. For DTC P1127, GO to DZ18. For DTCs P0133, P0153, P2096, P2097, P2098 or P2099, GO to DZ18. For DTCs P164A, P164B, P2626, P2627, P2628, P2629, P2630 or P2631, GO to DZ23. For all others, GO to DZ3.	For symptoms without DTCs, GO to DZ23. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

DZ2 CROSSED SENSOR WIRES

- Ignition OFF.
- Check the vehicle repair history.
- Verify the connectors are connected to the correct engine bank.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**.

DZ3 VISUALLY INSPECT THE UNIVERSAL HO2S HARNESS

- Ignition OFF.
- Visually inspect for:
  - pinched, shorted, and corroded wiring and pins
  - oil or water contamination
  - crossed sensor wires
  - damaged universal HO2S

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	For DTCs P0030 or P0050, GO to DZ4. For DTCs P0053, P0059, P0135 or P0155, GO to DZ7. For DTCs P0130, P0131, P0132, P0150, P0151, P0152, P2243, P2247, P2251 or P2254, GO to DZ12. For all others, GO to DZ16.

DZ4 CHECK FOR MISFIRE CONCERNS AND AFTERMARKET EQUIPMENT

- Ignition OFF.
- Check for the following:
  - misfire concern
  - non-factory or aftermarket equipment that may increase the exhaust temperature

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- Universal HO2S connector disconnected.
- Check the universal HO2S connector for damage or corrosion.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to DZ5.

DZ5 CHECK THE UO2SHTR CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) Universal HO2S Connector, Harness Side	(-)
UO2SHTR	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to DZ6.

DZ6 CHECK THE UO2S, UO2SGREF, UO2SHTR CIRCUITS FOR AN OPEN

- Ignition OFF.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2S	UO2S
UO2SGREF	UO2SGREF
UO2SHTR	UO2SHTR

Are the resistances less than 5 ohms?

Yes	No
GO to DZ7.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DZ7 CHECK FOR VPWR

- Ignition OFF.
- Universal HO2S connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Universal HO2S Connector, Harness Side	(-)
VPWR	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to DZ8.	REPAIR the open circuit. CHECK the fuses. Clear the PCM DTCs. REPEAT the self-test.

DZ8 CHECK THE UO2SHTR CIRCUIT FOR AN OPEN

- Ignition OFF.

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- Universal HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2SHTR	UO2SHTR

Is the resistance less than 5 ohms?

Yes	No
GO to DZ9.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DZ9 CHECK THE UO2SHTR CIRCUIT FOR A SHORT

NOTE: **This pinpoint test is designed to diagnose multiple circuits in the same test steps, only measure the circuits that apply to the vehicle being diagnosed.**

- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-)
UO2SHTR	Ground

- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) Universal HO2S Connector, Harness Side
UO2SHTR	UO2S
UO2SHTR	UO2SGREF
UO2SHTR	UO2SPC
UO2SHTR	UO2SPCT
UO2SHTR	VPWR

Are the resistances greater than 10K ohms?

Yes	No
GO to DZ10.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DZ10 CHECK THE INTERNAL RESISTANCE OF THE UNIVERSAL HO2S HEATER

- Measure the resistance between:

(+) Universal HO2S Connector, Component Side	(-) Universal HO2S Connector, Component Side
VPWR	UO2SHTR

Is the resistance between 1.8 - 6 ohms?

Yes	No
GO to DZ11.	INSTALL a new Universal HO2S. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DZ11 CHECK THE UO2SHTR CIRCUIT FOR AN INTERNAL SHORT TO GROUND

- Measure the resistance between:

(+) Universal HO2S Connector, Component Side	(-)

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(+) Universal HO2S Connector, Component Side	(-)
UO2SHTR	Ground

Is the resistance greater than 10K ohms?

Yes	No
For DTCs P0030 or P0050, GO to DZ12. For all others, GO to DZ28.	INSTALL a new Universal HO2S. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DZ12 CHECK THE UO2S AND UO2SGREF CIRCUITS FOR AN OPEN

- Ignition OFF.
- Universal HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2S	UO2S
UO2SGREF	UO2SGREF

Are the resistances less than 5 ohms?

Yes	No
GO to DZ13.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DZ13 CHECK THE UO2S, UO2SGREF, UO2SPC, AND UO2SPCT CIRCUITS FOR A SHORT TO GROUND

NOTE: **This pinpoint test is designed to diagnose multiple circuits in the same test steps, only measure the circuits that apply to the vehicle being diagnosed.**

- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-)
UO2S	Ground
UO2SGREF	Ground
UO2SPC	Ground
UO2SPCT	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to DZ14.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DZ14 CHECK THE UO2S, UO2SGREF, UO2SPC, AND UO2SPCT CIRCUITS FOR A SHORT TO VOLTAGE

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

(+) Universal HO2S Connector, Harness Side	(-)
UO2S	Ground
UO2SGREF	Ground
UO2SPC	Ground

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(+) Universal HO2S Connector, Harness Side	(-)
UO2SPCT	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to DZ15.

DZ15 CHECK THE UO2SGREF CIRCUIT FOR VOLTAGE

- Ignition OFF.
- PCM connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Universal HO2S Connector, Harness Side	(-)
UO2SGREF	Ground

Universal HO2S UO2SGREF Circuit Voltage

Vehicle	Voltage
Expedition, F-150, Mustang 2.3L, Mustang 5.0L, Navigator	7.5 - 7.8
E-Series 6.2L, F-Series Super Duty 6.2L	2 - 2.4
Continental 2.0L, Continental 2.7L, Continental 3.0L, EcoSport 2.0L, Edge 2.0L, Edge 2.7L, Escape/Kuga 1.5L, Escape/Kuga 2.0L, Explorer 2.3L, Explorer 3.5L GTDI, Fiesta, Flex 3.5L GTDI, Focus, Ford GT, Fusion 1.5L, Fusion 2.0L, Fusion 2.7L, MKC, MKS 3.5L, MKT 2.0L, MKT 3.5L, MKX 2.0L, MKX 2.7L, MKZ, Taurus 2.0L, Taurus 3.5L GTDI, Transit 3.5L	2.4 - 2.6
Continental 3.7L, E-Series 6.8L, Escape/Kuga 2.5L, Explorer 3.5L TiVCT, Explorer 3.7L, F-650/F-750, F-Series Super Duty 6.8L, Fusion 2.5L, MKX 3.7L, Motorhome/Stripped Chassis/Step Van, Mustang 5.2L, Transit 3.7L, Transit Connect	0.55 - 0.75
All others	3.5 - 3.7

Is the voltage within specification?

Yes	No
INSTALL a new Universal HO2S. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DZ28.

DZ16 CHECK THE UO2SPC CIRCUIT FOR AN OPEN

- Ignition OFF.
- Universal HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2SPC	UO2SPC

Is the resistance less than 5 ohms?

Yes	No

Yes	No
INSTALL a new Universal HO2S. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

DZ17 EXHAUST TEMPERATURE OUT OF RANGE

NOTE: **Diagnose all other powertrain related DTCs first.**

- Ignition ON, engine running.
- Engine at normal operating temperature.
- Access the PCM and monitor the HTR11 (MODE) and HTR21 (MODE) PIDs.

Are the PID states ON?

Yes	No
CARRY OUT the KOER self-test.	RUN the engine until the PID indicates ON. CARRY OUT the KOER self-test.

DZ18 CARRY OUT THE KOER SELF-TEST

- Engine at normal operating temperature.
- Carry out the PCM KOER self-test.

Are any DTCs present other than P0133, P0153, P2096, P2097, P2098, or P2099?

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** .	For DTCs P0133 or P0153, GO to DZ21. For all others, GO to DZ19.

DZ19 VISUALLY INSPECT THE UPSTREAM AND DOWNSTREAM HO2S CONNECTORS

- Ignition OFF.
- Universal HO2S connector disconnected.
- HO2S12 connector disconnected.
- HO2S22 connector disconnected.
- Check for a loose connection and damaged or corroded pins.

Is a concern present?

Yes	No
REPAIR as necessary. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DZ20.

DZ20 CHECK FOR LEAKS IN THE EXHAUST SYSTEM

- Visually inspect the exhaust system for the following:
  - exhaust leaks at flanges and gaskets
  - HO2S not tightened to specification
  - physical exhaust system concerns
  - aftermarket exhaust
  - punctures or cracks in the catalytic converter

Is a concern present?

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Yes	No
REPAIR as necessary. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	GO to DZ21.

DZ21 CHECK FOR POTENTIAL SENSOR CONTAMINATION CONCERNS

- Investigate the following items as potential sources of universal HO2S contamination:
  - use of unapproved silicon sealers
  - fuel contaminated by silicon additives
  - excessive oil consumption
  - 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. INSTALL a new Universal HO2S. REFER to the appropriate Electronic Engine Controls article. CHANGE the engine oil and oil filter. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	For DTCs P0133 or P0153, GO to DZ22. For all others, INSTALL a new Universal HO2S. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DZ22 CHECK THE UNIVERSAL HO2S RESPONSE TEST RESULTS

- Ignition ON, engine OFF.
- Access the diagnostic monitoring test results for the HO2S11 and HO2S21. Refer to **DIAGNOSTIC MONITORING TEST RESULTS MODE 6** .

Is the indicated value greater than the minimum threshold?

Yes	No
Unable to duplicate or identify the concern at this time. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new Universal HO2S. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DZ23 CHECK THE UO2SPCT CIRCUIT FOR AN OPEN CIRCUIT

- Ignition OFF.
- Universal HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2SPCT	UO2SPCT

Is the resistance less than 5 ohms?

Yes	No
For DTC P2626 or P2629 or symptoms without DTCs, GO to DZ27. For all others, GO to DZ24.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

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DZ24 CHECK THE UO2SPCT CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
UO2SPCT	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to DZ25.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

DZ25 CHECK THE UO2SPCT CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) Universal HO2S Connector, Harness Side	(-)
UO2SPCT	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to DZ26.

DZ26 CHECK THE RESISTANCE OF THE LABEL RESISTOR IN THE UNIVERSAL HO2S

- Measure the resistance between:

(+) Universal HO2S Connector, Component Side	(-) Universal HO2S Connector, Component Side
UO2SPCT	VPWR

Is the resistance between 3.5K - 999.9K ohms?

Yes	No
For DTCs P164A or P164B, unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**. For DTCs P2627, P2628, P2630 or P2631, GO to DZ28.	INSTALL a new Universal HO2S. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM), REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DZ27 CHECK THE RESISTANCE OF THE CURRENT TRIM RESISTOR IN THE UNIVERSAL HO2S

- Measure the resistance between:

(+) Universal HO2S Connector, Component Side	(-) Universal HO2S Connector, Component Side
UO2SPCT	UO2SPC

Is the resistance between 25 - 330 ohms?

Yes	No

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Yes	No
For DTCs P2626 or P2629, GO to DZ28. For all others, RETURN to **NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** for further direction.	INSTALL a new Universal HO2S. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM), REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

DZ28 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.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS EM: EMISSION COMPLIANCE

INTRODUCTION

NOTE: **Canada and some states or metropolitan areas in the United States require periodic emission, or inspection/maintenance (I/M) tests. All Ford products are designed to pass these tests. If a Ford product fails an I/M test the most likely causes are:**

- the engine or catalyst temperature was not warm and stabilized before the test.
- the vehicle 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.

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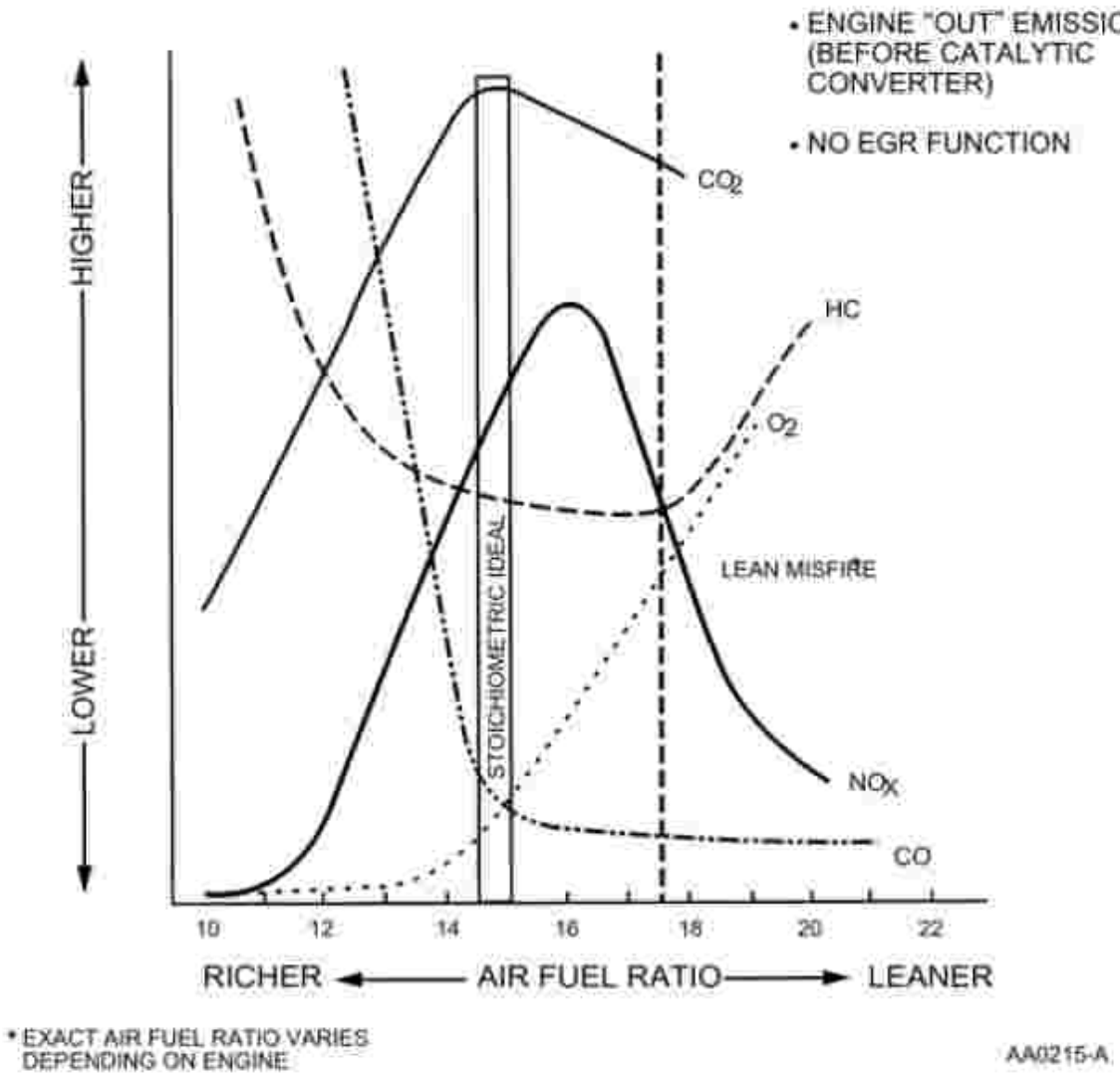

Fig. 92: Exhaust Gas Analysis Chart
Courtesy of FORD MOTOR CO.

Verifying an excessive grams per mile (gpm) indication using a parts per million (ppm) reading.

For excessive vehicle gas readings, 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 hydrocarbon (HC) produced by a vehicle is 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.

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- identify high and low gas readings.
- for reports that include a drive cycle, identify during which mode the gases 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)

Does the vehicle fail only an EVAP system leak or purge flow test (if these tests are carried out)?

Yes	No
This is an EVAP concern only. GO to EM22.	GO to EM3.

EM3 BASELINE THE VEHICLE

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. RETURN to **SYMPTOM CHARTS** for further direction. REFER to the Exhaust Gas Analysis Chart 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 for leaks and blockages
  - electrical connections
  - correct scheduled maintenance
  - Ford authorized emission controls and components installed on the vehicle

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- intake air tube and air cleaner concerns such as obstructions, leaks, or a dirty air cleaner element

Is a concern present?

Yes	No
REPAIR as necessary. After any repair, GO to EM26.	GO to EM6.

EM6 CARRY OUT THE PCM QUICK TEST

- Carry out the PCM Quick Test to access any PCM DTCs. For the procedure information, refer to **SYMPTOM CHARTS** .

Is a concern present?

Yes	No
FOLLOW the 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?

Yes	No
CHECK for the engine running rich and incomplete combustion. GO to EM11.	GO to EM12.

EM11 CHECK THE SECONDARY IGNITION SYSTEM

- For ignition coil on plug (COP) equipped vehicles, GO to JB3 and follow the pinpoint test direction.
- For ignition coil pack equipped vehicles, GO to JC3 and follow the pinpoint test direction.

Is a concern present?

Yes	No

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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 concern present?

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to EM26.	GO to EM13.

EM13 CHECK FOR VACUUM LEAKS OR OBSTRUCTIONS IN THE PCV SYSTEM (SUCH AS OIL CAP, PCV VALVE, HOSES, CUT GROMMETS, VALVE COVER BOLT TORQUE OR GASKET LEAK)

- GO to HG2 and follow the pinpoint test direction.

Is a concern present?

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to EM26.	GO to EM14.

EM14 CHECK THE EXHAUST SYSTEM

- GO to HF2 and follow the pinpoint test direction.

Is a concern present?

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to EM26.	GO to EM15.

EM15 CHECK THE BASE ENGINE

- Check for base engine concerns. Refer to the appropriate Engine System article.

Is a concern present?

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 concern present?

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to EM26.	GO to EM17.

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EM17 CHECK THE SECONDARY IGNITION

- For ignition coil on plug (COP) equipped vehicles, GO to JB3 and follow the pinpoint test direction.
- For ignition coil pack equipped vehicles, GO to JC3 and follow the pinpoint test direction.

Is a concern present?

Yes	No
FOLLOW the pinpoint test direction. After any repair, GO to EM26.	GO to EM18.

EM18 CHECK FOR VACUUM LEAKS OR OBSTRUCTIONS IN THE PCV SYSTEM (SUCH AS OIL CAP, PCV VALVE, HOSES, CUT GROMMETS, VALVE COVER BOLT TORQUE OR GASKET LEAK)

- GO to HG2 and follow the pinpoint test direction.

Is a concern present?

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, incorrect compression, or valvetrain or camshaft damage. Refer to the appropriate Engine System article to carry out the intake manifold vacuum test, compression test, and valve train analysis.

Is a concern present?

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 the appropriate Engine System article to diagnose the abnormal combustion.

Is a concern present?

Yes	No
REPAIR as necessary. After any repair, GO to EM26.	GO to EM21.

EM21 ADDITIONAL CHECKS

- Check the following:
  - transmission torque converter clutch operation
  - 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

Is a concern present?

Yes	No

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Yes	No
REPAIR as necessary. After any repair, GO to EM26.	GO to EM27.

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 (if equipped)
  - capless fuel tank filler pipe (if equipped)
  - EVAP system lines and hoses for correct connections, damage or blockage
  - fuel vapor storage canister damage

Is a concern present?

Yes	No
REPAIR as necessary. After any repair, GO to EM25.	GO to EM23.

EM23 CARRY OUT THE PCM QUICK TEST

- Carry out the PCM Quick Test to access any PCM DTCs. For the procedure information, refer to **SYMPTOM CHARTS** .

Is a concern present?

Yes	No
FOLLOW the Quick Test direction. After any repair, GO to EM25.	GO to EM24.

EM24 EVAP SYSTEM CHECK

- Check the EVAP system for leaks. GO to **PINPOINT TEST HX** and follow the pinpoint test direction.

Is a concern present?

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, RETURN to **SYMPTOMS CHARTS** for further direction. 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)** .

  This resets 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. For the procedure information, refer to **SYMPTOM CHARTS** .
- Carry out the EVAP system leak test and flow check.

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Does the vehicle pass the EVAP system leak test and flow check?

Yes	No
SAVE any repair documentation that may be required by local or 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 miles) 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)** .

  This resets 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. For the procedure information, refer to **SYMPTOM CHARTS** . 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 or 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.
- Ignition OFF.
- Disconnect and ground 1 spark plug wire from each cylinder bank (for coil on plug applications, disconnect the 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 28Â°C (50Â°F) between its inlet and outlet reading?

Yes	No

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Yes	No
The catalytic converter is operating correctly. CONNECT the spark plug wires. CLEAR the DTCs. VERIFY the test step results. If all test steps are OK, GO to **PINPOINT TEST Z**. For additional symptoms, RETURN to **SYMPTOMS CHARTS** for further direction. After any repair, GO to EM26.	For catalytic converters that have less than 28Â° C (50Â°F) difference, testing indicates the catalytic converter 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 TESTS FA: AMBIENT AIR TEMPERATURE (AAT) SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- AAT sensor
- harness circuits: AAT and SIGRTN
- PCM (12A650)

Ambient Air Temperature (AAT) Sensor Expected Values

Temperature		AAT Sensor Values
Â°C	Â°F	Resistance (K ohms)
-1.1 to 4.4	30 to 40	8.14 to 9.85 (Focus), 27.49 to 33.47 (All Others)
4.4 to 10	40 to 50	6.01 to 8.14 (Focus), 22.06 to 28.86 (All Others)
10 to 15.6	50 to 60	4.90 to 6.01 (Focus), 16.63 to 23.10 (All Others)
15.6 to 21.1	60 to 70	3.79 to 4.90 (Focus), 11.74 to 17.32 (All Others)
21.1 to 26.7	70 to 80	2.86 to 3.79 (Focus), 9.34 to 12.14 (All Others)
26.7 to 32.2	80 to 90	2.34 to 2.86 (Focus), 8.49 to 9.62 (All Others)
32.2 to 37.8	90 to 100	1.81 to 2.34 (Focus), 5.93 to 7.87 (All Others)
37.8 to 43.3	100 to 110	1.43 to 1.82 (Focus), 4.78 to 6.11 (All Others)

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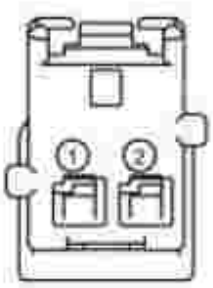
A



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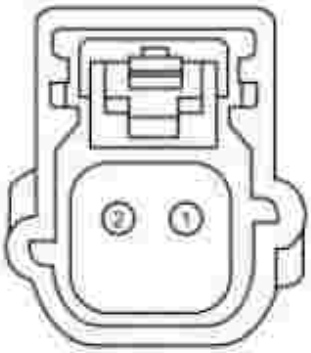

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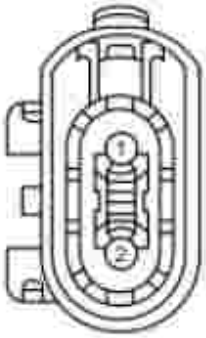

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Fig. 93: Ambient Air Temperature (AAT) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
F-Series Super Duty	A	2 1	SIGRTN AAT
Ranger	B	1 2	SIGRTN AAT
Transit	C	2 1	SIGRTN AAT
All other vehicles	B	2 1	SIGRTN AAT

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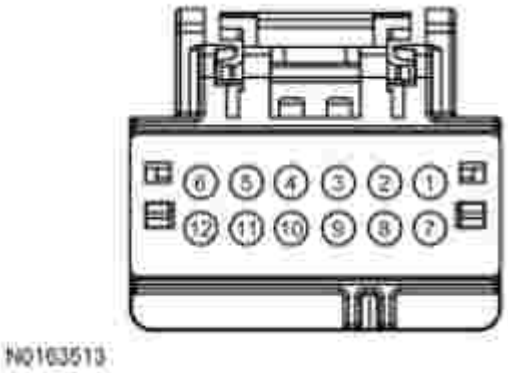

Fig. 94: Right Exterior Rear View Mirror Assembly Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
10	SIGRTN (Signal Return)
9	AAT (Ambient Air Temperature)

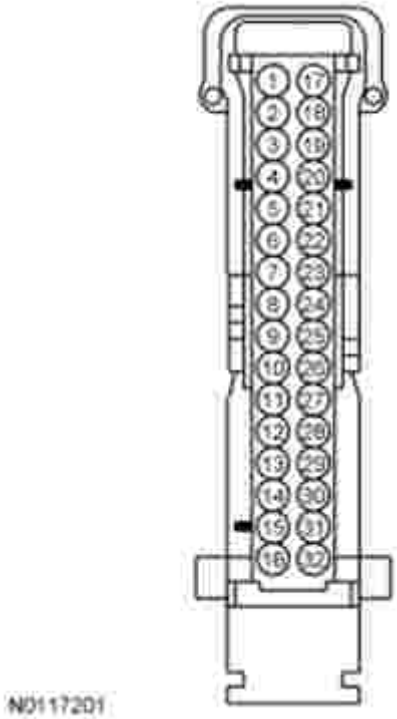

Fig. 95: Instrument Panel Cluster (IPC) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
19	SIGRTN (Signal Return)
20	AAT (Ambient Air Temperature)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
Continental 3.7L, Edge 3.5L, Explorer TiVCT 3.5L, Explorer 3.7L, F-Series Super Duty, Flex TiVCT 3.5L, MKT 3.7L, MKX 3.7L, Mustang 5.2L, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L	198 PIN	B51 B47	SIGRTN AAT
EcoSport 1.0L Manual Transmission	198 PIN	B34 B51	SIGRTN AAT
EcoSport 1.5L Automatic Transmission	198 PIN	B15 B47	SIGRTN AAT
EcoSport 1.5L Manual Transmission	112 PIN	B8 B20	SIGRTN AAT
Escape/Kuga 1.5L	198 PIN	B24 B72	SIGRTN AAT
Escape/Kuga 2.5L, Fusion 2.5L	198 PIN	B33 B47	SIGRTN AAT
Expedition, F-150 3.5L, Navigator	198 PIN	B30 B51	SIGRTN AAT
F-150 2.7L, F-150 3.3L, F-150 5.0L	306 PIN	B43 B84	SIGRTN AAT
Focus GDI 2.0L	154 PIN	B34 B35	SIGRTN AAT
KA	128 PIN	T20 T2	SIGRTN AAT
Mustang 2.3L	198 PIN	B36 B31	SIGRTN AAT
Mustang 5.0L	306 PIN	B26 B84	SIGRTN AAT
Ranger	128 PIN	B33 B45	SIGRTN AAT
Transit Connect	198 PIN	B30 B47	SIGRTN AAT
All other vehicles	198 PIN	B18 B51	SIGRTN AAT

TEST PROCEDURE

FA1 CHECK FOR DTCS

Are DTCs P0071, P0072, P0073 or P0074 present?

Yes	No
GO to FA2.	RETURN to **SYMPTOM CHARTS** for further direction.

FA2 CHECK FOR AN OPEN

- Ignition OFF.
- For Fiesta,
- AAT Sensor connector disconnected.
- IPC connector disconnected.

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- Measure the resistance between:

(+) AAT Sensor Connector, Harness Side	(-) IPC Connector, Harness Side
AAT	AAT - Pin 20
SIGRTN	SIGRTN - Pin 19

- For Focus,
- Right Exterior Rear View Mirror Assembly connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Right Exterior Rear View Mirror Assembly Connector, Harness Side	(-) PCM Connector, Harness Side
AAT - Pin 9	AAT
SIGRTN - Pin 10	SIGRTN

- For all others,
- AAT Sensor connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) AAT Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
AAT	AAT
SIGRTN	SIGRTN

Are the resistances less than 5 ohms?

Yes	No
GO to FA3.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

FA3 CHECK FOR A SHORT TO GROUND

- For Focus,
- Measure the resistance between:

(+) Right Exterior Rear View Mirror Assembly Connector, Harness Side	(-)
AAT - Pin 9	Ground

- For all others,
- Measure the resistance between:

(+) AAT Sensor Connector, Harness Side	(-)
AAT	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to FA4.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

FA4 CHECK FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For Focus,
- Measure the voltage between:

(+) Right Exterior Rear View Mirror Assembly Connector, Harness Side	(-)

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(+) Right Exterior Rear View Mirror Assembly Connector, Harness Side	(-)
AAT - Pin 9	Ground
SIGRTN - Pin 10	Ground

- For all others,
- Measure the voltage between:

(+) AAT Sensor Connector, Harness Side	(-)
AAT	Ground
SIGRTN	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to FA5.

FA5 INTERMITTENT CHECK

- Ignition OFF.
- For Fiesta,
- IPC connector connected.
- For all others,
- PCM connector connected.
- For Focus,
- Right Exterior Rear View Mirror Assembly connector connected.
- For all others,
- AAT Sensor connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the AAT_V (VOLT) PID.
- While observing the PID, carry out the following:
  - Wiggle the harness from the sensor to the module.
  - Wiggle the connectors and make sure they seat correctly.
  - Look for sudden changes in the PID value when the harness and connector are wiggled.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to FA6.

FA6 CHECK THE RESISTANCE OF THE AAT SENSOR

NOTE: **Verify the external temperature of the sensor is at ambient temperature. Refer to the chart at the beginning of this test for the temperature and resistance values.**

- Ignition OFF.
- For Focus,
- Right Exterior Rear View Mirror Assembly connector disconnected.
- Measure the resistance between:

(+) Right Exterior Rear View Mirror Assembly Connector, Component Side	(-) Right Exterior Rear View Mirror Assembly Connector, Component Side
AAT - Pin 9	SIGRTN - Pin 10

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- For all others,
- AAT Sensor connector disconnected.
- Measure the resistance between:

(+) AAT Sensor Connector, Component Side	(-) AAT Sensor Connector, Component Side
AAT	SIGRTN

Is the resistance within specification?

Yes	No
For Fiesta, GO to FA7. For all others, The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.	For Focus, INSTALL a new Right Exterior Rear View Mirror. REFER to the appropriate Rear View Mirrors article. For all others, INSTALL a new AAT sensor. REFER to the appropriate Climate Control article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . Clear the PCM DTCs. REPEAT the self-test.

FA7 CHECK FOR CORRECT INSTRUMENT PANEL CLUSTER (IPC) OPERATION

- Disconnect all the IPC connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the IPC connectors and make sure they seat correctly.
- Operate the system and verify the concern is still present.

Is the concern still present?

Yes	No
INSTALL a new IPC. REFER to the appropriate Instrumentation, Message Center, And Warning Chimes article.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS FB: POWER TAKE OFF (PTO)

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- PTO switch
- PCM (12A650)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Pin	Circuit
Transit 3.5L	B33 B80 B91 B87	PTORPM PTOIL PTOENG PTO
All other vehicles	B85 B98 B88 B84	PTORPM PTOIL PTOENG PTO

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TEST PROCEDURE

FB1 PTO INDICATOR LAMP

Did you come to this pinpoint test for an always on/never on PTO indicator?

Yes	No
GO to FB5.	GO to FB2.

FB2 PTO NOT WORKING CORRECTLY: CHECK THE PTO INDICATOR LAMP OPERATION

NOTE: **The following conditions must be met before the PTO engages:**

- engine at normal operating temperature
- accelerator pedal is released
- transmission fluid temperature (TFT) within normal operating temperature
- parking brake is applied
- brake pedal is released
- automatic transmission is in the PARK position
- manual transmission - the clutch pedal is released

NOTE: **This step requires operating the PTO component. Refer to the aftermarket manufacturer for the PTO operating instructions. Follow all safety precautions.**

- Ignition ON, engine running.
- Activate the PTO switch.

Does the PTO indicator illuminate?

Yes	No
GO to the aftermarket PTO mechanical manual.	GO to FB3.

FB3 CHECK THE INTEGRITY OF THE PTO SWITCH AND THE PTO SWITCH CIRCUIT

- Access the PCM and monitor the PTO_STATUS (MODE) PID.
- Cycle the PTO switch, from off to on to off.

Does the PTO PID change state?

Yes	No
GO to FB4.	REPAIR the PTO circuit or switch as necessary. Clear the PCM DTCs. REPEAT the self-test.

FB4 CHECK THE PTOIR_V PID STATE IN THE PCM

NOTE: **The PTOIR_V PID represents an analog input which reflects the user requested engine speed.**

- Access the PCM and monitor the PTOIR_V (VOLT) PID.
- Cycle the PTO switch,

Does the PTOIR_V PID change state?

Yes	No
GO to FB5.	REPAIR the PTO RPM circuit or switch as necessary. Clear the PCM DTCs. REPEAT the self-test.

FB5 CHECK THE PTOIL PID STATE IN THE PCM

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- Access the PCM and monitor the PTOIL (MODE) PID.
- Cycle the PTO switch,

Does the PTOIL PID change state?

Yes	No
GO to the aftermarket PTO mechanical manual.	REPAIR the circuit as necessary. Clear the PCM DTCs. REPEAT the self-test.

PINPOINT TESTS FD: BRAKE PEDAL INPUTS

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- brake pedal position (BPP) switch (13480)
- harness circuits: B+, BPP, BPS and BPS1
- PCM (12A650)

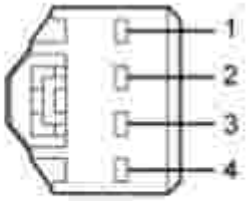

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Fig. 96: Brake Pedal Position (BPP) Switch Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series, EcoSport, Escape/Kuga, Focus, Ford GT, Motorhome/Stripped Chassis/Step Van, Transit Connect	A	2 3	GND BPS
All other vehicles	A	3 2	GND BPS

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
Continental 3.7L, E-Series, Edge 3.5L, Explorer TiVCT 3.5L, Explorer 3.7L, F-650/F-750, F-Series Super Duty, Flex TiVCT 3.5L, MKT 3.7L, MKX 3.7L, Motorhome/Stripped Chassis/Step Van, Mustang 5.2L, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L	198 PIN	B66 B67	BPS BPP
EcoSport 1.5L Automatic Transmission, Escape/Kuga 2.5L, Transit Connect	198 PIN	B12 B14	BPS BPP
EcoSport 1.5L Manual Transmission	112 PIN	B35 B34	BPS BPP
Escape/Kuga 1.5L	198 PIN	B71 B33	BPS BPP
Expedition, F-150 3.5L, Navigator	198 PIN	B28 B48	BPS BPP
F-150 2.7L, F-150 3.3L, F-150 5.0L	306 PIN	B23 B8	BPS BPP
Fiesta 1.0L, Fiesta GTDI 1.6L	198 PIN	B66	BPP
Fiesta TiVCT 1.6L	128 PIN	B2	BPP
Focus GDI 2.0L	154 PIN	B16 B30	BPS BPP
Fusion 2.5L	198 PIN	B46 B13	BPS BPP
KA	128 PIN	B2 B14	BPS BPP
Mustang 2.3L	198 PIN	B11 B10	BPS BPP
Mustang 5.0L	306 PIN	B8 B23	BPS BPP
Ranger	128 PIN	B3 B2	BPS BPP
All other vehicles	198 PIN	B65 B66	BPS BPP

TEST PROCEDURE

FD1 CHECK FOR DTCS

Are DTCs P0504, P0571, P0572, P0573, P05FF, P0703, P1572 or P1703 present?

Yes	No
For KOER DTCs P0571, P05FF, P0703 or P1703, GO to FD2. For all others, GO to FD3.	RETURN to **SYMPTOM CHARTS** for further direction.

FD2 VERIFY THE BRAKE PEDAL WAS APPLIED

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Was the brake pedal applied and released during the KOER self-test?

Yes	No
GO to FD3.	REPEAT the KOER self-test. APPLY and RELEASE the brake pedal during the KOER test. Clear the PCM DTCs. REPEAT the self-test.

FD3 CHECK THE OPERATION OF THE STOPLAMPS

- Ignition 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 the appropriate Exterior Lighting article, to diagnose all the stoplamps are inoperative. Clear the PCM DTCs. REPEAT the self-test.

FD4 CHECK THE BPP SWITCH OPERATION

- Ignition ON, engine OFF.
- Access the PCM and monitor the BOO1 (MODE) PID.
- Apply and release the brake pedal while monitoring the brake position PID.

Does the PID cycle ON and OFF?

Yes	No
For Fiesta, GO to FD12. For all others, GO to FD6.	GO to FD5.

FD5 CHECK FOR BPP CIRCUIT CYCLING

- Ignition OFF.
- PCM connector disconnected.
- Ignition ON, engine OFF.
- Apply and release the brake pedal while monitoring the voltage.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
BPP	Ground

Is voltage less than 1 volt with the brake pedal released and greater than 10.5 volts with the brake pedal fully applied?

Yes	No
For Fiesta, GO to FD12. For all others, GO to FD6.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

FD6 CHECK BPS CIRCUIT CONTINUITY

- PCM connector disconnected.
- BPP Switch connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) BPP Switch Connector, Harness Side
BPS	BPS

Is the resistance less than 5 ohms?

Yes	No

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Yes	No
GO to FD7.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

FD7 CHECK THE BPS CIRCUIT

- Measure the resistance between:

(+) BPP Switch Connector, Harness Side	(-)
BPS	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to FD8.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

FD8 CHECK THE BPS CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) BPP Switch Connector, Harness Side	(-)
BPS	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to FD9.

FD9 CHECK THE SIGRTN OR GND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure the resistance between:

(+) BPP Switch Connector, Harness Side	(-)
GND	Ground

Is the resistance less than 5 ohms?

Yes	No
GO to FD10.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

FD10 CHECK THE CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) BPP Switch Connector, Harness Side	(-)
GND	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to FD11.

FD11 CHECK THE BPP SWITCH

- Measure the resistance between:

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(+) BPP Switch Connector, Component Side	(-) BPP Switch Connector, Component Side
BPS	GND

Is the resistance less than 5 ohms with brake pedal released and greater than 10K ohms with the brake pedal pressed?

Yes	No
GO to FD12.	INSTALL a new BPP switch. Clear the PCM DTCs. REPEAT the self-test.

FD12 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.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS H: FUEL CONTROL

INTRODUCTION

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.**

This pinpoint test is intended to diagnose the following:

- HO2S (9G444)
- universal HO2S (9Y460)
- fuel injectors (9F593)
- harness circuits: HO2S12, HO2S22, HTR12, HTR22, SIGRTN, UO2SPC and VPWR
- vacuum systems
- PCM (12A650)

For additional information on heated oxygen sensor (HO2S), refer to **CATALYST AND EXHAUST SYSTEMS** .

Heated Oxygen Sensor Bank 1, Sensor 2 (HO2S12) Connector

The pin numbering for the connector is in reference to the connector lock tab. Not all connector key combinations are shown.

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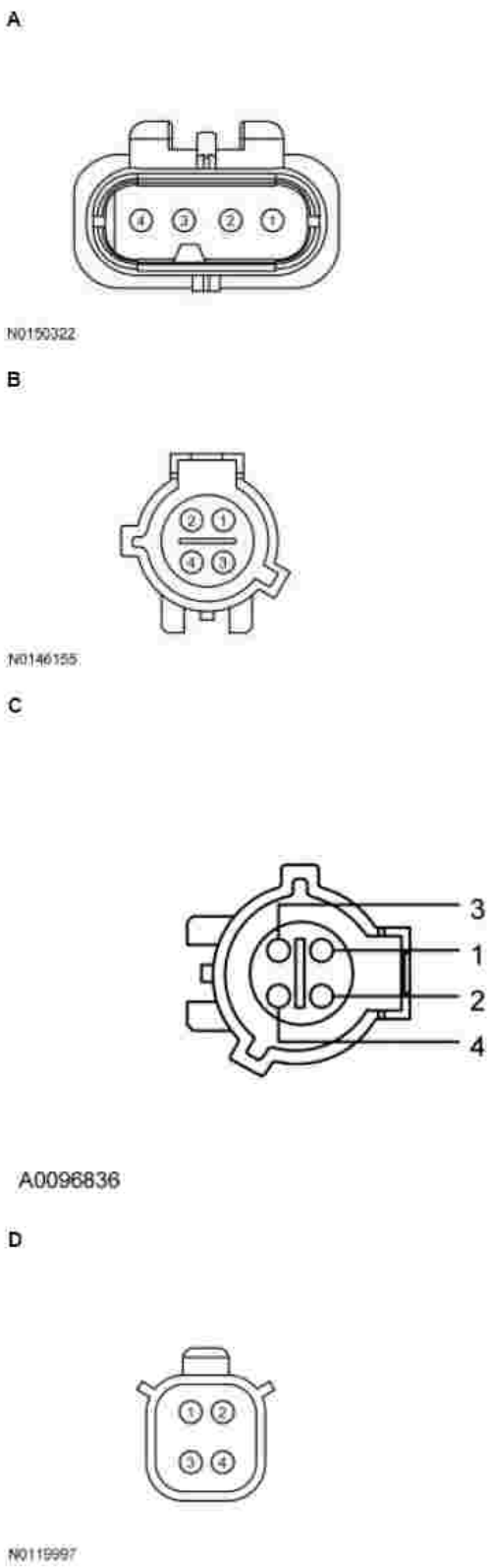

Fig. 97: Heated Oxygen Sensor Bank 1, Sensor 2 (HO2S12) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 2.0L, Edge 2.0L, Escape/Kuga 1.5L, Expedition, Explorer 2.3L, Focus 1.0L, Focus 2.3L, Ford GT, Fusion 1.5L, MKX 2.0L, Navigator	A	2 1 3 4	HTR12 VPWR SIGRTN HO2S12

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Vehicle	Connector	Pin	Circuit
EcoSport, F-150, Mustang 2.3L, Mustang 5.0L	A	1 2 3 4	HTR12 VPWR SIGRTN HO2S12
Fiesta GTDI 1.6L	B	2 1 3 4	HTR12 VPWR SIGRTN HO2S12
Fiesta TiVCT 1.6L	C	1 2 4 3	HTR12 VPWR SIGRTN HO2S12
KA 1.5L	C	2 1 4 3	HTR12 VPWR SIGRTN HO2S12
All other vehicles	D	2 1 3 4	HTR12 VPWR SIGRTN HO2S12

Heated Oxygen Sensor Bank 2, Sensor 2 (HO2S22) Connector

The pin numbering for the connector is in reference to the connector lock tab. Not all connector key combinations are shown.

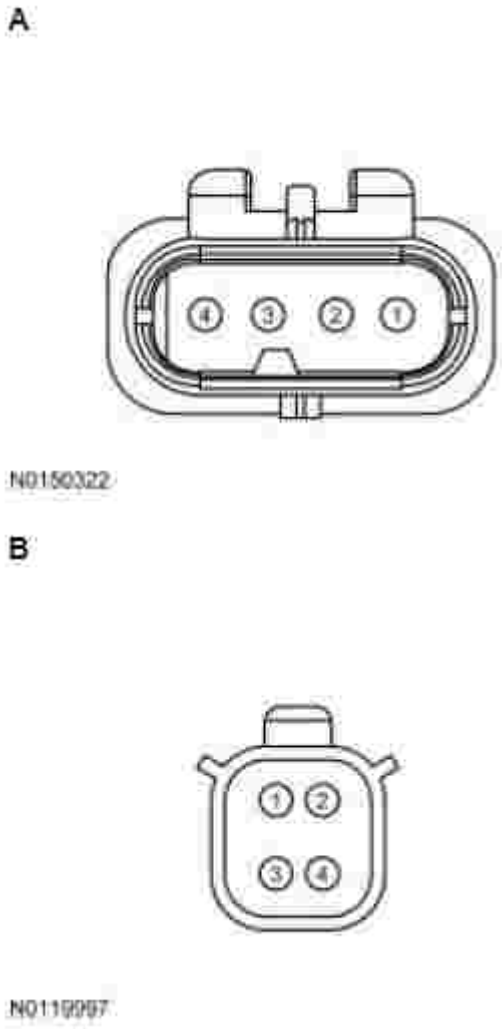

Fig. 98: Heated Oxygen Sensor Bank 2, Sensor 2 (HO2S22) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
Expedition, Ford GT, Navigator	A	2 1 3 4	HTR22 VPWR SIGRTN HO2S22
F-150, Mustang 5.0L	A	1 2 3 4	HTR22 VPWR SIGRTN HO2S22
All other vehicles	B	2 1 3 4	HTR22 VPWR SIGRTN HO2S22

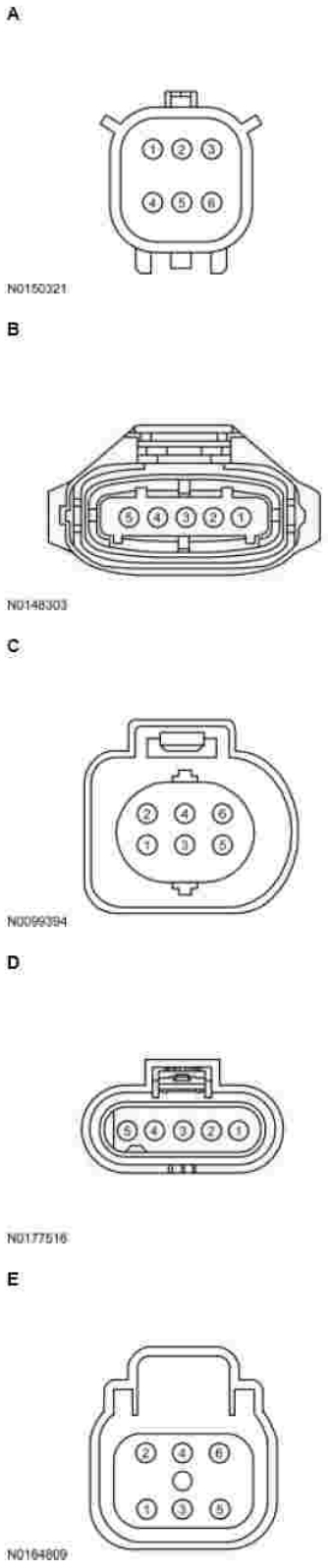

Fig. 99: Universal HO2S Connector
Courtesy of FORD MOTOR CO.

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Vehicle	Connector	Pin	Circuit
Continental 3.7L, E-Series, Edge 3.5L, Explorer 3.7L, Explorer TiVCT 3.5L, F-650/F-750, F-Series Super Duty 6.8L, Flex TiVCT 3.5L, Fusion 2.5L, MKT 3.7L, MKX 3.7L, Motorhome/Stripped Chassis/Step Van, Mustang 5.2L, Taurus 3.7L, Taurus TiVCT 3.5L, Transit 3.7L, Transit Connect	A	6	UO2SPC
Escape/Kuga 2.5L	B	3	UO2SPC
Escape/Kuga 1.5L	C	2	UO2SPC
F-150 3.3L, F-150 5.0L, Mustang 5.0L	D	3	UO2SPC
Fiesta GTDI 1.6L	E	1	UO2SPC
All other vehicles	C	1	UO2SPC

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, Edge 2.7L, Explorer GTDI 3.5L, Flex GTDI 3.5L, Ford GT, Fusion 2.7L, MKT 3.5L, MKX 2.7L, MKZ 3.0L, Taurus GTDI 3.5L, Transit 3.5L	198 PIN	E61 E63 B61 B37 B56 B101, B102, B103 B1 B38 B57	UO2SPC21 UO2SPC11 HTR22 SIGRTN HO2S22 VPWR HTR12 SIGRTN HO2S12
Continental 3.7L, E-Series, Edge 3.5L, Explorer TiVCT 3.5L, Explorer 3.7L, F-Series Super Duty 6.2L, Flex TiVCT 3.5L, MKT 3.7L, MKX 3.7L, Motorhome/Stripped Chassis/Step Van, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L	198 PIN	E36 E35 E83 B90 B91 B97, B99 E78 B71 B72	UO2SPC21 UO2SPC11 HTR22 SIGRTN HO2S22 VPWR HTR12 SIGRTN HO2S12

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Vehicle	Connector	Pin	Circuit
EcoSport 1.0L Manual Transmission, Fiesta 1.0L, Fiesta GTDI 1.6L	198 PIN	E39 B101, B102, B103 B1 B37 B57	UO2SPC11 VPWR HTR12 SIGRTN HO2S12
EcoSport 1.5L Automatic Transmission	198 PIN	B97, B99 E92 B53 B72	VPWR HTR12 SIGRTN HO2S12
EcoSport 1.5L Manual Transmission	112 PIN	B55, B56 E49 E1 E14	VPWR HTR12 SIGRTN HO2S12
Escape/Kuga 1.5L	198 PIN	E52 B101, B102, B103 B100 B73 B74	UO2SPC11 VPWR HTR12 SIGRTN HO2S12
Escape/Kuga 2.5L	198 PIN	E23 B97, B99 E92 B71 E72	UO2SPC11 VPWR HTR12 SIGRTN HO2S12
Expedition, F-150 3.5L, Navigator	198 PIN	E63 E62 B78 B94 B95 B101, B102, B103 B1 B75 B76	UO2SPC21 UO2SPC11 HTR22 SIGRTN HO2S22 VPWR HTR12 SIGRTN HO2S12
F-150 2.7L, F-150 3.3L, F-150 5.0L, Mustang 5.0L	306 PIN	T30 T29 T16 T85 T26 B1, B16, B2 T77 T84 T10	UO2SPC21 UO2SPC11 HTR22 SIGRTN HO2S22 VPWR HTR12 SIGRTN HO2S12
F-650/F-750, F-Series Super Duty 6.8L	198 PIN	E36 E35 B97, B99 E78 B71 B72	UO2SPC21 UO2SPC11 VPWR HTR12 SIGRTN HO2S12
Fiesta TiVCT 1.6L	128 PIN	E8 B11, B12, E13, E37 E35 E9 E21	UO2SPC11 VPWR HTR12 SIGRTN HO2S12
Focus GDI 2.0L	154 PIN	E64 B5, B6 B20 B21 B48	UO2SPC11 VPWR HTR12 SIGRTN HO2S12

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Vehicle	Connector	Pin	Circuit
Focus GTDI 2.0L	198 PIN	E63 B101, B102, B103 B1 B37 B56	UO2SPC11 VPWR HTR12 SIGRTN HO2S12
Fusion 2.5L, Transit Connect	198 PIN	E6 B97, B99 E92 B71 B72	UO2SPC11 VPWR HTR12 SIGRTN HO2S12
KA	128 PIN	B36, E24 E36 E8 E19	VPWR HTR12 SIGRTN HO2S12
MKC	198 PIN	E63 B101, B102, B103 B1 B38 B56	UO2SPC11 VPWR HTR12 SIGRTN HO2S12
Mustang 2.3L	198 PIN	E33 B101, B102, B103 E81 E13 E26	UO2SPC11 VPWR HTR12 SIGRTN HO2S12
Mustang 5.2L	198 PIN	E35 E36 E83 B90 B91 B97, B99 E78 B71 B72	UO2SPC21 UO2SPC11 HTR22 SIGRTN HO2S22 VPWR HTR12 SIGRTN HO2S12
Ranger	128 PIN	B11, B12 E47 E9 E20	VPWR HTR12 SIGRTN HO2S12
All other vehicles	198 PIN	E63 B101, B102, B103 B1 B38 B57	UO2SPC11 VPWR HTR12 SIGRTN HO2S12

TEST PROCEDURE

H1 CHECK FOR DTCS

Are DTCs P0171, P0172, P0174, P0175, P1137, P1138, P1157, P1158, P2195, P2196, P2197, P2198, P219A, P219B, P219C, P219D, P219E, P219F, P21A0, P21A1, P2270, P2271, P2272, P2273, P2BEC, P2BED, P2BEE, P2BEF, P2BF0, P2BF1, P2BF2 or P2BF3 present?

Yes	No
For DTCs P1137, P1138, P1157, P1158, P2270, P2271, P2272 or P2273, GO to H3. For all others, GO to H2.	RETURN to **SYMPTOM CHARTS** for further direction.

H2 RICH OR LEAN SYSTEM DTCS

NOTE: **All PIDs may not be available on all vehicles.**

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NOTE: **Do not clear the DTCs or reset the keep alive memory (KAM).**

- Access the PCM and record the ECT or ECT1 PID from the freeze frame data. The freeze frame data is used to recreate the concern.
- Carry out the PCM self-test.

Are any DTCs present other than the following: P0171, P0172, P0174, P0175, P2195, P2196, P2197, P2198, P219A, P219B, P219C, P219D, P219E, P219F, P21A0, P21A1, P2BEC, P2BED, P2BEE, P2BEF, P2BF0, P2BF1, P2BF2 or P2BF3 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 H3.

H3 CARRY OUT A VISUAL INSPECTION

- Ignition OFF.
- Check the air filter element and housing for restrictions.
- Inspect the entire air intake system from the mass airflow (MAF) sensor to the intake manifold for leaks such as:
  - hoses connecting to the MAF sensor assembly
  - cracked or punctured intake air tube
  - loose connections on the intake air tube at the air cleaner housing or throttle body
  - hoses connecting to the throttle body
  - obstructions, restrictions, or damage
- Check the throttle plate for obstructions or sludge.
- Inspect the entire length of all the vacuum hoses for:
  - correct connections
  - damage or cracks
  - damaged or cracked vacuum tees
- Inspect the intake manifold or gasket for leaks.
- Inspect the exhaust gas recirculation (EGR) system for leaks such as:
  - EGR valve gasket leak to intake manifold
  - EGR valve diaphragm or control solenoid
- Verify the integrity of the positive crankcase ventilation (PCV) system.
- Verify the correct PCV valve part number, (if equipped).
- Inspect the exhaust system for leaks at flanges and gaskets.
- Visually inspect the HO2S for:
  - pinched, shorted, and corroded wiring and pins
  - oil or water contamination
  - crossed sensor wires
- Inspect for an incorrectly seated engine oil dipstick, dipstick tube, or oil fill cap.

Is a concern present?

Yes	No
For vacuum leak concerns, GO to H9. For all others, REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to H4.

H4 CARRY OUT THE POWER BALANCE TEST

NOTE: **The IDS test referenced in this step may not be available on all vehicles. Follow the YES answer if the IDS test is not available.**

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- Carry out the Power Balance Test. Refer to the instruction manual provided by the scan tool manufacturer.

Does the test pass?

Yes	No
For DTCs P1137, P1138, P1157, P1158, P2270, P2271, P2272 or P2273, GO to H25. For Explorer 3.5L GTDI with DTCs P219C, P219D, P219E, P219F, P21A0 or P21A1, GO to H7. For all others with DTCs P219C, P219D, P219E, P219F, P21A0 or P21A1, GO to H6. For all others, GO to H5.	INSTALL a new Fuel Injector. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

H5 CHECK THE EVAP SYSTEM FOR A STUCK OPEN EVAP PURGE VALVE

- Ignition ON, engine running.
- Access the PCM and monitor the FTP (PRESS) PID.
- Access the PCM and control the EVAPCP (PER) PID.
- Close the EVAP purge valve by commanding the EVAPCP PID to 0%.
- Access the PCM and control the EVAPCV (MODE) PID.
- Close the EVAP canister vent valve by commanding the EVAPCV PID to ON (100% duty cycle).

Does the FTP PID decrease, the engine RPM change, or the engine stall, as an indication that the EVAP purge valve is stuck open?

Yes	No
INSTALL a new Evaporative Emission (EVAP) Purge valve. REFER to the appropriate Evaporative Emissions article. Clear the PCM DTCs. REPEAT the self-test.	For Continental, EcoSport 1.0L, EcoSport 1.5L, Edge, Escape/Kuga 1.5L, Escape/Kuga 2.0L, Expedition, Explorer 2.3L, Explorer 3.5L GTDI, F-150, F-Series Super Duty 6.2L, Fiesta, Flex 3.5L GTDI, Focus 1.0L, Focus 2.0L GTDI, Focus 2.3L, Ford GT, Fusion 1.5L, Fusion 2.0L, Fusion 2.7L, KA, MKC, MKS 3.5L, MKT 2.0L, MKT 3.5L, MKX, MKZ, Mustang 2.3L, Navigator, Ranger, Taurus 2.0L, Taurus 3.5L GTDI and Transit with DTCs P0171, P0174, P2195, P2197, P2BEC, P2BEE, P2BF0 or P2BF2, GO to H7. For DTCs P0172, P0175, P219A, P219B, P2BED, P2BEF, P2BF1 or P2BF3, GO to H11. For EcoSport 1.5L and KA with DTC P2196, GO to H11. For all others with DTCs P2196 or P2198, GO to H10. For all others, GO to H6.

H6 CHECK FOR THE PRESENCE OF A VACUUM LEAK

NOTE: **All PIDs may not be available on all vehicles.**

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 airflow at idle than at part throttle.**

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 LONGFT2 equals +24% and SHRTFT2 equals -3% the total fuel correction for bank 2 equals +21%.**

NOTE: **If the freeze frame ECT or ECT1 PID is available, stabilize the engine at the temperature recorded by the freeze frame ECT or ECT1 PID. If the freeze frame ECT or ECT1 PID is not available, maintain the engine coolant temperature between 82Â°C - 101Â°C (180Â°F - 215Â°F) and the intake air temperature less than 46Â°C (115Â°F).**

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- Ignition ON, engine running.
- Access the PCM and monitor the CHT (TEMP), ECT (TEMP), ECT1 (TEMP) and IAT (TEMP) PIDs.
- Access the PCM and monitor the LONGFT1 (PER), SHRTFT1 (PER), LONGFT2 (PER) and SHRTFT2 (PER) 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 each bank, for a total fuel correction at idle.
- Increase the engine speed to 3, 500 RPM for 10 seconds.
- Record the LONGFT1, SHRTFT1, LONGFT2, and SHRTFT2 PID values.
- Mathematically add and record the LONGFT PID value to the SHRTFT PID value for each bank, for a total fuel correction at 3, 500 RPM.

Is the total fuel correction value difference between idle and 3, 500 RPM, less than 15 percent of the total value at idle?

Yes	No
No vacuum leak is present. For DTCs P0171, P0174, P219C, P219D, P219E, P219F, P21A0 or P21A1, GO to H11. For all others, GO to H10.	GO to H8.

H7 MONITOR THE KOEO AND KOER MAP SENSOR VOLTAGE

- Ignition ON, engine OFF.
- Access the PCM and monitor the MAP_V (VOLT) PID.
- Record the MAP voltage.
- Ignition ON, engine running.
- Record the MAP voltage.

Does the PID value change?

Yes	No
For EcoSport 1.5L and KA with DTC P2195, GO to H11. For DTCs P0171, P0174, P219C, P219D, P219E, P219F, P21A0, P21A1, P2BEC, P2BEE, P2BF0 or P2BF2, GO to H11. For all others, GO to H10.	GO to **PINPOINT TEST DM**.

H8 LOCATE THE VACUUM LEAK

NOTE: **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 SHRTFT PIDs in the following steps, if SHRTFT1 equals +15% and the hose is restricted, SHRTFT1 decreases to -7%. The total decrease in the SHRTFT PIDs equals 22%.**

- Locate the vacuum tees for the intake air and PCV systems.
- Ignition ON, engine running.
- Access the PCM and monitor the SHRTFT1 (PER) and SHRTFT2 (PER) PIDs.
- Restrict the vacuum lines one at a time for 30 seconds. If a vacuum leak is present, the SHRTFT PID values decrease as the hose is restricted.

Is the decrease in the SHRTFT PIDs greater than 15 percent when one of the vacuum hoses is restricted?

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Yes	No
GO to H9.	INSPECT the intake air system for a vacuum leak in the intake manifold or intake gaskets. REPAIR as necessary. For repair verification, GO to H9.

H9 VACUUM LEAK REPAIR VERIFICATION

NOTE: **If the freeze frame ECT or ECT1 PID is available, stabilize the engine at the temperature recorded by the freeze frame ECT or ECT1 PID. If the freeze frame ECT or ECT1 PID is not available, maintain the engine coolant temperature between 82Â°C - 101Â°C (180Â°F - 215Â°F) and the intake air temperature less than 46Â°C (115Â°F).**

- Ignition ON, engine running.
- Access the PCM and monitor the SHRTFT1 (PER) and SHRTFT2 (PER) PIDs.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- Record the SHRTFT1 and SHRTFT2 PID values.
- Ignition OFF.
- Repair the vacuum leak.
- Ignition ON, engine running.
- Allow the engine to stabilize at the temperature necessary to recreate the concern.
- Compare the recorded SHRTFT PID values, prior to the vacuum leak repair, to the current SHRTFT PID values.

Is the decrease in the SHRTFT PIDs greater than 15 percent?

Yes	No
RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	A vacuum leak is still present. GO to H8.

H10 CHECK THE UO2SPC CIRCUIT FOR AN OPEN

NOTE: **Only the suspect universal HO2S needs to be diagnosed.**

- Ignition OFF.
- Universal HO2S connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) Universal HO2S Connector, Harness Side	(-) PCM Connector, Harness Side
UO2SPC	UO2SPC

Is the resistance less than 5 ohms?

Yes	No
GO to H11.	REPAIR the open circuit. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

H11 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.**

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NOTE: **For vehicle specific fuel pressure ranges, refer to the Fuel System Specification Chart in PINPOINT TEST HC.**

- Universal HO2S connector connected.
- Relieve the fuel pressure. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure.
- Mechanical fuel pressure gauge connected.
- Pressurize the fuel system. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Ignition ON, engine running.
- Allow the fuel pressure to stabilize.
- Ignition OFF.
- Ignition ON, engine running.
- Access the PCM and control the FP (MODE) PID.
- Run the fuel pump to obtain maximum fuel pressure.

Is the fuel pressure within range for the vehicle being diagnosed?

Yes	No
GO to H12.	GO to PINPOINT TEST HC.

H12 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.**

NOTE: **During output state control, the fuel pump stays commanded on for approximately 5 seconds.**

- Ignition OFF.
- Ignition ON, engine OFF.
- Access the PCM and control the FP (MODE) PID.
- Run the fuel pump to obtain maximum fuel pressure.
- Command the fuel pump OFF.
- Allow the fuel pressure to stabilize.
- Record the stabilized reading.
- Monitor the fuel pressure for 10 seconds.

Does the fuel pressure remain within 34 kPa (5 psi) of the recorded reading after 10 seconds?

Yes	No
GO to H14.	GO to H13.

H13 CHECK FOR AN EXTERNAL FUEL LEAK

- Inspect the fuel tank, lines, and filler pipe for a fuel leak.

Is a concern present?

Yes	No

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Yes	No
REPAIR as necessary. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to **PINPOINT TEST HC**. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.	For KA with DTCs P0171 or P2195, Unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**. For DTCs P219A, P219B, P219C, P219D, P219E, P219F, P21A0 or P21A1, GO to H14. For all others, GO to H22.

H14 CHECK THE FUEL SYSTEM FOR PRESSURE STABILITY - SLOW LEAKDOWN

- Continue to monitor the fuel pressure for 1 minute.

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

Yes	No
For DTCs P219A or P219B, INSTALL a new Universal HO2S. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test. For DTCs P219C, P219D, P219E, P219F, P21A0 or P21A1, GO to H15. For E100 vehicles, GO to H22. For all others, GO to H16.	GO to HC12.

H15 CHECK FOR ELECTRICAL NOISE

- Ignition OFF.
- Check the crankshaft position (CKP) sensor harness for routing, alterations, incorrect shielding or electrical interference from other systems.
- Check for radio frequency interference and excessive audible generator noise.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	UNABLE to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**.

H16 CHECK THE SEPARATION LEVEL OF THE ETHANOL, WATER AND GASOLINE MIXTURE IN THE FUEL

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

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

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

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

Does the ethanol and water mixture and gasoline separate?

Yes	No
GO to H17.	The ethanol and water mixture will separate from the gasoline. If the fuel does not appear to separate, then the fuel is either 100% ethanol or a mixture of ethanol and water. REPLACE the contaminated fuel. Clear the PCM DTCs. REPEAT the self-test.

H17 CALCULATE THE PERCENTAGE OF ETHANOL IN THE FUEL

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

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

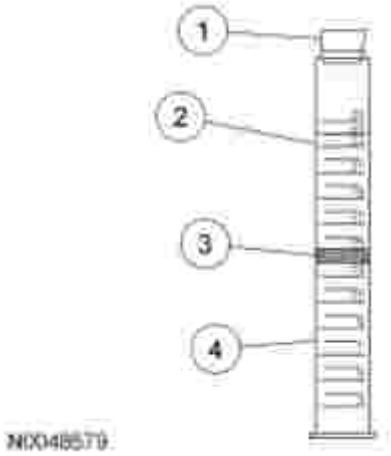

Fig. 100: Calculating Percentage Of Ethanol In Fuel
Courtesy of FORD MOTOR CO.

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

- Record the calculated percentage of ethanol in the fuel.

Is any ethanol present in the fuel?

Yes	No
For flex fuel vehicles, GO to H18. For all others, GO to H21.	For DTCs P0171, P0174, P2195, P2197, P2BEC, P2BEE, P2BF0 or P2BF2, GO to **PINPOINT TEST HC**. For all others, GO to H22.

H18 COMPARE THE FF_INF PID TO THE CALCULATED PERCENTAGE OF ETHANOL

NOTE: **When determining if the FF_INF PID value is within 20% of the calculated percentage of ethanol, for example, if the calculated percentage of ethanol**

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value is 40% then the PID value should be between 32 - 48%. The PID value cannot be less than zero.

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

Is the FF_INF PID value within 20% of the calculated percentage of ethanol?

Yes	No
For DTCs P0171, P0174, P2195, P2197, P2BEC, P2BEE, P2BF0 or P2BF2, GO to **PINPOINT TEST HC**. For all others, GO to H22.	GO to H19.

H19 RESET THE PERCENT ETHANOL PARAMETER IN THE PCM

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

- Reset the keep alive memory (KAM). Refer to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .
- Ignition ON, engine running.
- Access the PCM and monitor the FF_LRND (MODE) PID.
- Drive the vehicle approximately 11.3 km (7 miles) or until the FF_LRND PID indicates yes.

Is the PID state YES?

Yes	No
GO to H20.	GO to H30.

H20 COMPARE THE UPDATED FF_INF PID TO THE CALCULATED PERCENTAGE OF ETHANOL

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

Is the FF_INF PID value within 20% of the calculated percentage of ethanol?

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

H21 DETERMINE IF THE PERCENTAGE OF ETHANOL IN THE FUEL IS LESS THAN 25%

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

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

Yes	No

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Yes	No
For DTCs P0171, P0174, P2195, P2197, P2BEC, P2BEE, P2BF0 or P2BF2, GO to **PINPOINT TEST HC**. For all others, GO to H22.	REPAIR as necessary. ADVISE the customer of the correct fuel type required for this vehicle. REFER to the Owner's Literature for additional information. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)**. REPEAT the self-test.

H22 CARRY OUT A VISUAL INSPECTION

- Ignition OFF.
- Universal HO2S connector disconnected.
- 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. Clear the PCM DTCs. REPEAT the self-test.	For Continental, EcoSport 1.0L, EcoSport 1.5L, Edge, Escape/Kuga 1.5L, Escape/Kuga 2.0L, Expedition, Explorer 2.3L, Explorer 3.5L GTDI, F-150, F-Series Super Duty 6.2L, Fiesta 1.6L TiVCT, Flex 3.5L GTDI, Focus 1.0L, Focus 2.0L GTDI, Focus 2.3L, Fusion 1.5L, Fusion 2.0L, Fusion 2.7L, KA, MKC, MKT 2.0L, MKT 3.5L, MKX, MKZ, Mustang 2.3L, Navigator, Ranger, Taurus 2.0L, Taurus 3.5L GTDI, and Transit, GO to H24. For all others, GO to H23.

H23 CHECK THE FUNCTIONALITY OF THE MASS AIRFLOW (MAF) SENSOR

NOTE: **All PIDs may not be available on all vehicles.**

- Ignition ON, engine running.

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- Access the PCM and monitor the RPM (RPM) PID.
- Access the PCM and monitor the MAF (VOLT) PID.
- Access the PCM and monitor the MAF_HZ (FREQ) PID.
- Run the engine up to 1, 500 RPM for 5 seconds, then bring it back to idle. Run the engine up to 1, 500 RPM for 5 seconds, then bring it back to idle.
- Check that the PID value at idle is within 30% of the normal PID value listed in **REFERENCE VALUES** .

Is the PID value within the expected range?

Yes	No
GO to H24.	To continue diagnosis of the MAF/IAT sensor, GO to **PINPOINT TEST DC**.

H24 CHECK THE UNIVERSAL HO2S ACTIVITY

- Universal HO2S connector connected.
- Ignition ON, engine running.
- Access the PCM and monitor the FUELSYS (MODE) PID.
- Allow the engine to enter closed loop fuel control.
- Access the PCM and monitor the O2S11_CUR (CUR) and O2S21_CUR (CUR) PIDs.

Does the O2S11_CUR or O2S21_CUR PID value switch?

Yes	No
Unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**.	INSTALL a new Universal HO2S. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

H25 CHECK FOR KOER DTCS

- Ignition ON, engine OFF.
- Clear the PCM DTCs.
- Ignition ON, engine running.
- Run the engine at approximately 2, 000 RPM. Maintain the engine speed for 3 minutes.
- Carry out the PCM self-test.

Are DTCs P1137, P1138, P1157, P1158, P2270, P2271, P2272 or P2273 present?

Yes	No
GO to H26.	Unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**.

H26 CHECK FOR SHORTS BETWEEN CIRCUITS IN THE HO2S HARNESS

NOTE: **Diagnose the suspect sensor indicated by the DTC.**

- PCM connector disconnected.
- For HO2S12,
- HO2S12 connector disconnected.
- Measure the resistance between:

(+) HO2S12 Connector, Harness Side	(-)
HO2S12	Ground

- Measure the resistance between:

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(+) HO2S12 Connector, Harness Side	(-) HO2S12 Connector, Harness Side
HO2S12	SIGRTN
HO2S12	VPWR
HO2S12	HTR12

- For HO2S22,
- HO2S22 connector disconnected.
- Measure the resistance between:

(+) HO2S22 Connector, Harness Side	(-)
HO2S22	Ground

- Measure the resistance between:

(+) HO2S22 Connector, Harness Side	(-) HO2S22 Connector, Harness Side
HO2S22	SIGRTN
HO2S22	VPWR
HO2S22	HTR22

Are the resistances greater than 10K ohms?

Yes	No
GO to H27.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

H27 CHECK THE HO2S CIRCUIT FOR AN OPEN

- For HO2S12,
- Measure the resistance between:

(+) HO2S12 Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S12	HO2S12
SIGRTN	SIGRTN
HTR12	HTR12
VPWR	VPWR

- For HO2S22,
- Measure the resistance between:

(+) HO2S22 Connector, Harness Side	(-) PCM Connector, Harness Side
HO2S22	HO2S22
SIGRTN	SIGRTN
HTR22	HTR22
VPWR	VPWR

Are the resistances less than 5 ohms?

Yes	No
GO to H28.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

H28 CHECK THE HO2S CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For HO2S12,
- Measure the voltage between:

(+) HO2S12 Connector, Harness Side	(-)

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(+) HO2S12 Connector, Harness Side	(-)
HO2S12	Ground
SIGRTN	Ground

- For HO2S22,
- Measure the voltage between:

(+) HO2S22 Connector, Harness Side	(-)
HO2S22	Ground
SIGRTN	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to H29.

H29 CHECK THE HO2S OUTPUT VOLTAGE

- PCM connector connected.
- For HO2S12,
- HO2S12 connector connected.
- Ignition ON, engine running.
- Allow the engine to idle for 2 minutes.
- Access the PCM and monitor the O2S12 (VOLT) PID.
- Record the HO2S PID value.
- For HO2S22,
- HO2S22 connector connected.
- Ignition ON, engine running.
- Allow the engine to idle for 2 minutes.
- Access the PCM and monitor the O2S22 (VOLT) PID.
- Record the HO2S PID value.

Is the PID voltage less than 1.1 V (Fiesta TiVCT 1.6L, Fiesta 1.6L GTDI) or less than 1.6 V (all others)?

Yes	No
Unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**.	INSTALL a new HO2S. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

H30 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.
- Verify the concern is still present.

Is the concern still present?

Yes	No

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

PINPOINT TESTS HC: FUEL DELIVERY SYSTEM

INTRODUCTION

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 FUEL PRESSURE TEST KIT 310-D009 (D95L-7211A) OR EQUIVALENT.**
- **GRADUALLY OPEN THE TESTING KIT VALVE TO RELIEVE THE FUEL PRESSURE IN THE VEHICLE FUEL SYSTEM AND DRAIN THE FUEL INTO A SUITABLE CONTAINER OR RETURN IT TO THE FUEL TANK.**
- **TO AVOID UNNECESSARY FUEL SPILLAGE AND FIRE HAZARD, ANY TIME FUEL LINES ARE DISCONNECTED, THE IGNITION SWITCH MUST BE IN THE OFF POSITION UNLESS FUEL PUMP OPERATION IS REQUIRED FOR TEST PURPOSES.**

FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

WARNING: **BEFORE WORKING ON OR DISCONNECTING ANY OF THE FUEL TUBES OR FUEL SYSTEM COMPONENTS, RELIEVE THE FUEL SYSTEM PRESSURE TO PREVENT ACCIDENTAL SPRAYING OF FUEL. FUEL IN THE FUEL SYSTEM REMAINS UNDER HIGH PRESSURE, EVEN WHEN THE ENGINE IS NOT RUNNING. FAILURE TO FOLLOW THIS INSTRUCTION MAY RESULT IN SERIOUS PERSONAL INJURY.**

WARNING: **DO NOT SMOKE, CARRY LIGHTED TOBACCO OR HAVE AN OPEN FLAME OF ANY TYPE WHEN WORKING ON OR NEAR ANY FUEL-RELATED COMPONENT. HIGHLY FLAMMABLE MIXTURES ARE ALWAYS PRESENT AND MAY BE IGNITED. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN SERIOUS PERSONAL INJURY.**

WARNING: **DO NOT CARRY PERSONAL ELECTRONIC DEVICES SUCH AS CELL PHONES, PAGERS OR AUDIO EQUIPMENT OF ANY TYPE WHEN WORKING ON OR NEAR ANY FUEL-RELATED COMPONENT. HIGHLY FLAMMABLE MIXTURES ARE ALWAYS PRESENT AND MAY BE IGNITED. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN SERIOUS PERSONAL INJURY.**

WARNING: **WHEN HANDLING FUEL, ALWAYS OBSERVE FUEL HANDLING PRECAUTIONS AND BE PREPARED IN THE EVENT OF FUEL SPILLAGE. SPILLED FUEL MAY BE IGNITED BY HOT VEHICLE COMPONENTS OR OTHER IGNITION SOURCES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN SERIOUS PERSONAL INJURY.**

WARNING: **CLEAN ALL FUEL RESIDUE FROM THE ENGINE COMPARTMENT. IF NOT REMOVED, FUEL RESIDUE MAY IGNITE WHEN THE ENGINE IS RETURNED TO OPERATION. FAILURE TO FOLLOW THIS INSTRUCTION MAY RESULT IN SERIOUS PERSONAL INJURY.**

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

This pinpoint test is intended to diagnose the following:

- chassis components
- fuel pressure
- fuel supply line
- fuel supply
- fuel filter (9155)
- fuel injectors (9F593)
- fuel pump (9H307)

NOTE: **With the engine running, the FRP PID value may be higher than a fuel pressure reading taken with a mechanical gauge.**

FUEL SYSTEM SPECIFICATION CHART (IGNITION ON, ENGINE OFF VALUES)

Application	FLP Or FRP PID Fuel Pressure	External Pressure Gauge
Mustang 5.2L	290-552 kPa (42-80 psi)	188-450 kPa (27-65 psi)
E-Series, Escape/Kuga 2.5L, F-Series Super Duty, Transit 3.7L	-	350-415 kPa (51-60 psi)
Continental 2.7L, Continental 3.0L, Edge 2.0L, Edge 2.7L, Explorer 2.3L, Fusion 2.7L, MKX 2.0L, MKX 2.7L, MKZ	455-607 kPa (66-88 psi)	350-500 kPa (51-73 psi)
EcoSport 1.0L, EcoSport 2.0L, Escape/Kuga 2.0L, Fiesta 1.0L, Fiesta 1.6L GTDI, Focus	483-607 kPa (70-88 psi)	380-500 kPa (55-73 psi)
Transit Connect, Fusion 2.5L	-	350-450 kPa (51-65 psi)
Continental 2.0L, Escape/Kuga 1.5L, Focus 2.3L, Fusion 1.5L, Fusion 2.0L, MKC, Mustang 2.3L	421-641 kPa (61-93 psi)	320-540 kPa (46-78 psi)
Expedition, F-150, Ford GT, Mustang 5.0L, Navigator, Transit 3.5L	531-614 kPa (77-89 psi)	425-510 kPa (62-74 psi)
All Others	-	331-485 kPa (48-70 psi)

Inertia Fuel Shutoff (IFS) Switch - Reset Instructions

WARNING: **IF YOU SEE OR SMELL GASOLINE AT ANY TIME OTHER THAN DURING FUELING, DO NOT RESET THE INERTIA FUEL SHUTOFF (IFS) SWITCH. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

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

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A

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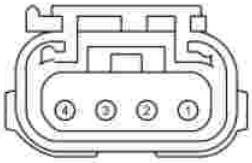
B



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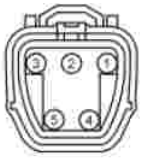

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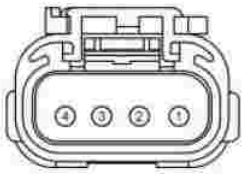

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E

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Fig. 101: Fuel Pump (FP) Assembly Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 3.0L, Focus 2.3L, Mustang 5.2L	A	4 3 1 6	FP2PWR FPPWR FP2RTN FPRTN
E-Series, Expedition, F-150, Mustang 2.3L, Mustang 5.0L, Navigator, Transit	B	4 3	FPPWR FPRTN

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Vehicle	Connector	Pin	Circuit
EcoSport 1.5L, EcoSport 1.0L Manual Transmission, KA	C	5	FPPWR
F-650/F-750, F-Series Super Duty, Motorhome/Stripped Chassis/Step Van	D	4 3	FPPWR FPRTN
Ford GT	E	2 4 3 1	FP2PWR FPPWR FP2RTN FPRTN
MKZ 3.0L	C	4 2 5 1	FP2PWR FPPWR FP2RTN FPRTN
All other vehicles	C	5 4	FPPWR FPRTN

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
  - relays
  - fuel tank
  - fuel pump
  - fuel pressure regulator
  - 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) (vehicles with inline fuel filter).
- Verify the inertia fuel shutoff (IFS) switch is set (button pushed in). Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch (if equipped).
- Verify the fuse integrity.
- Verify the battery is fully charged.
- Verify clean sufficient fuel.

Is a concern present?

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

HC2 CHECK THE FUEL PRESSURE

- Ignition OFF.
- Relieve the fuel pressure. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure.
- Mechanical fuel pressure gauge connected.
- Ignition ON, engine OFF.
- Pressurize the fuel system. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure to pressurize the fuel system.
- FP Assembly connector connected.
- Cycle the ignition several times to charge the fuel system.

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- Compare the fuel pressure reading to the Fuel System Specification Chart.

Is the fuel pressure within range?

Yes	No
For DTCs P0171, P0174, P2195, P2197, P2BEC, P2BEE, P2BF0, or P2BF2, GO to HC14. For DTCs P008A or P008B, GO to HC11. For E100 vehicles, GO to HC11. For all others, GO to HC5.	GO to HC3.

HC3 CHECK THE FUEL PUMP GROUND CIRCUIT FOR AN OPEN CIRCUIT

- Ignition OFF.
- FP Assembly connector disconnected.
- For Continental 3.0L, Focus 2.3L, Ford GT, MKZ 3.0L and Mustang 5.2L,
- Measure the resistance between:

(+) FP Assembly Connector, Harness Side	(-)
FPRTN	Ground
FP2RTN	Ground

- For all others,
- Measure the resistance between:

(+) FP Assembly Connector, Harness Side	(-)
FPRTN	Ground

Are the resistances less than 5 ohms?

Yes	No
GO to HC4.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HC4 CHECK THE FUEL PUMP POWER CIRCUIT FOR AN OPEN

NOTE: **During output state control, the fuel pump stays commanded on for only about 5 seconds. Be aware that output state control turns the FP off after a calibrated time. If this happens, command the output ON to continue testing.**

- Verify the inertia fuel shutoff (IFS) switch is set (button pushed in). Refer to the Owner's Literature, Roadside Emergencies for the location of the IFS switch (if equipped).
- Ignition ON, engine OFF.
- For Continental 3.0L, Focus 2.3L, Ford GT, MKZ 3.0L and Mustang 5.2L,
- Measure the voltage between:

(+) FP Assembly Connector, Harness Side	(-) Vehicle Battery
FPPWR	Negative terminal
FP2PWR	Negative terminal

- For all others,
- Measure the voltage between:

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

- Access the PCM and control the FP (MODE) PID.
- Command the fuel pump ON.

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Does the voltage increase with the PID commanded ON?

Yes	No
For Vehicles that do not start, GO to HC15. For all others, GO to HC11.	GO to **PINPOINT TEST KC**.

HC5 CHECK THE SEPARATION LEVEL OF THE ETHANOL/WATER MIXTURE AND GASOLINE IN THE FUEL

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

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

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

Did the ethanol/water mixture and gasoline separate?

Yes	No
GO to HC6.	The ethanol/water mixture will separate from the gasoline. If the fuel does not appear to separate, then the fuel is either 100% ethanol or a mixture of ethanol and water. REPLACE the contaminated fuel. Clear the PCM DTCs. REPEAT the self-test.

HC6 CALCULATE THE PERCENTAGE OF ETHANOL IN THE FUEL

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

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

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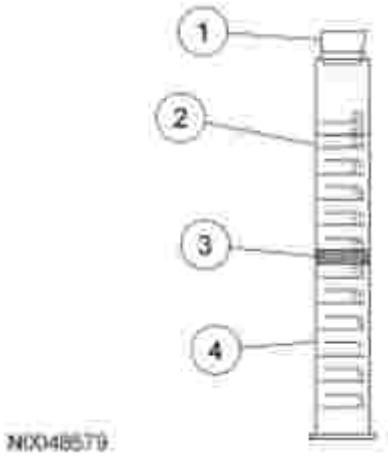

Fig. 102: Calculating Percentage Of Ethanol In Fuel
Courtesy of FORD MOTOR CO.

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

- Record the calculated percentage of ethanol in the fuel.

Is any ethanol present in the fuel?

Yes	No
For E100 and flex fuel vehicles, GO to HC7. For all others, GO to HC10.	GO to HC11.

HC7 COMPARE THE FF_INF PID TO THE CALCULATED PERCENTAGE OF ETHANOL

NOTE: **When determining if the FF_INF PID value is within 20% of the calculated percentage of ethanol, for example, if the calculated percentage of ethanol value is 40% then the PID value should be between 32 - 48%. The PID value cannot be less than zero.**

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

Is the FF_INF PID value within 20% of the calculated percentage of ethanol?

Yes	No
GO to HC11.	GO to HC8.

HC8 RESET THE PERCENT ETHANOL PARAMETER IN THE PCM

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

- Reset the keep alive memory (KAM). Refer to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .
- Ignition ON, engine running.
- Access the PCM and monitor the FF_LRND (MODE) PID.
- Drive the vehicle approximately 11.3 km (7 miles) or until the FF_LRND PID indicates yes.

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Is the PID state YES?

Yes	No
GO to HC9.	GO to HC17.

HC9 COMPARE THE UPDATED FF_INF PID TO THE CALCULATED PERCENTAGE OF ETHANOL

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

Is the FF_INF PID value within 20% of the calculated percentage of ethanol?

Yes	No
RETURN the vehicle to the customer. ADVISE the customer of the correct fueling practices when using flex fuel. REFER to the Owner's Literature for additional information. ADVISE the customer to continue to use the same fuel for the next 2-3 refuels. This practice helps verify the PCM is learning the correct percentage of ethanol in the fuel.	A fuel system concern may be present, which prevents the PCM from learning the correct percentage of ethanol in the fuel, GO to HC11.

HC10 DETERMINE IF THE PERCENTAGE OF ETHANOL IN THE FUEL IS LESS THAN 25%

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

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

Yes	No
GO to HC11.	REPAIR as necessary. ADVISE the customer of the correct fuel type required for this vehicle. REFER to the Owner's Literature for additional information. Clear the PCM DTCs. REPEAT the self-test.

HC11 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. Be aware that output state control turns the FP off after a calibrated time. If this happens, command the output ON to continue testing.**

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

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

Yes	No

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Yes	No
For Continental 2.0L, Continental 2.7L, Continental 3.0L, EcoSport 1.0L, EcoSport 2.0L, Edge 2.0L, Edge 2.7L, Escape/Kuga 1.5L, Escape/Kuga 2.0L, Expedition, Explorer 2.3L, Explorer 3.5L GTDI, F-150 2.7L, F-150 3.5L, Fiesta 1.0L, Fiesta 1.6L GTDI, Flex 3.5L GTDI, Focus, Ford GT, Fusion 1.5L, Fusion 2.0L, Fusion 2.7L, MKC, MKT 2.0L, MKT 3.5L, MKX 2.0L, MKX 2.7L, MKZ, Mustang 2.3L, Mustang 5.2L, Navigator, Taurus 2.0L, and Taurus 3.5L GTDI, GO to HC13. For all others, GO to HC14.	GO to HC12.

HC12 CARRY OUT THE POWER BALANCE TEST

NOTE: **The IDS test referenced in this step may not be available on all vehicles. Follow the YES answer if the IDS test is not available.**

- Carry out the Power Balance Test. Refer to the instruction manual provided by the scan tool manufacturer.

Does the test pass?

Yes	No

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Yes	No
For Continental 2.0L, Continental 2.7L, Continental 3.0L, EcoSport 1.0L, EcoSport 2.0L, Edge 2.0L, Edge 2.7L, Escape/Kuga 1.5L, Escape/Kuga 2.0L, Expedition, Explorer 2.3L, Explorer 3.5L GTDI, F-150 2.7L, F-150 3.5L, Fiesta 1.0L, Fiesta 1.6L GTDI, Flex 3.5L GTDI, Focus, Ford GT, Fusion 1.5L, Fusion 2.0L, Fusion 2.7L, MKC, MKT 2.0L, MKT 3.5L, MKX 2.0L, MKX 2.7L, MKZ, Mustang 2.3L, Mustang 5.2L, Navigator, Taurus 2.0L, and Taurus 3.5L GTDI, GO to HC13. For all others, GO to HC14. Â	INSTALL a new fuel injector as necessary. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

HC13 COMPARE THE PID TO THE MECHANICAL GAUGE

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

- Ignition OFF.

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- Relieve the fuel pressure. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure.
- Disable the fuel pump.
- Ignition ON, engine OFF.
- Monitor the mechanical gauge.
- For Mustang 5.2L,
- Access the PCM and monitor the FRP (PRESS) PID.
- For all others,
- Access the PCM and monitor the FLP (PRESS) PID.
- Compare the PID value to the mechanical gauge.
- Ignition OFF.
- Pressurize the fuel system. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Ignition ON, engine running.
- Allow the fuel pressure to stabilize.
- Ignition OFF.
- Ignition ON, engine OFF.
- Compare the PID value to the mechanical gauge.

Are the PID values within 153 kPa (22 psi) of the mechanical gauge readings?

Yes	No
GO to HC14.	For Mustang 5.2L, INSTALL a new FRPT sensor. REFER to the fuel system WARNING information at the beginning of this pinpoint test. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test. For all others, INSTALL a new Fuel Pressure Sensor. REFER to the fuel system WARNING information at the beginning of this pinpoint test. REFER to the appropriate Fuel Tank and Lines article. Clear the PCM DTCs. REPEAT the self-test.

HC14 MONITOR THE FUEL PRESSURE WHILE ROAD TESTING THE VEHICLE

WARNING: **STRICT OBSERVANCE OF POSTED SPEED LIMITS AND ATTENTION TO DRIVING CONDITIONS ARE MANDATORY WHEN CARRYING OUT THE ROAD TEST. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

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

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

Is the fuel pressure always greater than 352 kPa (51 psi)?

Yes	No

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Yes	No
For misfire DTC diagnosis, GO to HD11. For DTCs P0171, P0174, P2195, P2197, P2BEC, P2BEE, P2BF0, or P2BF2, GO to H22. For the fuel pressure leakdown concern, INSTALL a new FP assembly. REFER to the appropriate Fuel Tank and Lines article. For all others, RETURN to **NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** for further direction.	GO to HC15.

HC15 CHECK THE FUEL SUPPLY LINE FOR RESTRICTION

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

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

Does air flow freely through the line?

Yes	No
For Mustang 5.2L, INSTALL a new Fuel Filter assembly. REFER to the appropriate Fuel Tank and Lines article. GO to HC16. For all others, GO to HC16.	REPAIR the cause of the restriction. Clear the PCM DTCs. REPEAT the self-test.

HC16 VERIFY THE REPAIR

WARNING: **STRICT OBSERVANCE OF POSTED SPEED LIMITS AND ATTENTION TO DRIVING CONDITIONS ARE MANDATORY WHEN CARRYING OUT THE ROAD TEST. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

NOTE: **For vehicles that do not start, follow the NO answer.**

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

Is the fuel pressure always greater than 352 kPa (51 psi)?

Yes	No
For DTC P0087, GO to **PINPOINT TEST HP**. For all others, the test is complete and no concerns are present.	INSTALL a new FP assembly. REFER to the appropriate Fuel Tank and Lines article. Clear the PCM DTCs. REPEAT the self-test.

HC17 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.
- Verify the concern is still present.

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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 TESTS HD: MISFIRE DETECTION MONITOR

INTRODUCTION

NOTE: **Mechanical noise caused by the front end accessory drive components, mechanically driven cooling fans, or rough roads at high RPM with light load conditions may produce a non-symmetrical loss of cylinder acceleration, which may result in a misfire.**

This pinpoint test is intended to diagnose the misfire detection monitor.

Clearing the powertrain control module (PCM) diagnostic trouble codes (DTCs) erases any PCM recorded freeze frame data. Make sure to record any PCM freeze frame information before proceeding. Refer to **FREEZE FRAME DATA** .

TEST PROCEDURE

HD1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

Are DTCs P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, P0310, P0313, P0316 or P1336 present?

Yes	No
For DTC P1336, GO to HD16. For all others, GO to HD2.	RETURN to **SYMPTOM CHARTS** for further direction.

HD2 VIEW THE PCM MISFIRE FREEZE FRAME DATA

NOTE: **The misfire freeze frame data may be used to determine the operating conditions when the misfire DTC was set.**

- Retrieve and record any available misfire freeze frame data PID values from the PCM.
- Compare recorded freeze frame data PID values to the typical reference values in **REFERENCE VALUES** .

Are any values out of range?

Yes	No
REFER to the table in **PINPOINT TEST Z** to find corresponding circuit, and PROCEED with the intermittent diagnosis. GO to **PINPOINT TEST Z**.	GO to HD3.

HD3 RELATIVE COMPRESSION TEST

NOTE: **The IDS test referenced in this step may not be available on all vehicles. Follow the YES answer if the IDS test is not available.**

- Carry out the Relative Compression Test. Refer to the instruction manual provided by the scan tool manufacturer.

Do all cylinders pass the test?

Yes	No

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Yes	No
GO to HD4.	CARRY OUT a cylinder compression test on the suspected cylinder. REFER to the appropriate Engine System article - General Information to diagnose the non contributing cylinder concern.

HD4 CHECK FOR OTHER NON-MISFIRE CONTINUOUS MEMORY DTCS

- Retrieve the PCM 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 HD5.

HD5 CHECK FOR ANY KOEO SELF-TEST DTCS

- Carry out the PCM KOEO self-test.

Are any 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 HD6.

HD6 CHECK FOR ANY KOER DTCS

- Carry out the PCM KOER self-test.

Are any 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 HD7.

HD7 CYLINDER POWER BALANCE TEST

NOTE: **The IDS test referenced in this step may not be available on all vehicles. Follow the YES answer if the IDS test is not available.**

- Carry out the Power Balance Test. Refer to the instruction manual provided by the scan tool manufacturer.

Are all cylinders contributing correctly during the power balance test?

Yes	No
GO to HD9.	GO to HD8.

HD8 CHECK THE IGNITION SYSTEM FOR CONCERNS

- For ignition coil on plug (COP) equipped vehicles, GO to JB4 and follow the pinpoint test direction.
- For ignition coil pack equipped vehicles, GO to JC4 and follow the pinpoint test direction.

Is an ignition related concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to HD9.

HD9 RELATIVE INJECTOR FLOW TEST

NOTE: **The IDS test referenced in this step may not be available on all vehicles. Follow the YES answer if the IDS test is not available.**

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- Carry out the Relative Injector Flow Test. Refer to the instruction manual provided by the scan tool manufacturer.

Are all injectors flowing correctly?

Yes	No
GO to HD10.	CHECK for a loose connection, and damaged or corroded pins. REPAIR as necessary. GO to HD10.

HD10 CHECK THE FUEL SYSTEM FOR CONCERNS

- GO to **PINPOINT TEST HC** and follow the pinpoint test direction.

Is a fuel system related concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to HD11.

HD11 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 restriction to one of the various actuators or sensors. If a restriction is found remove the restriction or install new parts as necessary.

Is the vehicle vacuum system OK?

Yes	No
For Escape/Kuga 2.5L, F-150 2.7L, F-150 3.3L, Fusion 2.5L, and Transit Connect, GO to HD12. For all others, GO to HD14.	REPAIR the vacuum system. Clear the PCM DTCs. REPEAT the self-test.

HD12 MONITOR THE EGR SYSTEM RELATED PIDS

- Ignition ON, engine running.
- Bring the engine to normal operating temperature.
- For F-150,
- Access the PCM and monitor the EGRVPDES (PER) PID.
- For all others,
- Access the PCM and monitor the EGRMC1F (MODE), EGRMC2F (MODE), EGRMC3F (MODE) and EGRMC4F (MODE) PIDs.
- Access the PCM and monitor the MAP (PRESS) PID.
- Record the PID values with the engine idling.
- Ignition ON, engine OFF.
- Record the PID values with the engine off.
- Compare the recorded PID values to the typical reference values in **REFERENCE VALUES** .

Are any values out of range?

Yes	No
GO to **PINPOINT TEST KD** and DIAGNOSE the EGR system.	GO to HD13.

HD13 RECREATE THE MISFIRE SYMPTOM WITH EGR SYSTEM DISABLED

NOTE: The PCM may store EGR system related DTCs during this procedure.

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NOTE: **To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.**

- Ignition OFF.
- EEGR Assembly connector disconnected.
- Access the misfire freeze frame data (if available) and record the operating conditions.
- Obtain information from the customer information worksheet or any other available data from the customer.
- Recreate the misfire symptom using the freeze frame and customer information.

Can the symptom be recreated?

Yes	No
GO to HD14.	REMOVE and INSPECT the EGR for signs of contamination, unusual wear, carbon deposits, binding or other damage. REFER to the appropriate Engine Emission Control article for more EGR system information. REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.

HD14 CHECK FOR BASE ENGINE CONCERNS

NOTE: **The engine temperature may affect the results.**

- This step determines if there are any base engine concerns that may have caused the misfire DTC or drive concern.
- Ignition OFF.
- Carry out the following tests in order to evaluate base engine integrity:
- For vehicles equipped with mechanically driven cooling fans only, rotate the cooling fan by hand. The cooling fan should rotate freely, with no abnormal binding or interference. If binding or interference is present, remove any foreign materials or repair the cooling fan as necessary.
- Refer to the appropriate Accessory Drive article and carry out checks in the Visual Inspection Chart.
- Refer to the appropriate Engine System article and carry out the Compression Test and Cylinder Leakage Detection.
- Refer to the appropriate Engine System article and carry out the Valve Train Analysis.
- Visually inspect the positive crankcase ventilation (PCV) valve and tube for leaks.
- Refer to the appropriate Engine System article and carry out Component Tests.

Is a concern present?

Yes	No
REPAIR as necessary. REFER to the appropriate Engine System article. Clear the PCM DTCs. REPEAT the self-test.	For DTCs P0300 or P0316, GO to HD17. For all others, GO to HD15.

HD15 CHECK FUEL INJECTORS

NOTE: **For vehicles without the injector disable PIDs, follow the Yes answer.**

- Ignition ON, engine running.
- Access the PCM and control the suspect INJ_OFF (MODE) PID.
- Command the suspect injector OFF.

Does the engine RPM change?

Yes	No
GO to HD17.	CHECK the suspect fuel injector connector and pins for damage, corrosion or an incorrect connection. If no concerns are present, INSTALL a new Fuel Injector. Clear the PCM DTCs. REPEAT the self-test.

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HD16 CHECK THE CMP SENSOR

- Ignition ON, engine running.
- Access the PCM and monitor the SYNC (MODE) PID.

Is a concern present?

Yes	No
A CMP sensor that is installed out of synchronization may set a DTC. To verify the correct CMP sensor installation, REFER to the appropriate Electronic Engine Controls article. If the CMP sensor is installed correctly, GO to HD17.	GO to HD17.

HD17 CHECK THE GENERATOR FOR EXCESSIVE ELECTRICAL NOISE

NOTE: **If the generator/regulator is electrically noisy, the noise decreases when the B+ connector is disconnected.**

- Ignition ON, engine running.
- Monitor the generator for an audible electric noise.
- Ignition OFF.
- Generator/regulator B+ connector disconnected.
- Ignition ON, engine running.
- With the engine running, determine if the generator is still noisy.

Does the noise remain constant when the B+ connector is disconnected?

Yes	No
GO to HD18.	REFER to the appropriate Charging System article, and DIAGNOSE the generator is noisy symptom.

HD18 CHECK THE CKP HARNESS FOR INTERMITTENT CONCERNS

NOTE: **Damaged CKP wires or other physical damage to the harness may cause an intermittent short in the CKP circuit.**

- Ignition OFF.
- Visually check for damaged CKP wires or other physical damage to the CKP harness.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to HD19.

HD19 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 crankshaft pulse wheel for damaged teeth.
- Inspect the crankshaft pulse wheel for wobble.
- Inspect the crank pulley for wobble.
- Check for a loose crankshaft pulse wheel.
- Check the CKP sensor for damage.

Are the CKP sensor, crankshaft pulse wheel and the crank shaft pulley OK?

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Yes	No
GO to HD20.	REPAIR as necessary. REFER to the appropriate Electronic Engine Controls article and check for correct CKP sensor installation. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . CARRY OUT the Misfire Monitor Neutral Profile Correction procedure using the scan tool.

HD20 CHECK THE RECENT VEHICLE REPAIR HISTORY

NOTE: **Misfire Profiles stored in non-volatile memory may need to be relearned if major engine work is done.**

- Check the recent vehicle repair history to determine if any rotational components have been replaced such as:
- crankshaft
- crankshaft pulley
- camshaft
- flexplate
- flywheel
- pistons or connecting rods
- front end accessory drive components

Does the vehicle repair history indicate any engine repairs for rotational components?

Yes	No
CARRY OUT the Misfire Monitor Neutral Profile Correction procedure using the scan tool. To verify the repair, RECREATE the original conditions that set the misfire DTC or caused the symptom using the freeze frame data and customer information. MONITOR the cylinder misfire data in Mode 6 - On Board Test Results and VERIFY the misfire count is below 10. REFER to the scan tool manufacturers manual for specific information on the Mode 6 - On Board Test Results.	GO to **PINPOINT TEST Z**.

PINPOINT TESTS HE: EXHAUST GAS RECIRCULATION (EGR) SYSTEMS

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- differential pressure feedback exhaust gas recirculation (EGR) sensor (9J460)
- differential pressure feedback EGR sensor pressure hoses
- orifice tube assembly (9D477)
- EGR cooler
- harness circuits: DPFE, SIGRTN and VREF
- PCM (12A650)

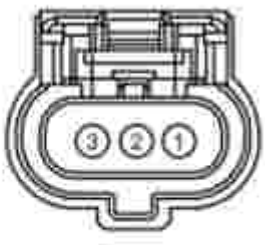

Fig. 103: Differential Pressure Feedback EGR Sensor Connector
Courtesy of FORD MOTOR CO.

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Pin	Circuit
1	DPFE (Differential Pressure Feedback EGR)
2	SIGRTN (Signal Return)
3	VREF (Reference Voltage)

Powertrain Control Module (PCM) Connector

For PCM connector views or **REFERENCE VALUES** .

Connector	Pin	Circuit
306 PIN	E32	DPFE

TEST PROCEDURE

HE1 CHECK FOR DTCS

Are DTCs P0401, P0402, P044C, P044D, P139A, P139B, P139C, P1408, or P2457 present?

Yes	No
For DTCs P139A, P139B or P139C, GO to HE7. For DTC P2457, GO to HE9. For all others, GO to HE2.	RETURN to **SYMPTOM CHARTS** for further direction.

HE2 CHECK THE VREF AND SIGRTN CIRCUITS FOR AN OPEN

- Ignition OFF.
- Differential Pressure Feedback EGR Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Differential Pressure Feedback EGR Sensor Connector, Harness Side	(-) Differential Pressure Feedback EGR Sensor Connector, Harness Side
VREF - Pin 3	SIGRTN - Pin 2

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to HE3.	GO to **PINPOINT TEST C**.

HE3 CHECK THE DPFE CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) Differential Pressure Feedback EGR Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
DPFE - Pin 1	DPFE - Pin E32

Is the resistance less than 5 ohms?

Yes	No
GO to HE4.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HE4 CHECK THE DPFE CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

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(+) Differential Pressure Feedback EGR Sensor Connector, Harness Side	(-)
DPFE - Pin 1	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to HE5.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

HE5 CHECK THE DPFE CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) Differential Pressure Feedback EGR Sensor Connector, Harness Side	(-)
DPFE - Pin 1	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to HE6.

HE6 CARRY OUT A THOROUGH WIGGLE TEST ON THE DIFFERENTIAL PRESSURE FEEDBACK EGR HARNESS

- Ignition OFF.
- Differential Pressure Feedback EGR Sensor connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the DPFEGR (VOLT) PID.
- Wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.

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

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to HE7.

HE7 INSPECT THE DIFFERENTIAL PRESSURE FEEDBACK EGR PRESSURE HOSES AND ORIFICE TUBE FOR CONCERNS

- Visually inspect the upstream pressure hose routing.
- Visually inspect the downstream pressure hose routing.
- Inspect both hoses for leaks and restrictions.
- Inspect the differential pressure feedback EGR sensor and orifice tube assembly for restrictions or damage at the pick up tubes.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to HE8.

HE8 CHECK THE DIFFERENTIAL PRESSURE FEEDBACK EGR SENSOR OUTPUT BY APPLYING VACUUM WITH THE HAND PUMP

NOTE: **Verify a prior repair has not resulted in the differential pressure feedback EGR sensor hoses being connected to the opposite ports.**

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- Disconnect the pressure hoses at the differential pressure feedback EGR sensor.
- Connect the vacuum pump to the downstream connection at the sensor (intake manifold side of the sensor or the smaller diameter pickup tube).
- Ignition ON, engine OFF.
- Access the PCM and monitor the DPFEGR (VOLT) PID.
- Apply 27 - 30 kPa (8 - 9 in-Hg) vacuum to the differential pressure feedback EGR sensor and hold for 10 seconds.
- Quickly release the vacuum.
    - The DPFEGR PID voltage must be between 0.25 and 1.3 volts with the ignition ON and no vacuum applied.
    - The DPFEGR PID voltage must increase to greater than 4 volts with the vacuum applied.
    - The DPFEGR PID must drop to less than 1.5 volts in less than 3 seconds when the vacuum is released.

Does the DPFEGR PID voltage indicate a concern in the differential pressure feedback EGR sensor?

Yes	No
INSTALL a new Differential Pressure Feedback EGR sensor. REFER to the appropriate Engine Emission Control article. Clear the PCM DTCs. REPEAT the self-test.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

HE9 VISUALLY INSPECT THE EGR COOLER FOR CONCERNS

- Ignition OFF.
- Visually inspect for:
- damaged EGR cooler
- damaged EGR cooler coolant hoses

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to HE10.

HE10 CHECK THE COOLING SYSTEM FOR CONCERNS

- Check the cooling system for a system overheating condition or a low coolant condition. Refer to the appropriate Engine Cooling article, Inspection and Verification.

Is a concern present?

Yes	No
REPAIR as necessary. REFER to the appropriate Engine Cooling article, Symptom Chart to diagnose the overheats symptom or loss of coolant symptom. Clear the PCM DTCs. REPEAT the self-test.	GO to HE11.

HE11 CHECK THE EGR COOLER OPERATION

- Ignition ON, engine running.
- Access the PCM and monitor the EGRT12 (TEMP) PID.
- Record the EGRT12 PID value.
- Access the PCM and control the RPMDSD (RPM) PID.
- Increase the commanded engine speed to 2, 500 RPM.
- Access the PCM and control the EGRVPDES (PER) PID.
- Increase the commanded EGR valve position to the maximum value.
- Record the EGRT12 PID value.

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Does the EGRT12 PID value change when the EGR valve is opened?

Yes	No
The system is operating correctly at this time. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new EGR cooler. REFER to the appropriate Engine Emission Control article. Clear the PCM DTCs. REPEAT the self-test.

PINPOINT TESTS HF: CATALYST EFFICIENCY MONITOR AND EXHAUST SYSTEMS

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- catalytic converter
- exhaust system

TEST PROCEDURE

HF1 CHECK FOR DTCS

Are DTCs P0420 or P0430 present?

Yes	No
GO to HF2.	For symptoms without DTCs, GO to HF6. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

HF2 CHECK FOR OTHER DTCS

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.**

NOTE: **Make sure the customer has not noticed a high engine oil consumption. An engine that consumes oil at a high rate deposits high levels of phosphorus on the catalyst and reduces the catalyst efficiency.**

- Carry out the PCM self-test.

Are any DTCs present other than DTCs P0420 or P0430?

Yes	No
GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** for pinpoint test direction and REPAIR the other DTCs first. Clear the PCM DTCs. REPEAT the self-test.	GO to HF3.

HF3 CHECK THE ELECTRONIC ENGINE CONTROL (EEC) WIRING HARNESS

NOTE: **Check the HO2S electrical connectors to make sure the correct HO2S is connected to the correct electrical connector. The electrical connectors may be color coded to make sure the correct connection is made.**

If the electrical connections of the rear HO2S are crossed, the catalyst efficiency monitor test fails.

- Visually inspect the HO2S harness connectors for any indication of crossed wiring.
- Visually inspect the harness for exposed wiring, corrosion and correct routing.
- Visually inspect the PCM connectors for damaged, or pushed out pins, corrosion and loose wires.

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Are there any concerns with the wiring or the PCM connection?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. CARRY OUT the catalyst monitor drive cycle to verify the repairs.	GO to HF4.

HF4 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. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

NOTE: **Fuel pressure above specification can produce an abnormally rich air to fuel mixture. This rich air to fuel mixture can cause higher than normal catalyst operating temperatures.**

- Ignition ON, engine OFF.
- For Continental 2.0L, Continental 2.7L, Continental 3.0L, Edge 2.0L, Edge 2.7L, Escape/Kuga 1.5L, Escape/Kuga 2.0L, Expedition, Explorer 2.3L, Explorer 3.5L GTDI, F-150, Fiesta 1.0L, Fiesta 1.6L GTDI, Flex 3.5L GTDI, Focus, Fusion 1.5L, Fusion 2.0L, Fusion 2.7L, MKC, MKS 3.5L, MKT 2.0L, MKT 3.5L, MKX 2.0L, MKX 2.7L, MKZ, Mustang 2.3L, Mustang 5.0L, Navigator, Taurus 2.0L and Taurus 3.5L GTDI,
- Access the PCM and monitor the FLP (PRESS) PID.
- For mechanical returnless fuel systems (MRFS),
- Ignition OFF.
- Relieve the fuel pressure. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure.
- Mechanical fuel pressure gauge connected.
- Ignition ON, engine OFF.
- Pressurize the fuel system. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Cycle the ignition several times to charge the fuel system.
- Compare the fuel pressure reading to the Fuel System Specification Chart found at the beginning of Pinpoint Test HC. GO to **PINPOINT TEST HC**.
- Ignition OFF.

Is the fuel pressure within specifications?

Yes	No
GO to HF5.	GO to **PINPOINT TEST HC**.

HF5 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 the following:
- leaks
- cracks
- loose connections
- punctures
- aftermarket accessories or performance modifications

Is a concern present?

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Yes	No
REPAIR as necessary. Clear the PCM DTCs. CARRY OUT the catalyst monitor drive cycle to verify the repairs.	GO to HF10.

HF6 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

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to HF7.

HF7 CHECK FOR EXCESSIVE EXHAUST BACK PRESSURE

- The internal condition of exhaust system and its ability to flow can be checked with an exhaust back pressure tool.

Is an exhaust back pressure tester available?

Yes	No
GO to HF8.	GO to HF9.

HF8 CHECK FOR EXCESSIVE EXHAUST BACK PRESSURE WITH EXHAUST BACK PRESSURE TOOL

NOTE: **Typical exhaust back pressure, when measured near the exhaust manifold and at normal engine operating temperature, should not exceed 20.7 kPa (3 psi) at idle and 55.2 kPa (8 psi) at wide open throttle (WOT) under load.**

- Install an exhaust back pressure tester and follow the tool manufacturer installation and testing instructions.

Does the exhaust back pressure test indicate a restriction?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test. To continue diagnosis of a symptom (lack of power, loss of power, or no start), REFER to **SYMPTOM CHARTS** .	No indication of restrictions or leaks has been detected in the exhaust system. To continue diagnosis of a symptom (lack of power, loss of power, or no start), REFER to **SYMPTOM CHARTS** .

HF9 CHECK MANIFOLD VACUUM FOR AN INDICATION OF EXCESSIVE EXHAUST SYSTEM RESTRICTION

NOTE: **When the engine is first started and is idled, the reading may be normal 51-74 kPa (15-22 in-Hg), but as the engine RPM is increased, the back pressure caused by a clogged exhaust system causes the needle to slowly drop to 0 kPa (0 in-Hg). The needle then may slowly rise. Excessive exhaust restriction causes the needle to drop to a low point even if the engine is only idling.**

- Attach a vacuum gauge to the intake manifold vacuum source.

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- Observe the vacuum gauge while increasing the engine RPM.

Does the vacuum gauge indicate an exhaust restriction concern?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test. To continue diagnosis of a symptom (lack of power, loss of power, or no start), REFER to **SYMPTOM CHARTS** .	No indication of restrictions or leaks has been detected in the exhaust system. To continue diagnosis of a symptom (lack of power, loss of power, or no start), REFER to **SYMPTOM CHARTS** .

HF10 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 PCM self-test.

Are DTCs P0420 or P0430 present?

Yes	No
INSTALL a new catalyst between the monitored HO2S, only for the bank referenced, (P0420 Bank 1), (P0430 Bank 2). Do not install a new unmonitored catalyst unless it is repaired as an assembly. REFER to the appropriate Exhaust System article. Clear the PCM DTCs. REPEAT the self-test.	The test is complete and no concerns are present.

PINPOINT TESTS HG: POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- positive crankcase ventilation (PCV) valve (6A666) and related vacuum lines
- crankcase pressure sensor (6758)
- PCM (12A650)

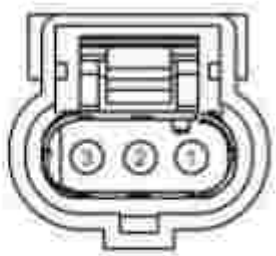

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Fig. 104: Crankcase Pressure Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	CKCP (Crankcase Pressure)
2	SIGRTN (Signal Return)
3	VREF (Reference Voltage)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Escape/Kuga 1.5L	198 PIN	B69	CKCP

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Vehicle	Connector	Pin	Circuit
Expedition, F-150 3.5L, Navigator	198 PIN	E18	CKCP
F-150 2.7L	306 PIN	E73	CKCP
All other vehicles	198 PIN	B72	CKCP

TEST PROCEDURE

HG1 CHECK FOR DTCS

Are DTCs P04DB, P051B, P051C, P051D, or P2282 present?

Yes	No
GO to HG3.	For symptoms without DTCs, GO to HG2. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

HG2 VISUAL INSPECTION OF THE PCV SYSTEM

- Check the PCV valve, hoses and connections for leaks or restrictions.
- Verify the PCV valve maintenance schedule has been followed.
- Verify the correct PCV valve part number.
- Verify the PCV valve is clean.
- Verify the fresh air tube and related hoses are clean and routed correctly.

Is a concern present?

Yes	No
REPAIR as necessary. VERIFY the symptom no longer exists.	GO to HG10.

HG3 CHECK FOR LEAKS

- Check for disconnected, damaged or restricted vacuum lines between the engine and any vacuum operated components.
- Check for disconnected, damaged or restricted intake air system lines between the engine and any intake air system components.
- Check for disconnected, damaged or restricted positive crankcase ventilation (PCV) system lines between the engine and any PCV components.
- Visually inspect for a damaged or pinched PCV hose o-ring seal.
- Visually inspect for a correctly installed oil level indicator or a damaged oil level indicator o-ring seal.
- Check for a correctly installed oil cap.
- Check for air leaks between the throttle body and intake valves.
- Visually inspect the intake throttle plate for sticking or binding.
- Verify the correct PCV valve part number.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	For DTCs P04DB or P2282, GO to HG10. For all others, GO to HG4.

HG4 MONITOR THE CRANKCASE PRESSURE SENSOR PID

- Ignition ON, engine running.
- Access the PCM and monitor the CRNKCAS_P_V (VOLT) PID.

Is the voltage between 3.7 - 4.1 V?

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Yes	No
For DTC P051B, GO to HG9. For all others, GO to HG5.	GO to HG5.

HG5 CHECK FOR VREF AT THE SENSOR

- Ignition OFF.
- Crankcase Pressure Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Crankcase Pressure Sensor Connector, Harness Side	(-) Crankcase Pressure Sensor Connector, Harness Side
VREF - Pin 3	SIGRTN - Pin 2

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to HG6.	GO to **PINPOINT TEST C**.

HG6 CHECK FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) Crankcase Pressure Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
CKCP - Pin 1	CKCP

Is the resistance less than 5 ohms?

Yes	No
GO to HG7.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HG7 CHECK FOR A SHORT TO GROUND

- Ignition OFF.
- Measure the resistance between:

(+) Crankcase Pressure Sensor Connector, Harness Side	(-)
CKCP - Pin 1	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to HG8.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

HG8 CHECK FOR A SHORT TO VOLTAGE

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

(+) Crankcase Pressure Sensor Connector, Harness Side	(-)
CKCP - Pin 1	Ground

Is any voltage present?

Yes	No

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Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new Crankcase Pressure sensor. Clear the PCM DTCs. REPEAT the self-test.

HG9 CHECK FOR INTERMITTENT CONCERNS

- Ignition OFF.
- Crankcase Pressure Sensor connector connected.
- PCM connector connected.
- Ignition ON, engine running.
- Access the PCM and monitor the CRNKCAS_P_V (VOLT) PID.
- Wiggle the harness connector to simulate road shock.

Does a sudden change in voltage occur while monitoring the PID?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**.

HG10 PCV SYSTEM CHECK

- Start the engine and warm it until engine temperature is stable.
- Disconnect the intake air system hose from the air cleaner outlet.
- Place a stiff piece of paper over the disconnected intake air system hose opening. Wait 1 minute.

Does vacuum hold the paper in place?

Yes	No
For DTC P04DB, INSTALL a new Crankcase Pressure sensor. Clear the PCM DTCs. REPEAT the self-test. For all others, the PCV system is OK. RETURN to **SYMPTOM CHARTS** for further direction.	CHECK for vacuum leaks or restrictions in the PCV system (such as oil cap, PCV valve, hoses, cut grommets, valve cover bolt torque or gasket leak). REFER to the appropriate Engine Emission Control article, Evaporative Emission (EVAP) Control System Vacuum Routing, for PCV system components and routing. REPAIR as necessary.

PINPOINT TESTS HK: VARIABLE CAMSHAFT TIMING (VCT)

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- VCT solenoid (6L713) or (6B297)
- spider assembly right bank (6C260) or left bank (6C261)
- harness circuits: VPWR and VCT
- PCM (12A650)

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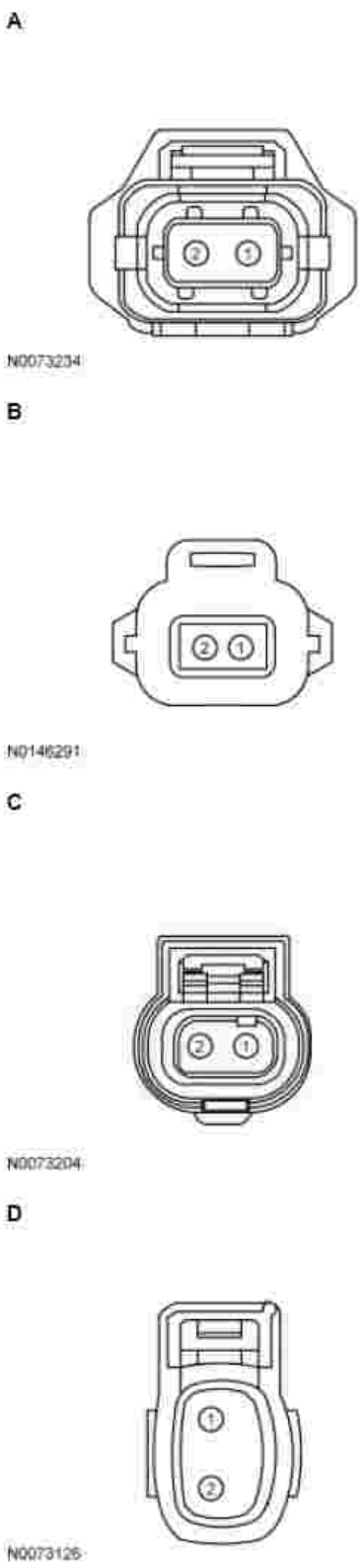

Fig. 105: Variable Camshaft Timing Bank 1 Solenoid 1 (VCT11) Solenoid Connector (1 Of 2)
Courtesy of FORD MOTOR CO.

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E

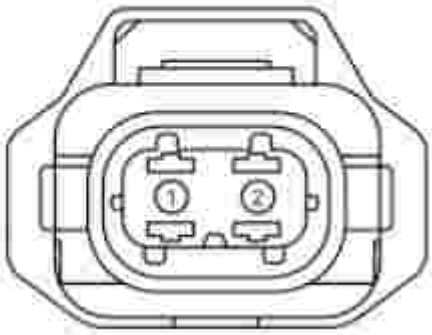

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Fig. 106: Variable Camshaft Timing Bank 1 Solenoid 1 (VCT11) Solenoid Connector (2 Of 2)
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series, Expedition, F-150 5.0L, Mustang 5.0L, Navigator	A	1 2	VPWR VCT11
EcoSport 1.5L, Escape/Kuga 1.5L, Ford GT	B	1 2	VPWR VCT11
Escape/Kuga 2.0L, Mustang 5.2L	C	2 1	VPWR VCT11
Explorer GTDI 3.5L, Flex GTDI 3.5L, MKT 3.5L, Taurus GTDI 3.5L	D	1 2	VPWR VCT11

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Vehicle	Connector	Pin	Circuit
F-Series Super Duty	E	1 2	VPWR VCT11
Fiesta 1.6L, Fusion 1.5L	F	1 2	VPWR VCT11
KA 1.5L	G	1 2	VPWR VCT11
All other vehicles	C	1 2	VPWR VCT11

A

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B

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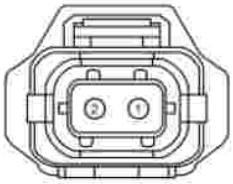
C



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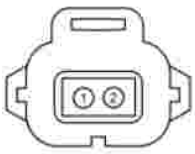

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Fig. 107: Variable Camshaft Timing Bank 1 Solenoid 2 (VCT12) Solenoid Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
EcoSport 1.5L, Escape/Kuga 1.5L, Ford GT	A	1 2	VPWR VCT12
Escape/Kuga 2.0L, Mustang 5.2L	B	2 1	VPWR VCT12
Expedition, F-150 5.0L, Mustang 5.0L, Navigator	C	1 2	VPWR VCT12
Fiesta 1.6L, Fusion 1.5L	D	1 2	VPWR VCT12
KA 1.5L	E	1 2	VPWR VCT12
All other vehicles	B	1 2	VPWR VCT12

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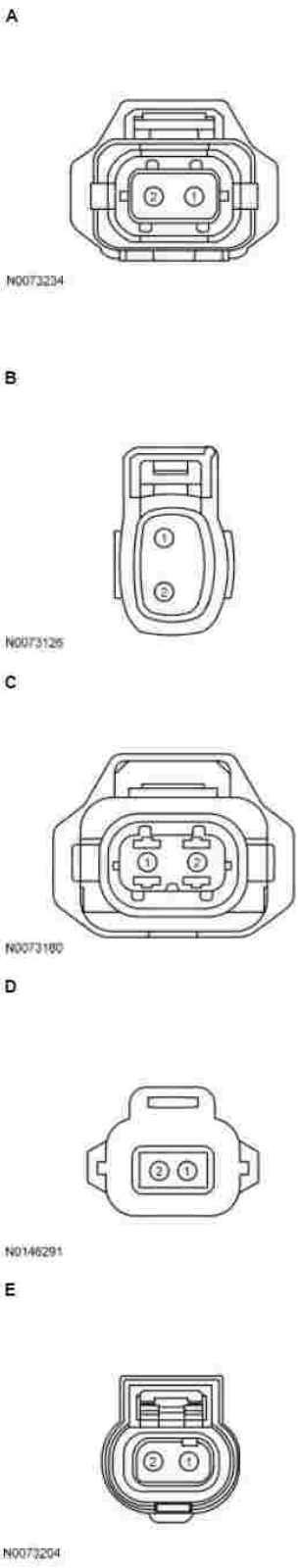

Fig. 108: Variable Camshaft Timing Bank 2 Solenoid 1 (VCT21) Solenoid Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series, Expedition, F-150 5.0L, Mustang 5.0L, Navigator	A	1 2	VPWR VCT21
Explorer GTDI 3.5L, Flex GTDI 3.5L, MKT 3.5L, Taurus GTDI 3.5L	B	1 2	VPWR VCT21
F-Series Super Duty	C	1 2	VPWR VCT21

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Vehicle	Connector	Pin	Circuit
Ford GT	D	1 2	VPWR VCT21
Mustang 5.2L	E	2 1	VCT21 VPWR
All other vehicles	E	1 2	VPWR VCT21

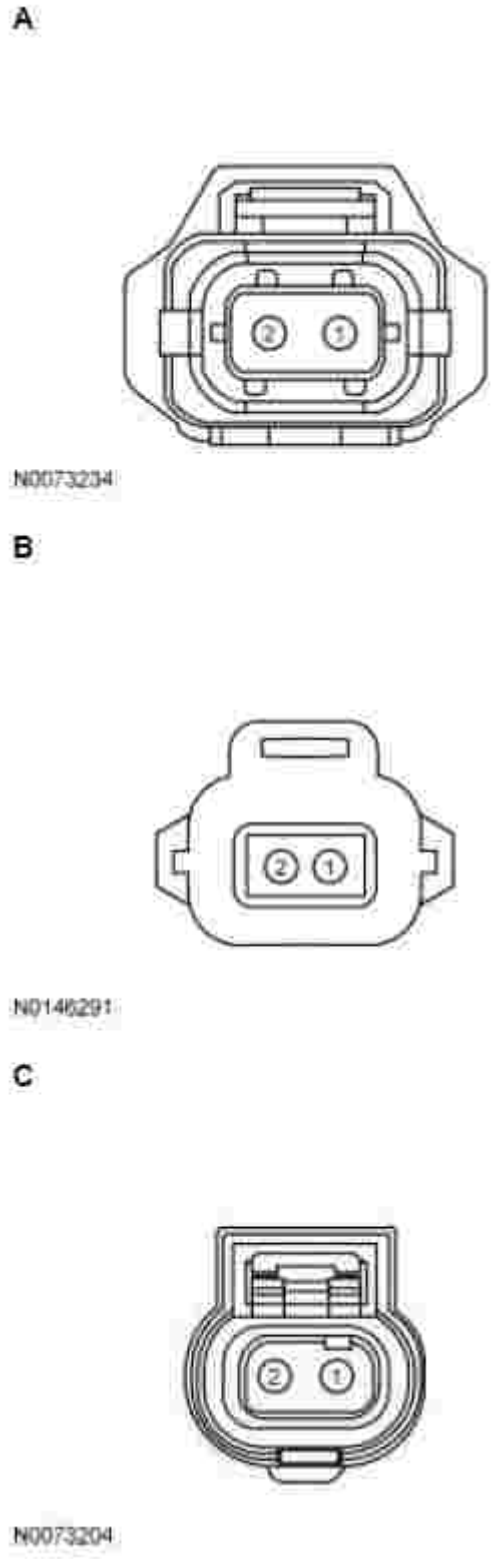

Fig. 109: Variable Camshaft Timing Bank 2 Solenoid 2 (VCT22) Solenoid Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition, F-150 5.0L, Mustang 5.0L, Navigator	A	1 2	VPWR VCT22

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Vehicle	Connector	Pin	Circuit
Ford GT	B	1 2	VPWR VCT22
Mustang 5.2L	C	2 1	VPWR VCT22
All other vehicles	C	1 2	VPWR VCT22

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, Edge 2.7L, Ford GT, Transit 3.5L	198 PIN	E17 E18 E29 E1 B101, B102, B103	VCT22 VCT21 VCT12 VCT11 VPWR
Continental 3.7L, Edge 3.5L, Explorer TiVCT 3.5L, Explorer 3.7L, Flex TiVCT 3.5L, MKT 3.7L, MKX 3.7L, Mustang 5.2L, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L	198 PIN	E6 E7 E4 E5 B97, B99	VCT22 VCT21 VCT12 VCT11 VPWR
E-Series 6.2L, F-Series Super Duty 6.2L	198 PIN	E7 E5 B97, B99	VCT21 VCT11 VPWR
E-Series 6.8L, F-650/F-750, F-Series Super Duty 6.8L, Motorhome/Stripped Chassis/Step Van	198 PIN	B97, B99	VPWR
EcoSport 1.0L Manual Transmission, Fiesta 1.0L, Fiesta GTDI 1.6L	198 PIN	E31 E16 B101, B102, B103	VCT12 VCT11 VPWR
EcoSport 1.5L Automatic Transmission	198 PIN	E2 E1 B97, B99	VCT12 VCT11 VPWR
EcoSport 1.5L Manual Transmission	112 PIN	E45 E51 B55, B56	VCT12 VCT11 VPWR
Escape/Kuga 1.5L	198 PIN	E5 E46 B101, B102, B103	VCT12 VCT11 VPWR
Escape/Kuga 2.5L, Fusion 2.5L, Transit Connect	198 PIN	E1 B97, B99	VCT11 VPWR
Expedition, F-150 3.5L, Navigator	198 PIN	E31 E61 E16 E46 B101, B102, B103	VCT22 VCT21 VCT12 VCT11 VPWR

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Vehicle	Connector	Pin	Circuit
Explorer GTDI 3.5L, Flex GTDI 3.5L, MKT 3.5L, Taurus GTDI 3.5L	198 PIN	E18 E1 B101, B102, B103	VCT21 VCT11 VPWR
F-150 2.7L, F-150 3.3L, F-150 5.0L, Mustang 5.0L	306 PIN	E111 E25 E102 E4 B1, B16, B2	VCT22 VCT21 VCT12 VCT11 VPWR
Fiesta TiVCT 1.6L	128 PIN	E42 E43 B11, B12, E13, E37	VCT12 VCT11 VPWR
Focus GDI 2.0L	154 PIN	E71 E67 B5, B6	VCT12 VCT11 VPWR
Fusion 2.7L, MKZ 3.0L	198 PIN	E17 E29 E18 E1 B101, B102, B103	VCT22 VCT21 VCT12 VCT11 VPWR
KA 1.0L	128 PIN	E46 E47 B36, E24	VCT12 VCT11 VPWR
KA 1.5L	128 PIN	E46 T5 B36, E24	VCT12 VCT11 VPWR
MKX 2.7L	198 PIN	E17 E26 E29 E1 B101, B102, B103	VCT22 VCT21 VCT12 VCT11 VPWR
Mustang 2.3L	198 PIN	E1 E5 B101, B102, B103	VCT12 VCT11 VPWR
Ranger	128 PIN	E43 B11, B12	VCT11 VPWR
All other vehicles	198 PIN	E29 E1 B101, B102, B103	VCT12 VCT11 VPWR

TEST PROCEDURE

HK1 CHECK FOR DTCS

NOTE: **These DTCs may be accompanied by other DTCs. Diagnose all CMP sensor DTCs first. If no CMP sensor related DTCs are present, continue to follow diagnosis for the DTC. If any CMP DTCs are present, GO to PINPOINT TEST DR. If no CMP DTCs are present, continue to follow this test.**

Are DTCs P000A, P000B, P0010, P0011, P0012, P0013, P0014, P0015, P0016, P0017, P0018, P0019, P0020, P0021, P0022, P0023, P0024, P0025, P052A, P052B, P052C, P052D, P054A, P054B, P054C, P054D, P2088, P2089, P2090 or P2091 present?

Yes	No
For DTC P0010, P0013, P0020, P0023, P2088, P2089, P2090 and P2091, GO to HK2. For all others, GO to HK10.	For symptoms without DTCs, GO to HK10. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

HK2 CHECK FOR VCT DTCS

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NOTE: **The engine should be at operating temperature before running the self-test.**

- Clear the PCM DTCs.
- Carry out the PCM self-test.

Are DTCs P0010, P0013, P0020, P0023, P2088, P2089, P2090 or P2091 present?

Yes	No
GO to HK4.	GO to HK3.

HK3 CARRY OUT A THOROUGH WIGGLE TEST ON THE VCT HARNESS

- Carry out a thorough wiggle test on the VCT harness.
- Carry out the PCM self-test.

Are DTCs P0010, P0013, P0020, P0023, P2088, P2089, P2090 or P2091 present?

Yes	No
GO to HK4.	GO to **PINPOINT TEST Z**.

HK4 CHECK THE VCT SOLENOID RESISTANCE

NOTE: **Diagnose the suspect VCT solenoid indicated by the DTC.**

- Ignition OFF.
- Disconnect the VCT solenoid related to the current DTC.
- Measure the resistance between:

(+) VCT Solenoid Connector, Component Side	(-) VCT Solenoid Connector, Component Side
VCT	VPWR

Is the resistance between 5 - 14 ohms?

Yes	No
GO to HK5.	INSTALL a new VCT solenoid. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

HK5 CHECK THE VCT SOLENOID FOR INTERNAL SHORTS

- Measure the resistance between:

(+) VCT Solenoid Connector, Component Side	(-)
VCT	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to HK6.	INSTALL a new VCT solenoid. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

HK6 CHECK THE VPWR CIRCUIT FOR AN OPEN

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

(+) VCT Solenoid Connector, Harness Side	(-)
VPWR	Ground

Is the voltage greater than 10.5 V?

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Yes	No
GO to HK7.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HK7 CHECK THE VCT CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) VCT Solenoid Connector, Harness Side	(-) PCM Connector, Harness Side
VCT	VCT

Is the resistance less than 5 ohms?

Yes	No
GO to HK8.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HK8 CHECK THE VCT CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

(+) VCT Solenoid Connector, Harness Side	(-)
VCT	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to HK9.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

HK9 CHECK THE VCT CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) VCT Solenoid Connector, Harness Side	(-)
VCT	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to HK15.

HK10 CHECK THE OPERATION OF THE VCT SYSTEM

NOTE: **Do not install a new component unless directed to install a new component in this pinpoint test.**

NOTE: **Some vehicles require higher RPMs and loads to actuate the VCT system than others. The VCTADVERR PID, VCT_INT_DIF PID or VCT_EXH_DIF PID should be close to zero whether actuating or not. During rapid VCT movements, the VCTADVERR PID, VCT_INT_DIF PID or VCT_EXH_DIF PID may momentarily deviate from zero.**

NOTE: **For a symptom based concern, monitor all applicable PIDs during this step.**

- Ignition ON, engine OFF.
- Clear the PCM DTCs.
- Ignition ON, engine running.

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- For E-Series 6.2L, Escape 2.5L, F-Series Super Duty 6.2L, Fusion 2.5L, Transit Connect:
- For DTCs P0011, P0012, P0016, P052A or P052B,
- Access the PCM and monitor the VCTADV (ANGL) and VCTADVERR (ANGL) PIDs.
- For DTCs P0018, P0021, P0022, P052C or P052D,
- Access the PCM and monitor the VCTADV2 (ANGL) and VCTADVERR2 (ANGL) PIDs.
- For all others:
- For DTCs P000A, P0011, P0012, P0016, P052A or P052B,
- Access the PCM and monitor the VCT_INT_ACT1 (ANGL) and VCT_INT_DIF1 (ANGL) PIDs.
- For DTCs P000B, P0014, P0015, P0017, P054A or P054B,
- Access the PCM and monitor the VCT_EXH_ACT1 (ANGL) and VCT_EXH_DIF1 (ANGL) PIDs.
- For DTCs P0018, P0021, P0022, P052C or P052D,
- Access the PCM and monitor the VCT_INT_ACT2 (ANGL) and VCT_INT_DIF2 (ANGL) PIDs.
- For DTCs P0019, P0024, P0025, P054C or P054D,
- Access the PCM and monitor the VCT_EXH_ACT2 (ANGL) and VCT_EXH_DIF2 (ANGL) PIDs.
- Drive the vehicle while exercising the throttle to generate VCT movement.

Does the VCTADV PID, VCT_INT_ACT PID or VCT_EXH_ACT PID indicate VCT movement while the VCTADVERR PID or VCT_INT_DIF PID or VCT_EXH_DIF PID maintain close to zero?

Yes	No
Unable to duplicate or identify the concern at this time. The concern may have been caused by an oil flow restriction which was removed by operating the VCT system. Clear the PCM DTCs. REPEAT the self-test.	If the engine runs rough at idle and KOER or continuous memory DTCs are present, GO to HK12. For all others, GO to HK11.

HK11 CHECK THE FUNCTIONALITY OF THE VCT SYSTEM

NOTE: **Do not install a new component unless directed to install a new component in this pinpoint test.**

NOTE: **Diagnose the suspect VCT solenoid indicated by the DTC.**

NOTE: **For a symptom based concern, monitor all applicable PIDs during this step.**

- For E-Series 6.2L, Escape 2.5L, F-Series Super Duty 6.2L, Fusion 2.5L, Transit Connect:
- For DTCs P0011, P0012, P0016, P052A or P052B,
- Access the PCM and monitor the VCTADV (ANGL) PID.
- For DTCs P0018, P0021, P0022, P052C or P052D,
- Access the PCM and monitor the VCTADV2 (ANGL) PID.
- For all others:
- For DTCs P000A, P0011, P0012, P0016, P052A or P052B,
- Access the PCM and monitor the VCT_INT_ACT1 (ANGL) PID.
- For DTCs P000B, P0014, P0015, P0017, P054A or P054B,
- Access the PCM and monitor the VCT_EXH_ACT1 (ANGL) PID.
- For DTCs P0018, P0021, P0022, P052C or P052D,
- Access the PCM and monitor the VCT_INT_ACT2 (ANGL) PID.
- For DTCs P0019, P0024, P0025, P054C or P054D,
- Access the PCM and monitor the VCT_EXH_ACT2 (ANGL) PID.
- Ignition OFF.
- Disconnect the VCT solenoid related to the current DTC.
- Ignition ON, engine running.
- Record the PID value at engine idle.

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

Point A VCT Solenoid Connector, Component Side	Point B Vehicle Battery
VPWR	Positive terminal

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

Point A VCT Solenoid Connector, Component Side	Point B Vehicle Battery
VCT	Negative terminal

- Record the PID value at engine idle.

Does the VCTADV PID, VCT_INT_ACT PID or VCT_EXH_ACT PID indicate VCT movement of 20 degrees or more?

Yes	No
The concern is not present at this time. The concern may have been caused by an oil flow restriction which was removed by operating the VCT system. Clear the PCM DTCs. REPEAT the self-test.	GO to HK12.

HK12 ATTEMPT TO CLEAR ANY VCT SOLENOID DEBRIS

NOTE: **Do not install a new component unless directed to install a new component in this pinpoint test.**

NOTE: **Diagnose the suspect VCT solenoid indicated by the DTC.**

NOTE: **For a symptom based concern, monitor all applicable PIDs during this step.**

- For E-Series 6.2L, Escape 2.5L, F-Series Super Duty 6.2L, Fusion 2.5L, Transit Connect:
- For DTCs P0011, P0012, P0016, P052A or P052B,
- Access the PCM and monitor the VCTADV (ANGL) PID.
- For DTCs P0018, P0021, P0022, P052C or P052D,
- Access the PCM and monitor the VCTADV2 (ANGL) PID.
- For all others:
- For DTCs P000A, P0011, P0012, P0016, P052A or P052B,
- Access the PCM and monitor the VCT_INT_ACT1 (ANGL) PID.
- For DTCs P000B, P0014, P0015, P0017, P054A or P054B,
- Access the PCM and monitor the VCT_EXH_ACT1 (ANGL) PID.
- For DTCs P0018, P0021, P0022, P052C or P052D,
- Access the PCM and monitor the VCT_INT_ACT2 (ANGL) PID.
- For DTCs P0019, P0024, P0025, P054C or P054D,
- Access the PCM and monitor the VCT_EXH_ACT2 (ANGL) PID.
- Ignition ON, engine running.
- Record the PID value at engine idle.
- Connect a 5 amp fused jumper wire between the following:

Point A VCT Solenoid Connector, Component Side	Point B Vehicle Battery
VPWR	Positive terminal

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

Point A VCT Solenoid Connector, Component Side	Point B Vehicle Battery
VCT	Negative terminal

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- Quickly connect and disconnect the jumper wire to the negative battery terminal at least 20 times within 20 seconds.
- Connect the jumper wire to the negative battery terminal and leave it connected.
- Record the PID value at engine idle.

Does the VCTADV PID, VCT_INT_ACT PID or VCT_EXH_ACT PID indicate VCT movement of 20 degrees or more?

Yes	No
The concern is not present at this time. The concern may have been caused by an oil flow restriction which was removed by operating the VCT system. Clear the PCM DTCs. REPEAT the self-test.	GO to HK13.

HK13 CHECK THE BASE ENGINE OIL PRESSURE

- Ignition OFF.
- Connect the VCT solenoid related to the current DTC.
- Check the base engine oil pressure. Refer to the appropriate Engine System article, Oil Pressure Test.

Are any concerns present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to HK14.

HK14 CHECK THE FUNCTIONALITY OF THE VCT SOLENOID

NOTE: **Do not install a new component unless directed to install a new component in this pinpoint test.**

NOTE: **Diagnose the suspect VCT solenoid indicated by the DTC.**

- Ignition OFF.
- Disconnect the VCT solenoid related to the current DTC.
- Remove the VCT solenoid related to the current DTC. REFER to the appropriate Electronic Engine Controls article.
- Connect a 5 amp fused jumper wire between the following:

Point A VCT Solenoid Connector, Component Side	Point B Vehicle Battery
VPWR	Positive terminal

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

Point A VCT Solenoid Connector, Component Side	Point B Vehicle Battery
VCT	Negative terminal

- While holding the VCT solenoid, quickly connect and disconnect the jumper wire to the negative battery terminal. The VCT solenoid plunger vibration can be felt by hand when connecting the jumper wires.
- Repeat as necessary to verify the VCT solenoid operation.

Does the VCT solenoid plunger activate when the jumpers are connected?

Yes	No
INSTALL a new VCT phaser as necessary. REFER to the appropriate Engine System article Engine, Timing Drive Components. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new VCT solenoid. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

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HK15 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.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS HN: TURBOCHARGER SYSTEM

INTRODUCTION

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.**

WARNING: **STRICT OBSERVANCE OF POSTED SPEED LIMITS AND DRIVING CONDITIONS IS MANDATORY WHEN PROCEEDING THROUGH THE FOLLOWING DRIVE CYCLES.**
FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

NOTE: **To recreate the original conditions that set the DTC or caused the symptom, the vehicle may require driving.**

This pinpoint test is intended to diagnose the following:

- turbocharger bypass (TCBY) valve (9K378)
- turbocharger bypass 2 (TCBY2) valve (9K378)
- turbocharger wastegate regulating valve bank 1 solenoid 1 (9961 pressure actuated, 9E882 vacuum actuated)
- turbocharger wastegate regulating valve bank 2 solenoid 1 (9961 pressure actuated, 9E882 vacuum actuated)
- turbocharger wastegate motor (9G488)
- wastegate vacuum sensor (9F479)
- leaks or restrictions in the intake air system and charge air cooler (CAC)
- PCM (12A650)

Turbocharger Type

Vehicles	Electric Actuated Wastgate	Pressure Actuated Wastegate	Vacuum Actuated Wastegate (Normally Closed)	Vacuum Actuated Wastegate (Normally Open)
Escape/Kuga 1.5L, Fiesta 1.0L, Focus 1.0L, Fusion 1.5L	Â	Â	Â	X

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Vehicles	Electric Actuated Wastgate	Pressure Actuated Wastegate	Vacuum Actuated Wastegate (Normally Closed)	Vacuum Actuated Wastegate (Normally Open)
Continental, Edge, Escape/Kuga 2.0L, Explorer 2.3L, F-150 2.7L, Fusion 2.0L, Fusion 2.7L, MKC 2.0L, MKX, MKZ	Â	Â	X	Â
Expedition, F-150 3.5L, Navigator	X	Â	Â	Â
All others	Â	X	Â	Â

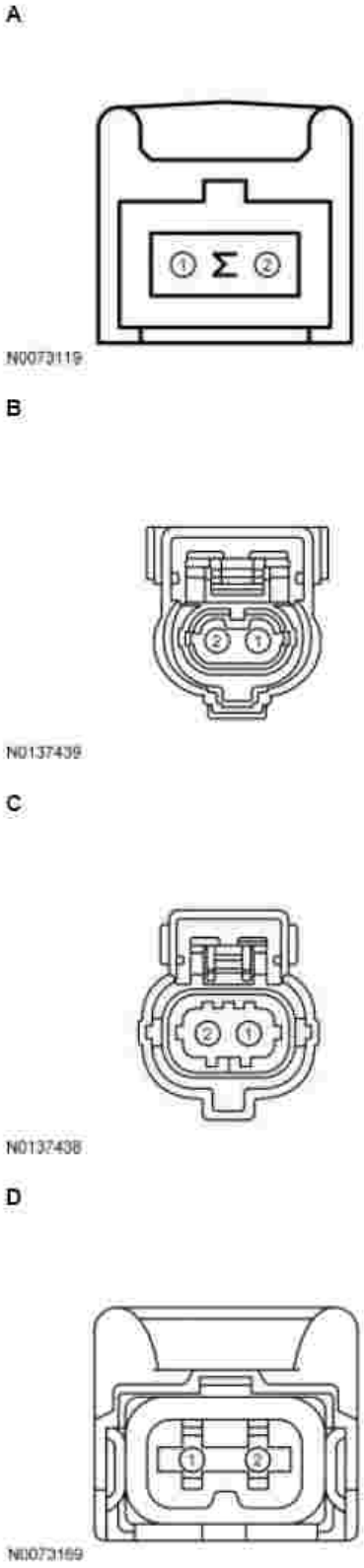

Fig. 110: Turbocharger Bypass (TCBY) Valve Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
EcoSport, Fiesta 1.0L, Focus 1.0L, MKT 2.0L, Taurus 2.0L	A	2 1	TCBY VPWR
Expedition, Navigator	B	1 2	TCBY VPWR
Explorer 3.5L, Flex, MKT 3.5L, Taurus 3.5L, Transit	C	2 1	TCBY VPWR
Explorer 2.3L, Focus GTDI 2.0L	A	1 2	TCBY VPWR
Fiesta 1.6L	C	1 2	TCBY VPWR
MKC	D	1 2	TCBY VPWR
All other vehicles	B	2 1	TCBY VPWR

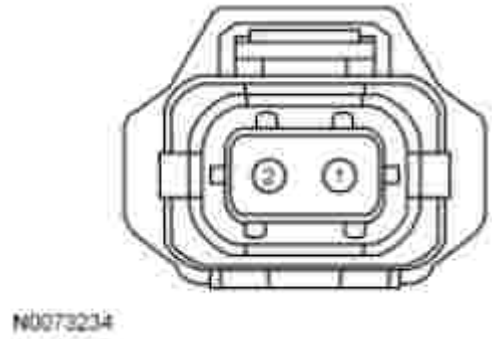

Fig. 111: Turbocharger Bypass 2 (TCBY2) Valve Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	TCBY2 (Turbocharger Bypass 2)
1	VPWR (Vehicle Power)

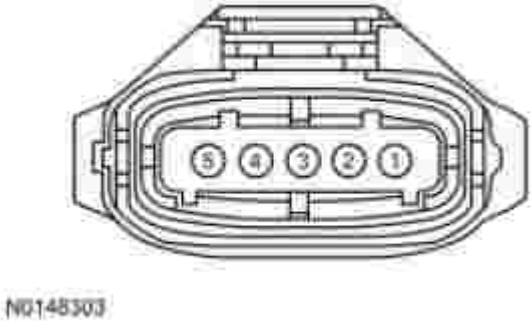

Fig. 112: Turbocharger Wastegate Motor Bank 1 Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
5	TCWGM1- (Turbocharger Wastegate Motor Bank 1 -)
1	TCWGM1+ (Turbocharger Wastegate Motor Bank 1 +)
2	TCWGP1 (Turbocharger Wastegate Position Bank 1)
3	SIGRTN (Signal Return)
4	VREF (Voltage Reference)

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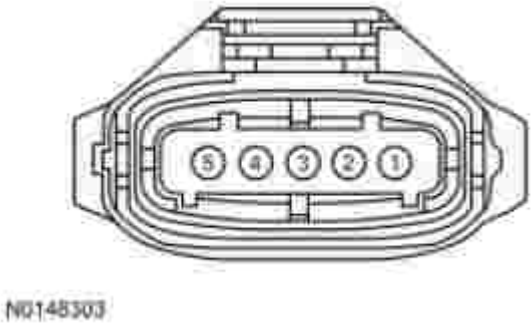

Fig. 113: Turbocharger Wastegate Motor Bank 2 Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
5	TCWGM2- (Turbocharger Wastegate Motor Bank 2 -)
1	TCWGM2+ (Turbocharger Wastegate Motor Bank 2 +)
2	TCWGP2 (Turbocharger Wastegate Position Bank 2)
3	SIGRTN (Signal Return)
4	VREF (Voltage Reference)

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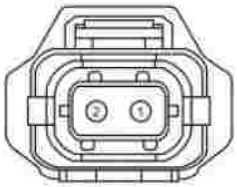
A



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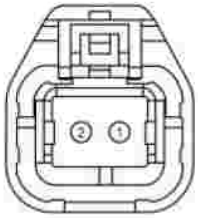
B



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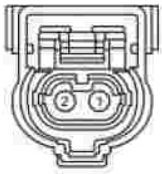
C



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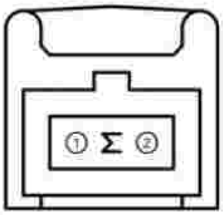
D



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E

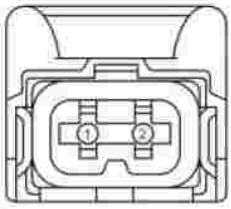

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Fig. 114: Turbocharger Wastegate Regulating Valve Bank 1, Solenoid 1 Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental, Edge, F-150, MKX	A	2 1	TCWRVS11 VPWR
EcoSport, Escape/Kuga 2.0L	B	2 1	TCWRVS11 VPWR
Escape/Kuga 1.5L, Fiesta, Fusion 1.5L, Fusion 2.7L, MKZ 3.0L	C	2 1	TCWRVS11 VPWR

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Vehicle	Connector	Pin	Circuit
Explorer, Flex, Focus 1.0L, MKT, Taurus 3.5L	D	2 1	TCWRVS11 VPWR
Ford GT, Mustang	E	1 2	TCWRVS11 VPWR
All other vehicles	D	1 2	TCWRVS11 VPWR

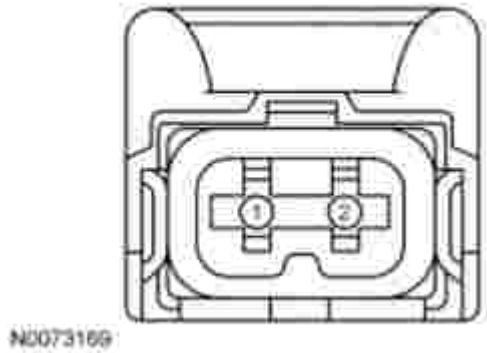

Fig. 115: Turbocharger Wastegate Regulating Valve Bank 2, Solenoid 1 Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	TCWRVS21 (Turbocharger Wastegate Regulating Valve Bank 2, Solenoid 1)
2	VPWR (Vehicle Power)

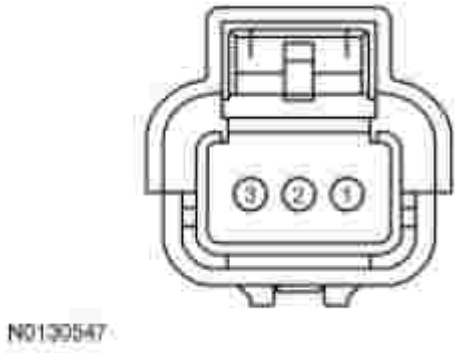

Fig. 116: Wastegate Vacuum Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
3	WVS (Wastegate Vacuum Sensor)
1	VREF (Reference Voltage)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, Edge 2.7L, Fusion 2.7L, MKX 2.7L	198 PIN	E20 B33 E16 E3	SIGRTN WVS TCWRVS11 TCBY

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Vehicle	Connector	Pin	Circuit
EcoSport 1.0L Automatic Transmission, Focus, Fusion 1.5L, MKC, MKT 2.0L, Taurus 2.0L, Transit	198 PIN	E16 E3	TCWRVS11 TCBY
EcoSport 1.0L Manual Transmission	198 PIN	E47	TCWRVS11
Escape/Kuga 1.5L	198 PIN	E4 E47	TCWRVS11 TCBY
Expedition, F-150 3.5L, Navigator	198 PIN	E77 E78 E23 E14 E15 E22 E75	TCWGM2- TCWGM2+ TCWGP2 TCWGM1- TCWGM1+ TCWGP1 TCBY
Explorer GTDI 3.5L, Flex, MKT 3.5L, Taurus GTDI 3.5L	198 PIN	E16 E19 E3	TCWRVS11 TCBY2 TCBY
F-150 2.7L	306 PIN	E5 E7 E15 E80	SIGRTN WVS TCWRVS11 TCBY
Fiesta 1.0L	198 PIN	E47 E46	TCWRVS11 TCBY
Fiesta GTDI 1.6L	198 PIN	E47 E48	TCWRVS11 TCBY
Ford GT	198 PIN	E19 E3 E4 E2	TCWRVS21 TCWRVS11 TCBY2 TCBY
MKZ 3.0L	198 PIN	B18 B33 E16 E3	SIGRTN WVS TCWRVS11 TCBY
Mustang	198 PIN	E2 E6	TCWRVS11 TCBY
All other vehicles	198 PIN	E20 E35 E16 E3	SIGRTN WVS TCWRVS11 TCBY

TEST PROCEDURE

HN1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: **This pinpoint test is designed to diagnose multiple components in the same test steps, only measure the circuits that apply to the vehicle and component being diagnosed.**

NOTE: **Diagnose and repair all circuit DTCs before diagnosing DTCs P0234 or P0299.**

NOTE: **Diagnose and repair all circuit DTCs before diagnosing any range or performance DTCs.**

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Are DTCs P0034, P0035, P00C1, P00C2, P0234, P0243, P0244, P0245, P0246, P0247, P0248, P0249, P0250, P0299, P100F, P1011, P1012, P1013, P1014, P1015, P1016, P25B3, P25B4, P25B5, P25B6, P2AB7, P2AB8, P2AB9, P2ABA, P2ABB, P2ABC, P2ABD, or P2ABE present?

Yes	No
For DTCs P0034, P0035, P00C1, P00C2, P0234, P0245, P0246, P0299, P100F, P1011, P1012, P1013, P1014, P1015 or P1016, GO to HN2. For all others, GO to HN29.	For Expedition, F-150 3.5L, and Navigator symptoms without DTCs, GO to HN37. For all other symptoms without DTCs, GO to HN12. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

HN2 VISUALLY INSPECT THE TURBOCHARGER SYSTEM

- Visually inspect the turbocharger system for:
- correct vacuum supply system hose connections and routing
- correct vacuum turbocharger wastegate control hose connection and routing
- correct pressure turbocharger wastegate control hose connection and routing
- correct vacuum turbocharger bypass control hose connection and routing
- leaks around tubing and intake manifold
- correct electrical connections
- damaged or leaking exhaust system
- turbocharger oil leaks. Refer to the appropriate Engine Controls - Fuel Charging And Controls - Turbocharger article.
- damaged or restricted turbocharger oil return tubes. Refer to the appropriate Engine Controls - Fuel Charging And Controls - Turbocharger article.
- damaged turbocharger. Refer to the appropriate Engine Controls - Fuel Charging And Controls - Turbocharger article.
- turbocharger wastegate linkage damaged or disconnected
- turbocharger wastegate linkage retainer damaged or disconnected

Do the visual inspections reveal any concerns?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	For DTC P100F, GO to HN3. For DTCs P1011, P1012, P1013, P1014, P1015 or P1016, GO to HN4. For all others, GO to HN5.

HN3 SENSOR CORRELATION

- Ignition ON, engine OFF.
- Access the PCM and monitor the BARO (PRESS), MAP (PRESS), TCBP (PRESS) and WGATE_PRES (PRESS) PIDs.

Is the WGATE_PRES PID reading within 6.77 kPa (0.98 psi) of the other PID readings?

Yes	No
GO to HN5.	CHECK the turbocharger wastegate vacuum system hoses for restrictions. REPAIR as necessary. If no concerns are present, INSTALL a new Wastegate Vacuum Sensor. Clear the PCM DTCs. REPEAT the self-test.

HN4 CHECK FOR VREF AT THE SENSOR

- Ignition OFF.
- Wastegate Vacuum Sensor connector disconnected.

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

(+) Wastegate Vacuum Sensor Connector, Harness Side	(-) Wastegate Vacuum Sensor Connector, Harness Side
VREF - Pin 1	SIGRTN

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to HN6.	GO to **PINPOINT TEST C**.

HN5 CHECK FOR VOLTAGE AT THE COMPONENT

NOTE: **This step applies to multiple components, only measure the circuits that apply to the vehicle and component being diagnosed.**

- Ignition OFF.
- For the TCBY valve,
- TCBY Valve connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) TCBY Valve Connector, Harness Side	(-)
VPWR	Ground

- For the TCBY2 valve,
- TCBY2 Valve connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) TCBY2 Valve Connector, Harness Side	(-)
VPWR - Pin 1	Ground

- For the turbocharger wastegate regulating valve bank 1, solenoid 1,
- Turbocharger Wastegate Regulating Valve Bank 1, Solenoid 1 connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Turbocharger Wastegate Regulating Valve Bank 1, Solenoid 1 Connector, Harness Side	(-)
VPWR	Ground

- For the turbocharger wastegate regulating valve bank 2, solenoid 1,
- Turbocharger Wastegate Regulating Valve Bank 2, Solenoid 1 connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Turbocharger Wastegate Regulating Valve Bank 2, Solenoid 1 Connector, Harness Side	(-)
VPWR - Pin 2	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to HN6.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

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HN6 CHECK FOR AN OPEN

NOTE: **This step applies to multiple components, only measure the circuits that apply to the vehicle and component being diagnosed.**

- Ignition OFF.
- PCM connector disconnected.
- For the TCBY valve,
- Measure the resistance between:

(+) TCBY Valve Connector, Harness Side	(-) PCM Connector, Harness Side
TCBY	TCBY

- For the TCBY2 valve,
- Measure the resistance between:

(+) TCBY2 Valve Connector, Harness Side	(-) PCM Connector, Harness Side
TCBY2 - Pin 2	TCBY2

- For the turbocharger wastegate regulating valve bank 1, solenoid 1,
- Measure the resistance between:

(+) Turbocharger Wastegate Regulating Valve Bank 1, Solenoid 1 Connector, Harness Side	(-) PCM Connector, Harness Side
TCWRVS11	TCWRVS11

- For the turbocharger wastegate regulating valve bank 2 solenoid 1,
- Measure the resistance between:

(+) Turbocharger Wastegate Regulating Valve Bank 2, Solenoid 1 Connector, Harness Side	(-) PCM Connector, Harness Side
TCWRVS21 - Pin 1	TCWRVS21

- For the wastegate vacuum sensor,
- Measure the resistance between:

(+) Wastegate Vacuum Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
WVS - Pin 3	WVS
SIGRTN - Pin 2	SIGRTN

Are the resistances less than 5 ohms?

Yes	No
GO to HN7.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HN7 CHECK FOR A SHORT TO GROUND

NOTE: **This step applies to multiple components, only measure the circuits that apply to the vehicle and component being diagnosed.**

- Ignition OFF.
- For the TCBY valve,
- Measure the resistance between:

(+) TCBY Valve Connector, Harness Side	(-)
TCBY	Ground

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- For the TCBY2 valve,
- Measure the resistance between:

(+) TCBY2 Valve Connector, Harness Side	(-)
TCBY2 - Pin 2	Ground

- For the turbocharger wastegate regulating valve bank 1 solenoid 1,
- Measure the resistance between:

(+) Turbocharger Wastegate Regulating Valve Bank 1, Solenoid 1 Connector, Harness Side	(-)
TCWRVS11	Ground

- For the turbocharger wastegate regulating valve bank 2 solenoid 1,
- Measure the resistance between:

(+) Turbocharger Wastegate Regulating Valve Bank 2, Solenoid 1 Connector, Harness Side	(-)
TCWRVS21 - Pin 1	Ground

- For the wastegate vacuum sensor,
- Measure the resistance between:

(+) Wastegate Vacuum Sensor Connector, Harness Side	(-)
WVS - Pin 3	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to HN8.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

HN8 CHECK FOR A SHORT TO VOLTAGE

NOTE: **This step applies to multiple components, only measure the circuits that apply to the vehicle and component being diagnosed.**

- Ignition ON, engine OFF.
- For the TCBY valve,
- Measure the voltage between:

(+) TCBY Valve Connector, Harness Side	(-)
TCBY	Ground

- For the TCBY2 valve,
- Measure the voltage between:

(+) TCBY2 Valve Connector, Harness Side	(-)
TCBY2 - Pin 2	Ground

- For the turbocharger wastegate regulating valve bank 1 solenoid 1,
- Measure the voltage between:

(+) Turbocharger Wastegate Regulating Valve Bank 1, Solenoid 1 Connector, Harness Side	(-)
TCWRVS11	Ground

- For the turbocharger wastegate regulating valve bank 2 solenoid 1,

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- Measure the voltage between:

(+) Turbocharger Wastegate Regulating Valve Bank 2, Solenoid 1 Connector, Harness Side	(-)
TCWRVS21 - Pin 1	Ground

- For the wastegate vacuum sensor,
- Measure the voltage between:

(+) Wastegate Vacuum Sensor Connector, Harness Side	(-)
WVS - Pin 3	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	For DTCs P1011, P1012, P1013 or P1014, GO to HN10. For all others, GO to HN9.

HN9 CHECK THE COMPONENT RESISTANCE

NOTE: **This step applies to multiple components, only measure the circuits that apply to the vehicle and component being diagnosed.**

- Ignition OFF.
- For the TCBY valve,
- Measure the resistance between:

(+) TCBY Valve Connector, Component Side	(-) TCBY Valve Connector, Component Side
TCBY	VPWR

- For the TCBY2 valve,
- Measure the resistance between:

(+) TCBY2 Valve Connector, Component Side	(-) TCBY2 Valve Connector, Component Side
TCBY2 - Pin 2	VPWR - Pin 1

- For the turbocharger wastegate regulating valve bank 1 solenoid 1,
- Measure the resistance between:

(+) Turbocharger Wastegate Regulating Valve Bank 1, Solenoid 1 Connector, Component Side	(-) Turbocharger Wastegate Regulating Valve Bank 1, Solenoid 1 Connector, Component Side
TCWRVS11	VPWR

- For the turbocharger wastegate regulating valve bank 2 solenoid 1,
- Measure the resistance between:

(+) Turbocharger Wastegate Regulating Valve Bank 2, Solenoid 1 Connector, Component Side	(-) Turbocharger Wastegate Regulating Valve Bank 2, Solenoid 1 Connector, Component Side
TCWRVS21 - Pin 1	VPWR - Pin 2

Are the resistances between 5 - 60 ohms?

Yes	No
GO to HN10.	INSTALL a new component. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

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HN10 CHECK THE WIRING HARNESS

NOTE: **This step applies to multiple components, only measure the circuits that apply to the vehicle and component being diagnosed.**

- Ignition OFF.
- PCM connector connected.
- For the TCBY valve,
- TCBY Valve connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the TURBO_BP1_STAT (MODE) PID.
- For the TCBY2 valve,
- TCBY2 Valve connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the TURBO_BP2_STAT (MODE) PID.
- For the turbocharger wastegate regulating valve bank 1 solenoid 1,
- Turbocharger Wastegate Regulating Valve Bank 1, Solenoid 1 connector connected.
- For the turbocharger wastegate regulating valve bank 2 solenoid 1,
- Turbocharger Wastegate Regulating Valve Bank 2, Solenoid 1 connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the TWGATE_STAT (MODE) PID.
- For the wastegate vacuum sensor,
- Wastegate Vacuum Sensor connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the WGATE_PRES_F (MODE) PID.
- For the Expedition, F-150 3.5L, and Navigator wastegate,
- Ignition ON, engine OFF.
- Access the PCM and monitor the WGATE_A_POS_PCT (PER) and WGATE_B_POS_PCT (PER) PIDs.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness while working from the component to the PCM.

Is there a change in the PID reading?

Yes	No
ISOLATE the concern. REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to HN11.

HN11 INTERMITTENT CHECK

NOTE: **This step applies to multiple components, only measure the circuits that apply to the vehicle and component being diagnosed.**

- For the TCBY,
- Access the PCM and monitor the TURBO_BP1_STAT (MODE) PID.
- For the TCBY2,
- Access the PCM and monitor the TURBO_BP2_STAT (MODE) PID.
- For the turbocharger wastegate regulating valve solenoids,
- Access the PCM and monitor the TWGATE_STAT (MODE) PID.
- For the wastegate vacuum sensor,
- Access the PCM and monitor the WGATE_PRES_F (MODE) PID.
- For the Expedition, F-150 3.5L, and Navigator wastegate,

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- Access the PCM and monitor the WGATE_A_POS_PCT (PER) and WGATE_B_POS_PCT (PER) PIDs.
- While observing the PID, carry out the following:
- lightly tap on the suspect component to simulate road shock
- wiggle the suspect component connector

Is there a change in the PID reading?

Yes	No
INSTALL a new component in question. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.	For DTCs P1011, P1012, P1013, P1014, P1015 or P1016, GO to HN27. For all others, GO to HN12.

HN12 TURBOCHARGER SYSTEM PERFORMANCE CONCERNS

NOTE: **For a performance concern related to a plugged or restricted exhaust, GO to HF8.**

NOTE: **Diagnose circuit concerns prior to range or performance concerns.**

NOTE: **Visually inspect the vehicle for aftermarket accessories and performance modifications (exhaust system, turbocharger, performance chip). Refer to ENGINE CONTROL (EC) SYSTEM , Modifications to OBD Vehicles.**

- Ignition OFF.
- Check the air filter element and housing for contamination, restrictions or water intrusion.
- Disconnect the air intake and check for restrictions or water intrusion.
- Visually inspect the turbocharger system for:
  - correct vacuum supply system hose connections and routing
  - correct vacuum turbocharger wastegate control hose connection and routing
  - correct pressure turbocharger wastegate control hose connection and routing
  - correct vacuum turbocharger bypass control hose connection and routing
  - leaks around the tubing and the intake manifold
  - correct electrical connections
  - damaged or leaking exhaust system
  - turbocharger oil leaks. Refer to the appropriate Engine Controls - Fuel Charging And Controls - Turbocharger article.
  - damaged or restricted turbocharger oil return tubes. Refer to the appropriate Engine Controls - Fuel Charging And Controls - Turbocharger article.
  - damaged turbocharger. Refer to the appropriate Engine Controls - Fuel Charging And Controls - Turbocharger article.
- Check the charge air cooler (CAC) system for leaks (hoses and cooler).
- Check the CAC and intake air system for restrictions.
- Check for aftermarket exhaust accessories and performance modifications.
- Visually inspect the exhaust system for the following:
  - leaks, cracks, or punctures upstream of the turbocharger
  - aftermarket accessories and performance modifications
  - tailpipe modifications that increase the exhaust restriction
  - restricted exhaust

Is a concern present?

Yes	No

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Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to HN13.

HN13 CHECK THE CHARGE AIR COOLER (CAC) AND INTAKE AIR SYSTEMS FOR LEAKS AND RESTRICTIONS

NOTE: **Remember to reinstall the sensor, reconnect the CAC tube to the throttle body and remove the plastic bag from the air filter at the completion of this step.**

- Disconnect the CAC tube from the throttle body.
- Use a suitable method to temporarily plug the CAC tube outlet.
- Place the air filter in a plastic bag to prevent air flow out the intake port and reinstall it in the vehicle.
- Remove the IAT sensor from the ducting between the air filter housing and the turbocharger.
- Connect the Rotunda Smoke Machine, Fuel Evaporative Emission System Tester 218-00001 (522) or equivalent to the intake air system using an appropriate adapter.
- Fill the intake air system with smoke.
- Check the intake air system for leaks and restrictions.

Are any leaks or restrictions present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to HN14.

HN14 CHECK BYPASS VALVE OPERATION

NOTE: **For vehicles without the RPM command PID, use the accelerator pedal to hold the engine RPM at approximately 2, 000 RPM.**

NOTE: **The TCBP PID value may decrease by 0.97 KPa (0.14 psi) or less when the TCBY valve is commanded ON.**

- Ignition ON, engine running.
- Access the PCM and control the TURBO_BPASS (MODE) PID.
- Access the PCM and control the TURBO_BPASS_2 (MODE) PID.
- Command the TURBO_BPASS PID and the TURBO_BPASS_2 PID to OFF.
- For the Expedition, F-150 3.5L, and Navigator wastegate,
- Access the PCM and monitor the WGATE_A_POS_PCT (PER) and WGATE_B_POS_PCT (PER) PIDs.
- For all others,
- Access the PCM and control the TURBO_WGATE (PER) PID.
- Command the TURBO_WGATE PID duty cycle to 100% (Continental, Edge, Escape/Kuga 2.0L, Explorer 2.3L, F-150 2.7L, Fusion 2.0L, Fusion 2.7L, MKC 2.0L, MKX, MKZ) or 0% (all others).
- Access the PCM and monitor the TCBP (PRESS) PID.
- Access the PCM and control the RPMDSD (RPM) PID.
- Command the RPM PID to the maximum RPM.
- Record the TCBP PID reading.
- Command the TURBO_BPASS and the TURBO_BPASS_2 PIDs ON and record the TCBP PID reading.

Does the TCBP PID reading decrease when the bypass valves are commanded ON?

Yes	No

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Yes	No
For Expedition, F-150 3.5L, and Navigator, GO to HN29. For all others, GO to HN15.	For EcoSport 1.0L, Fiesta 1.0L, Focus, Fusion 2.0L, MKC 2.3L, MKT 2.0L, MKZ 2.0L, and Taurus 2.0L, GO to HN19. For all others, INSTALL a new TCBY solenoid. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

HN15 CHECK WASTEGATE OPERATION

NOTE: **For vehicles without the RPM command PID, use the accelerator pedal to hold the engine RPM at approximately 2, 000 RPM.**

- Ignition ON, engine running.
- Access the PCM and control the TURBO_BPASS (MODE) PID.
- Access the PCM and control the TURBO_BPASS_2 (MODE) PID.
- Command the TURBO_BPASS PID and the TURBO_BPASS_2 PID to OFF.
- Access the PCM and control the TURBO_WGATE (PER) PID.
- Command the TURBO_WGATE PID duty cycle to 100% (Continental, Edge, Escape/Kuga 2.0L, Explorer 2.3L, F-150 2.7L, Fusion 2.0L, Fusion 2.7L, MKC 2.0L, MKX, MKZ) or 0% (all others).
- Access the PCM and monitor the TCBP (PRESS) PID.
- Access the PCM and control the RPMDSD (RPM) PID.
- Command the RPM PID to the maximum RPM.
- Record the TCBP PID reading.
- Command the TURBO_WGATE PID duty cycle to 0% (Continental, Edge, Escape/Kuga 2.0L, Explorer 2.3L, F-150 2.7L, Fusion 2.0L, Fusion 2.7L, MKC 2.0L, MKX, MKZ) or 100% (all others) and record the TCBP PID reading.

Does the TCBP PID reading increase from the initial recorded value?

Yes	No
GO to HN26.	For Continental, EcoSport 1.0L, Edge 2.0L, Edge 2.7L, Escape/Kuga 1.5L, Escape/Kuga 2.0L, Explorer 2.3L, F-150 2.7L, Fiesta 1.0L, Focus 1.0L, Fusion, MKC 2.0L, MKX 2.0L, MKX 2.7L, and MKZ, GO to HN22. For all others, GO to HN16.

HN16 CHECK TURBOCHARGER PRESSURE WASTEGATE ACTUATOR OPERATION

NOTE: **Do not exceed 103.4 kPa (15 psi) of pressure applied to the turbocharger actuators, excessive pressure will damage the actuators.**

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- Disconnect the turbocharger wastegate control hose from the turbocharger wastegate actuator.
- Record each of the turbocharger wastegate actuator linkage positions.
- Using a suitable hand pump with pressure gauge, pressurize the turbocharger wastegate actuator to 82.7 kPa (12 psi).

Does each turbocharger wastegate actuator linkage move from the starting position and does the pressure remain steady?

Yes	No
GO to HN17.	GO to HN18.

HN17 CHECK PRESSURE SYSTEM TO THE TURBOCHARGER WASTEGATE ACTUATOR

NOTE: **Do not exceed 103.4 kPa (15 psi) of pressure applied to the turbocharger actuators, excessive pressure will damage the actuators.**

- Disconnect the pressure supply hose from the inlet of the turbocharger wastegate regulating valve solenoid.
- Disconnect the pressure control hose from the outlet of the turbocharger wastegate regulating valve solenoid.
- Using a suitable adaptor, connect the pressure supply hose to the pressure control hose.
- Disconnect the turbocharger wastegate pressure supply hose from the high pressure tube.
- Using a suitable hand pump with pressure gauge, pressurize the turbocharger wastegate pressure supply hose to 48.3 kPa (7 psi).

Does each turbocharger wastegate actuator linkage move from the starting position and does the pressure remain steady?

Yes	No
INSTALL a new turbocharger wastegate regulating valve solenoid in question. REFER to the appropriate Engine Controls - Fuel Charging And Controls - Turbocharger article. Clear the PCM DTCs. REPEAT the self-test.	A pressure system leak or restriction is the cause of the concern. DIAGNOSE the turbocharger wastegate pressure system leak or restriction. REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.

HN18 CHECK THE TURBOCHARGER WASTEGATE ACTUATOR LINKAGE FOR DAMAGE OR OBSTRUCTIONS

- Attempt to manually activate the suspect actuator.

Can the suspect actuator be activated manually?

Yes	No
INSTALL a new turbocharger wastegate actuator. REFER to the appropriate Engine Controls - Fuel Charging And Controls - Turbocharger article. Clear the PCM DTCs. REPEAT the self-test.	Visually inspect the suspect turbocharger wastegate actuator linkage for damage or obstructions. Repair as necessary. If no turbocharger wastegate actuator linkage concerns are present, INSTALL a new turbocharger assembly. Refer to the appropriate Engine Controls - Fuel Charging And Controls - Turbocharger article. Clear the PCM DTCs. REPEAT the self-test.

HN19 CHECK THE TURBOCHARGER BYPASS VALVE SOURCE VACUUM

- Disconnect the vacuum supply tube from the vacuum pump.
- Using the DSL ENG Pressure Test Kit 014-00761 or equivalent, measure the vacuum at the vacuum pump.
- Ignition ON, engine running.
- Record the vacuum.

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Is the vacuum greater than 33.86 kPa (10 in-Hg)?

Yes	No
GO to HN20.	DIAGNOSE a loss of vacuum. REFER to the appropriate Brake System article. Clear the PCM DTCs. REPEAT the self-test.

HN20 CHECK THE BYPASS VALVE

- Disconnect the vacuum control tube from the TCBY valve.
- Using the DSL ENG Pressure Test Kit 014-00761 or equivalent, apply 33.86 kPa (10 in-hg) of vacuum to the TCBY valve.

Does the vacuum remain steady?

Yes	No
GO to HN21.	INSTALL a new TCBY valve. REFER to the appropriate Engine Controls - Fuel Charging And Controls - Turbocharger article. Clear the PCM DTCs. REPEAT the self-test.

HN21 CHECK THE VACUUM SYSTEM

- Disconnect the vacuum supply tube from the inlet of the TCBY solenoid.
- Disconnect the vacuum control tube from the outlet of the TCBY solenoid.
- Using a suitable adaptor, connect the vacuum supply tube to the vacuum control tube.
- Disconnect the vacuum supply tube from the vacuum pump.
- Using the DSL ENG Pressure Test Kit 014-00761 or equivalent, apply 33.86 kPa (10 in-hg) of vacuum to the vacuum supply tube.

Does the vacuum remain steady?

Yes	No
INSTALL a new TCBY solenoid. REFER to the appropriate Engine Controls - Fuel Charging And Controls - Turbocharger article. Clear the PCM DTCs. REPEAT the self-test.	A vacuum system leak or restriction is the cause of the concern. DIAGNOSE the vacuum system leak or restriction. REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.

HN22 CHECK THE TURBOCHARGER WASTEGATE SOURCE VACUUM

- Disconnect the vacuum supply tube from the vacuum pump.
- Using the DSL ENG Pressure Test Kit 014-00761 or equivalent, measure the vacuum at the vacuum pump.
- Ignition ON, engine running.
- Record the vacuum.

Is the vacuum greater than 33.86 kPa (10 in-Hg)?

Yes	No
GO to HN23.	DIAGNOSE a loss of vacuum. REFER to the appropriate Brake System article. Clear the PCM DTCs. REPEAT the self-test.

HN23 CHECK TURBOCHARGER VACUUM WASTEGATE ACTUATOR OPERATION

- Disconnect the turbocharger wastegate control hose from the turbocharger wastegate actuator.
- Record each of the turbocharger wastegate actuator linkage positions.
- Using the DSL ENG Pressure Test Kit 014-00761 or equivalent, apply 56.4 kPa (16.65 in-hg) (Explorer 2.3L GTDI) or 33.86 kPa (10 in-hg) (all others) of vacuum to the turbocharger wastegate actuator.

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Does each turbocharger wastegate actuator linkage move from the starting position and does the pressure remain steady?

Yes	No
GO to HN24.	GO to HN25.

HN24 CHECK THE VACUUM SUPPLY HOSE FROM THE VACUUM PUMP TO THE TURBOCHARGER WASTEGATE ACTUATOR

- For the turbocharger wastegate regulating valve bank 1 solenoid 1,
- Disconnect the vacuum supply hose from the inlet of the turbocharger wastegate regulating valve solenoid.
- Disconnect the vacuum control hose from the outlet of the turbocharger wastegate regulating valve solenoid.
- Using a suitable adaptor, connect the vacuum supply hose to the vacuum control hose.
- Disconnect the turbocharger wastegate vacuum supply hose from the vacuum pump.
- Using the DSL ENG Pressure Test Kit 014-00761 or equivalent, apply 56.4 kPa (16.65 in-hg) (Explorer 2.3L GTDI) or 33.86 kPa (10 in-hg) (all others) of vacuum to the vacuum supply hose.
- For the turbocharger wastegate regulating valve bank 2 solenoid 1,
- Disconnect the vacuum supply hose from the inlet of the turbocharger wastegate regulating valve solenoid.
- Disconnect the vacuum control hose from the outlet of the turbocharger wastegate regulating valve solenoid.
- Using a suitable adaptor, connect the vacuum supply hose to the vacuum control hose.
- Disconnect the turbocharger wastegate vacuum supply hose from the vacuum pump.
- Using the DSL ENG Pressure Test Kit 014-00761 or equivalent, apply 33.86 kPa (10 in-hg) of vacuum to the vacuum supply hose.

Does each turbocharger wastegate actuator linkage move from the starting position and does the vacuum remain steady?

Yes	No
INSTALL a new turbocharger wastegate regulating valve solenoid in question. REFER to the appropriate Engine Controls - Fuel Charging And Controls - Turbocharger article. Clear the PCM DTCs. REPEAT the self-test.	A vacuum system leak or restriction is the cause of the concern. DIAGNOSE the turbocharger wastegate vacuum system leak or restriction. REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.

HN25 CHECK THE TURBOCHARGER WASTEGATE ACTUATOR LINKAGE FOR DAMAGE OR OBSTRUCTIONS

- Attempt to manually activate the suspect actuator.

Can the suspect actuator be activated manually?

Yes	No
INSTALL a new turbocharger wastegate actuator. REFER to the appropriate Engine Controls - Fuel Charging And Controls - Turbocharger article. Clear the PCM DTCs. REPEAT the self-test.	Visually inspect the suspect turbocharger wastegate actuator linkage for damage or obstructions. Repair as necessary. If no turbocharger wastegate actuator linkage concerns are present, INSTALL a new turbocharger assembly. REFER to the appropriate Engine Controls - Fuel Charging And Controls - Turbocharger article. Clear the PCM DTCs. REPEAT the self-test.

HN26 TURBOCHARGER COMPRESSOR WHEEL CHECK

- Inspect the turbocharger compressor wheel and housing for the following:
- ability to spin freely
- noise while spinning

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- damage to vanes on the compressor wheel
- out of balance condition
- debris in housing

Is a concern present?

Yes	No
INSTALL a new turbocharger assembly. REFER to the appropriate Engine Controls - Fuel Charging And Controls - Turbocharger article. Clear the PCM DTCs. REPEAT the self-test.	GO to HN28.

HN27 CHECK THE WASTEGATE VACUUM SENSOR

NOTE: **A vacuum system leak may be internal or external to the vacuum system. Make sure to diagnose the entire vacuum system if a leak or restriction is the cause of the concern.**

- Ignition ON, engine OFF.
- Access the PCM and monitor the WGATE_V (VOLT) PID.
- Record the PID value.
- Disconnect the wastegate vacuum tube from the vacuum port on the turbocharger wastegate vacuum sensor.
- Using a suitable hand pump with gauge, apply 34.47 kPa (5 in-Hg) vacuum to the wastegate vacuum sensor port.
- Record the PID value.

Does the PID value change when vacuum is applied?

Yes	No
A vacuum system leak or restriction is the cause of the concern. DIAGNOSE the vacuum system leak or restriction. REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new Wastegate Vacuum Sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

HN28 CHECK FOR CORRECT SYSTEM 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.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

HN29 CHECK THE TURBOCHARGER WASTEGATE ACTUATORS

NOTE: **The turbocharger wastegate motor requires slow constant force to move the turbocharger wastegate linkage.**

- Ignition OFF.

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- Visually inspect the turbocharger wastegate linkage for damage or disconnections.
- Visually inspect the turbocharger wastegate system for obstructions or linkage restrictions.
- With constant pressure, slowly push the turbocharger wastegate linkage towards the turbocharger wastegate motor then pull the linkage away from the turbocharger wastegate motor.
- Check the turbocharger wastegate motor, the wiring harness, and connectors for the following:
- damaged housing
- damaged connectors
- crossed TCWGM circuits
- pushed out pins
- corrosion
- incorrect connections

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to HN30.

HN30 CHECK THE VREF AND SIGRTN CIRCUITS

NOTE: **The following steps apply to multiple components, only measure the circuits that apply to the vehicle and component being diagnosed.**

NOTE: **In the following measurement note the polarity of the probes.**

- Ignition OFF.
- Turbocharger Wastegate Motor Bank 1 connector disconnected.
- Turbocharger Wastegate Motor Bank 2 connector disconnected.
- Ignition ON, engine OFF.
- For DTCs P0243, P0244, P25B3, P25B4, P2AB7, P2AB8, P2AB9 or P2ABD,
- Measure the voltage between:

(+) Turbocharger Wastegate Motor Bank 1 Connector, Harness Side	(-) Turbocharger Wastegate Motor Bank 1 Connector, Harness Side
VREF - Pin 4	SIGRTN - Pin 3

- For all others,
- Measure the voltage between:

(+) Turbocharger Wastegate Motor Bank 2 Connector, Harness Side	(-) Turbocharger Wastegate Motor Bank 2 Connector, Harness Side
VREF - Pin 4	SIGRTN - Pin 3

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to HN31.	GO to **PINPOINT TEST C**.

HN31 CHECK FOR AN OPEN CIRCUIT

- Ignition OFF.
- PCM connector disconnected.
- For DTCs P0243, P0244, P25B3, P25B4, P2AB7, P2AB8, P2AB9 or P2ABD,
- Measure the resistance between:

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(+) Turbocharger Wastegate Motor Bank 1 Connector, Harness Side	(-) PCM Connector, Harness Side
TCWGP1 - Pin 2	TCWGP1
TCWGM1+ - Pin 1	TCWGM1+
TCWGM1- - Pin 5	TCWGM1-

- For all others,
- Measure the resistance between:

(+) Turbocharger Wastegate Motor Bank 2 Connector, Harness Side	(-) PCM Connector, Harness Side
TCWGP2 - Pin 2	TCWGP2
TCWGM2+ - Pin 1	TCWGM2+
TCWGM2- - Pin 5	TCWGM2-

Are the resistances less than 5 ohms?

Yes	No
GO to HN32.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HN32 CHECK FOR A SHORT TO GROUND

- For DTCs P0243, P0244, P25B3, P25B4, P2AB7, P2AB8, P2AB9 or P2ABD,
- Measure the resistance between:

(+) Turbocharger Wastegate Motor Bank 1 Connector, Harness Side	(-)
TCWGP1 - Pin 2	Ground
TCWGM1+ - Pin 1	Ground
TCWGM1- - Pin 5	Ground

- For all others,
- Measure the resistance between:

(+) Turbocharger Wastegate Motor Bank 2 Connector, Harness Side	(-)
TCWGP2 - Pin 2	Ground
TCWGM2+ - Pin 1	Ground
TCWGM2- - Pin 5	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to HN33.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

HN33 CHECK FOR CIRCUITS SHORTED TOGETHER

- For DTCs P0243, P0244, P25B3, P25B4, P2AB7, P2AB8, P2AB9 or P2ABD,
- Measure the resistance between:

(+) Turbocharger Wastegate Motor Bank 1 Connector, Harness Side	(-) Turbocharger Wastegate Motor Bank 1 Connector, Harness Side
TCWGP1 - Pin 2	VREF - Pin 4
TCWGP1 - Pin 2	SIGRTN - Pin 3
TCWGP1 - Pin 2	TCWGM1+ - Pin 1
TCWGP1 - Pin 2	TCWGM1- - Pin 5
TCWGM1+ - Pin 1	TCWGM1- - Pin 5
TCWGM1+ - Pin 1	VREF - Pin 4
TCWGM1+ - Pin 1	SIGRTN - Pin 3
TCWGM1- - Pin 5	VREF - Pin 4

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(+) Turbocharger Wastegate Motor Bank 1 Connector, Harness Side	(-) Turbocharger Wastegate Motor Bank 1 Connector, Harness Side
TCWGM1- - Pin 5	SIGRTN - Pin 3

- For all others,
- Measure the resistance between:

(+) Turbocharger Wastegate Motor Bank 2 Connector, Harness Side	(-) Turbocharger Wastegate Motor Bank 2 Connector, Harness Side
TCWGP2 - Pin 2	SIGRTN - Pin 3
TCWGP2 - Pin 2	VREF - Pin 4
TCWGP2 - Pin 2	TCWGM2+ - Pin 1
TCWGP2 - Pin 2	TCWGM2- - Pin 5
TCWGM2+ - Pin 1	TCWGM2- - Pin 5
TCWGM2+ - Pin 1	VREF - Pin 4
TCWGM2+ - Pin 1	SIGRTN - Pin 3
TCWGM2- - Pin 5	VREF - Pin 4
TCWGM2- - Pin 5	SIGRTN - Pin 3

Are the resistances greater than 10K ohms?

Yes	No
GO to HN34.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

HN34 CHECK FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For DTCs P0243, P0244, P25B3, P25B4, P2AB7, P2AB8, P2AB9 or P2ABD,
- Measure the voltage between:

(+) Turbocharger Wastegate Motor Bank 1 Connector, Harness Side	(-)
TCWGP1 - Pin 2	Ground
TCWGM1+ - Pin 1	Ground
TCWGM1- - Pin 5	Ground

- For all others,
- Measure the voltage between:

(+) Turbocharger Wastegate Motor Bank 2 Connector, Harness Side	(-)
TCWGP2 - Pin 2	Ground
TCWGM2+ - Pin 1	Ground
TCWGM2- - Pin 5	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to HN35.

HN35 CHECK THE INTERNAL RESISTANCE OF THE TURBOCHARGER WASTEGATE MOTOR

- Ignition OFF.
- For DTCs P0243, P0244, P25B3, P25B4, P2AB7, P2AB8, P2AB9 or P2ABD,
- Measure the resistance between:

(+) Turbocharger Wastegate Motor Bank 1 Connector, Component Side	(-) Turbocharger Wastegate Motor Bank 1 Connector, Component Side
TCWGM1+ - Pin 1	TCWGM1- - Pin 5

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- For all others,
- Measure the resistance between:

(+) Turbocharger Wastegate Motor Bank 2 Connector, Component Side	(-) Turbocharger Wastegate Motor Bank 2 Connector, Component Side
TCWGM2+ - Pin 1	TCWGM2- - Pin 5

Is the resistance between 1 - 90 ohms?

Yes	No
GO to HN36.	INSTALL a new turbocharger wastegate motor in question. REFER to the appropriate Engine Controls - Fuel Charging And Controls - Turbocharger article. RESET the keep alive memory. REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .

HN36 CHECK FOR AN INTERMITTENT CONCERN

- Ignition OFF.
- Turbocharger Wastegate Motor Bank 1 connector connected.
- Turbocharger Wastegate Motor Bank 2 connector connected.
- PCM connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the WGATE_A_POS_PCT (PER) and WGATE_B_POS_PCT (PER) PIDs.
- While observing the PIDs for percentage changes, wiggle, shake, and bend small sections of the wiring harness while working from each turbocharger wastegate motor to the PCM.

Is a concern indicated?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to HN37.

HN37 CHECK THE TURBOCHARGER WASTEGATE POSITION OPEN AND CLOSED PERCENTAGES

NOTE: **Certain failure mode effects management (FMEM) operating strategies may limit vehicle function in the event of a harness or component concern and may prevent the wastegates from operating correctly.**

NOTE: **Make sure the accelerator pedal is fully applied and fully released when recording the PID values.**

NOTE: **The PCM will command the turbocharger wastegate motors to follow the applied accelerator pedal position, until the accelerator pedal is fully released.**

- Ignition ON, engine OFF.
- Clear the PCM DTCs.
- Ignition OFF.
- Ignition ON, engine OFF.
- Access the PCM and monitor the WGATE_A_POS_PCT (PER) and WGATE_B_POS_PCT (PER) PIDs.
- Press the accelerator pedal fully to the floor. Wait 3 seconds, then record the PID values.
- Release the accelerator pedal and immediately record the PID values.

Turbocharger Wastegate Position Sensor Signal Percentages

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Accelerator Pedal	Wastegate Position Sensor PID Value
Accelerator Pedal Fully Applied	90.0 to 100.0
Accelerator Pedal Fully Released	0.0 to 10.0

Are the recorded PID values within range of the accelerator pedal fully applied and the accelerator pedal fully released values?

Yes	No
GO to HN38.	INSTALL a new turbocharger wastegate motor in question. REFER to the appropriate Engine Controls - Fuel Charging And Controls - Turbocharger article. RESET the keep alive memory. REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .

HN38 CHECK FOR CORRECT OPERATION

- Disconnect all the PCM connectors.
- Disconnect the turbocharger wastegate motor 1 and turbocharger wastegate motor 2 connectors.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors, the turbocharger wastegate motor connectors. Make sure the connectors are seated correctly.
- Carry out the PCM self-test.
- Verify the concern is still present.

Is the concern still present?

Yes	No
For DTCs P2ABD or P2ABE, GO to **PINPOINT TEST Z**. For all others, INSTALL a new turbocharger wastegate motor in question. REFER to the appropriate Engine Controls - Fuel Charging And Controls - Turbocharger article. RESET the keep alive memory. REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS HP: HIGH PRESSURE FUEL DELIVERY SYSTEM

INTRODUCTION

NOTE: **Do not apply battery voltage across the fuel injection pump circuits. Damage to the fuel volume regulator solenoid may result.**

This pinpoint test is intended to diagnose the following:

- fuel injection pump (9350)
- harness circuits: FVR and FVRRTN
- PCM (12A650)

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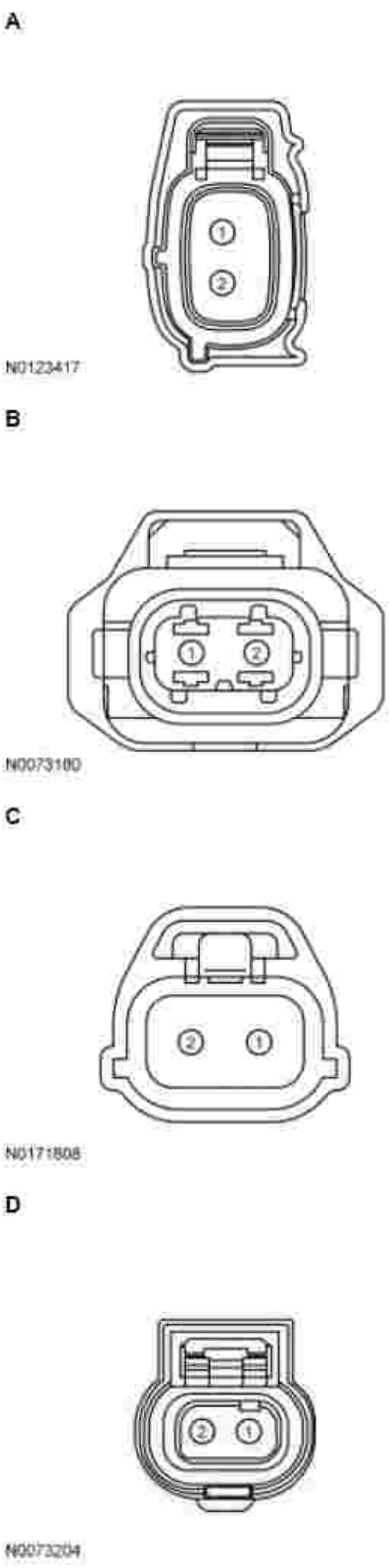

Fig. 117: Fuel Injection Pump Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, EcoSport 2.0L, Edge 2.7L, Focus GDI 2.0L, Fusion 2.7L, MKX 2.7L, MKZ 3.0L, Transit	A	2 1	FVRRTN FVR
EcoSport 1.0L, Fiesta	B	2 1	FVRRTN FVR

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Vehicle	Connector	Pin	Circuit
Expedition, F-150 2.7L, F-150 3.3L, F-150 3.5L, Navigator	C	2 1	FVRRTN FVR
F-150 5.0L	C	1 2	FVRRTN FVR
Ford GT	D	2 1	FVRRTN FVR
All other vehicles	B	1 2	FVRRTN FVR

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
EcoSport 1.0L Manual Transmission, Fiesta	198 PIN	E78 E79	FVRRTN FVR
Escape/Kuga 1.5L	198 PIN	E81 E86	FVRRTN FVR
Expedition, F-150 3.5L, Navigator	198 PIN	E95 E90	FVRRTN FVR
F-150 2.7L, F-150 3.3L, F-150 5.0L	306 PIN	E107 E86	FVRRTN FVR
Focus GDI 2.0L	154 PIN	E2 E1	FVRRTN FVR
Mustang 5.0L	306 PIN	E38 E86	FVRRTN FVR
All other vehicles	198 PIN	E77 E78	FVRRTN FVR

TEST PROCEDURE

HP1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: **Diagnose and repair all circuit DTCs before diagnosing P0087 or P0088.**

Are DTCs P0001, P0003, P0004, P0087, P0088, P00C6 or P053F present?

Yes	No
For DTC P0087, GO to HP2. For DTC P0088, GO to HP10. For DTCs P00C6 or P053F, GO to HP4. For all others, GO to HP5.	RETURN to **SYMPTOM CHARTS** for further direction.

HP2 CHECK THE LOW PRESSURE FUEL SYSTEM PRESSURE WITH ENGINE RUNNING

- Ignition OFF.
- Relieve the fuel pressure. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure.
- Mechanical fuel pressure gauge connected.
- Ignition ON, engine OFF.
- Pressurize the fuel system. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Ignition ON, engine running.

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- Monitor the mechanical fuel pressure gauge.

Is the low pressure fuel system pressure greater than 310 kPa (45 psi)?

Yes	No
GO to HP3.	GO to **PINPOINT TEST HC**.

HP3 COMPARE THE FLP PID TO THE MECHANICAL GAUGE

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

- Ignition OFF.
- Relieve the fuel pressure. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure.
- Disable the fuel pump.
- Ignition ON, engine OFF.
- Monitor the mechanical gauge.
- Access the PCM and monitor the FLP (PRESS) PID.
- Compare the FLP PID to the mechanical gauge.
- Ignition OFF.
- Pressurize the fuel system. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Ignition ON, engine running.
- Allow the fuel pressure to stabilize.
- Ignition OFF.
- Ignition ON, engine OFF.
- Compare the FLP PID to the mechanical gauge.

Are the FLP PID values within 153 kPa (22 psi) of the mechanical gauge readings?

Yes	No
GO to HP4.	INSTALL a new Fuel Pressure Sensor. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to **PINPOINT TEST HC**. REFER to the appropriate Fuel Tank and Lines article. Clear the PCM DTCs. REPEAT the self-test.

HP4 CHECK FOR LOW PRESSURE FUEL SYSTEM LEAKDOWN

- Relieve the fuel pressure. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure.
- Mechanical fuel pressure gauge connected.
- Ignition ON, engine OFF.
- Pressurize the fuel system. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Cycle the ignition several times to charge the fuel system.
- Ignition OFF.
- Wait 15 minutes.

Is the low pressure fuel system pressure greater than 310 kPa (45 psi)?

Yes	No
GO to HP5.	GO to **PINPOINT TEST HC**.

HP5 CHECK THE FUEL INJECTION PUMP RESISTANCE

- Ignition OFF.
- Fuel Injection Pump connector disconnected.

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- Measure the resistance between:

(+) Fuel Injection Pump Connector, Component Side	(-) Fuel Injection Pump Connector, Component Side
FVR	FVRRTN

Is the resistance between 0.3 - 3.1 ohms?

Yes	No
GO to HP6.	INSTALL a new Fuel Injection Pump. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to **PINPOINT TEST HC**. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. Clear the PCM DTCs. REPEAT the self-test.

HP6 CHECK THE FVR AND FVRRTN CIRCUITS FOR AN OPEN

- PCM connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-) Fuel Injection Pump Connector, Harness Side
FVR	FVR
FVRRTN	FVRRTN

Are the resistances less than 5 ohms?

Yes	No
For DTC P0087, GO to HP10. For all others, GO to HP7.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HP7 CHECK THE FVR AND FVRRTN CIRCUITS FOR A SHORT TO GROUND

- Measure the resistance between:

(+) Fuel Injection Pump Connector, Harness Side	(-)
FVR	Ground
FVRRTN	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to HP8.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

HP8 CHECK FOR THE FVR AND FVRRTN CIRCUITS SHORTED TOGETHER

- Measure the resistance between:

(+) Fuel Injection Pump Connector, Harness Side	(-) Fuel Injection Pump Connector, Harness Side
FVR	FVRRTN

Is the resistance greater than 10K ohms?

Yes	No
GO to HP9.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

HP9 CHECK THE FVRRTN CIRCUIT FOR A SHORT TO VOLTAGE

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

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(+) Fuel Injection Pump Connector, Harness Side	(-)
FVRRTN	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	For DTC P00C6, GO to HP10. For all others, GO to HP12.

HP10 CHECK FOR CORRECT FUEL INJECTION PUMP OPERATION

- Fuel Injection Pump connector disconnected.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Fuel Injection Pump connector connected.
- Ignition ON, engine running.
- Wait 15 seconds.
- Carry out the PCM self-test.

Are DTCs P0087, P0088 or P00C6 present?

Yes	No
For DTCs P0087 or P0088, GO to **PINPOINT TEST Z**. For all others, INSTALL a new Fuel Injection Pump. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to **PINPOINT TEST HC**. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. Clear the PCM DTCs. REPEAT the self-test.	For DTC P053F, GO to HP11. For all others, The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

HP11 CHECK FOR DTC

- Clear the PCM DTCs.
- Allow the engine to cold soak long enough for the engine coolant temperature to drop below 37.8Â°C (100Â°F).
- Ignition ON, engine running.
- Allow the engine to idle for 6 minutes.
- Carry out the PCM self-test.

Is DTC P053F present?

Yes	No
GO to HP12.	The test is complete and no concerns are present. Clear the PCM DTCs. REPEAT the self-test.

HP12 CHECK FOR CORRECT OPERATION

- Disconnect all the PCM connectors.
- Fuel Injection Pump connector disconnected.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors, and the fuel injection pump connector, and make sure they seat correctly.
- Carry out the PCM self-test.
- Verify the concern is still present.

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Is the concern still present?

Yes	No
INSTALL a new Fuel Injection Pump. REFER to the fuel system WARNING information at the beginning of Pinpoint Test HC. GO to **PINPOINT TEST HC**. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. Clear the PCM DTCs. REPEAT the self-test.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS HU: INTAKE AIR SYSTEMS

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- air cleaner assembly (including air cleaner element) (9600)
- air inlet tube (9F843)
- clean air tube hose and resonator (9R504) and (9F593)
- intake manifold runner control bank 1 (IMRC1) solenoid (9J559)
- intake manifold runner control bank 2 (IMRC2) solenoid (9J559)
- intake manifold runner control bank 1 (IMRC1) sensor (9P471)
- intake manifold runner control bank 2 (IMRC2) sensor (9P471)
- intake manifold tuning valve (IMTV) (9L490)
- IMTV electric actuator assembly (9L490)
- throttle body assembly (9E926)
- harness circuits: IMRC, IMRC1, IMRC1A, IMRC2, IMRC2A, IMTV, SIGRTN, VPWR and VREF
- PCM (12A650)

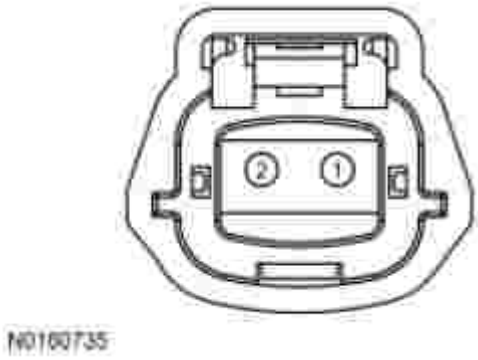

Fig. 118: Intake Manifold Runner Control Bank 1 (IMRC1) Solenoid Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	VPWR (Vehicle Power)
2	IMRC1A (Intake Manifold Runner Control Bank 1 Actuator)

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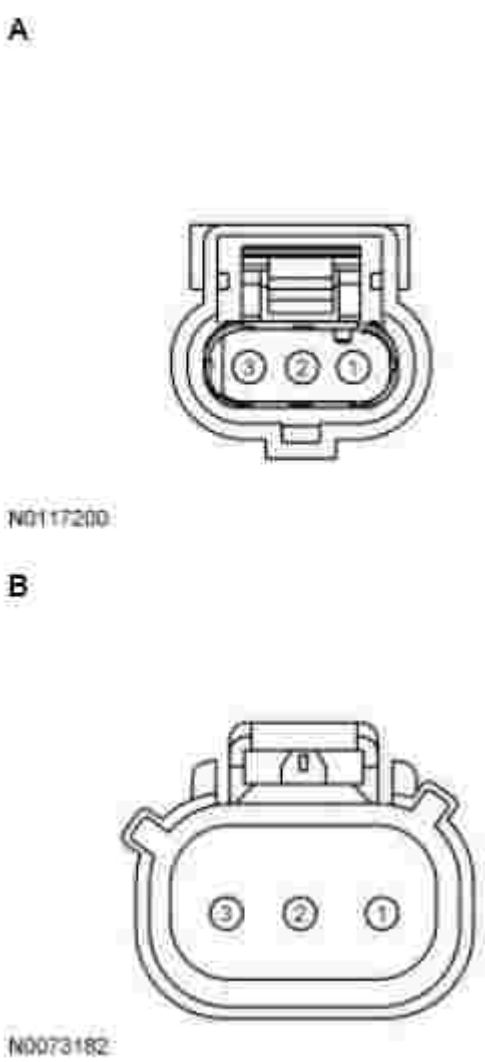

Fig. 119: Intake Manifold Runner Control Bank 1 (IMRC1) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
F-150, Mustang 5.0L	A	2 1 3	IMRC1 SIGRTN VREF
F-Series Super Duty, Mustang 5.2L	B	1 3 2	IMRC1 SIGRTN VREF

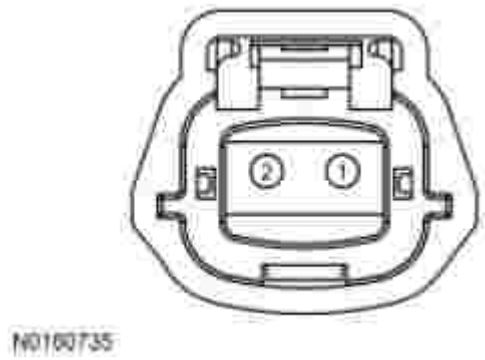

Fig. 120: Intake Manifold Runner Control Bank 2 (IMRC2) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	VPWR (Vehicle Power)
2	IMRC2A (Intake Manifold Runner Control Bank 2 Actuator)

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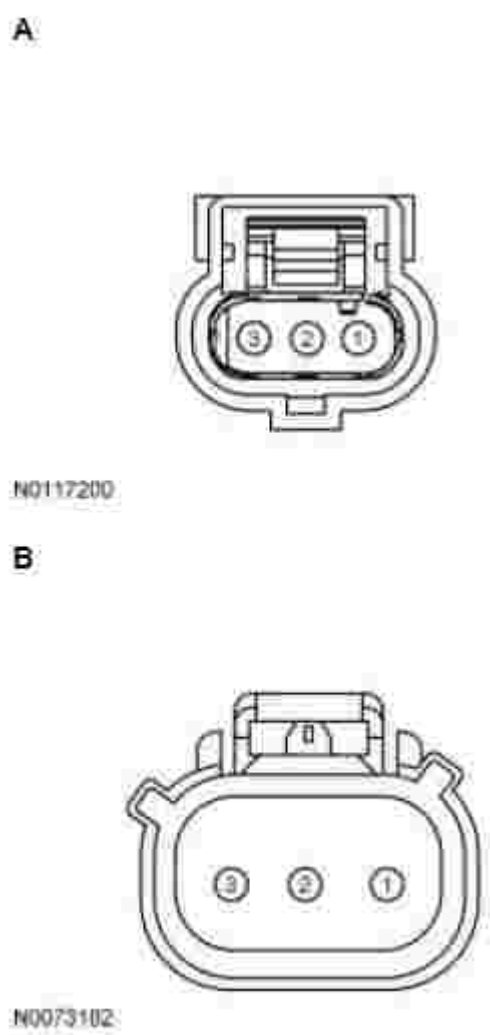

Fig. 121: Intake Manifold Runner Control Bank 2 (IMRC2) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
F-150, Mustang 5.0L	A	2 1 3	IMRC2 SIGRTN VREF
F-Series Super Duty, Mustang 5.2L	B	1 3 2	IMRC2 SIGRTN VREF

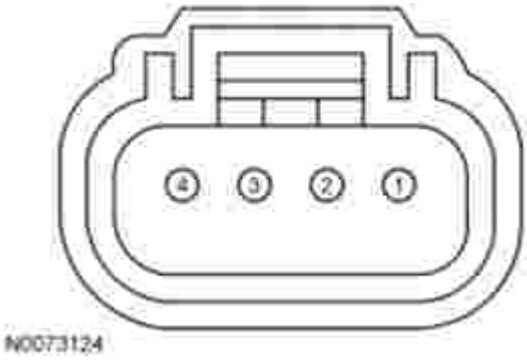

Fig. 122: Intake Manifold Tuning Valve (IMTV) Actuator Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
3	IMTV (Intake Manifold Tuning Valve)
1	VPWR (Vehicle Power)

Powertrain Control Module (PCM) Connector

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For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
F-150, Mustang 5.0L	306 PIN	E27 E7 E15	IMRC2 IMRC1 IMRC1A
F-Series Super Duty 6.2L, Mustang 5.2L	198 PIN	E44 E45 E59 E60	IMRC2 IMRC1 IMRC2A IMRC1A
All other vehicles	198 PIN	E5	IMTV

TEST PROCEDURE

HU1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

Are DTCs P0505, P0506, P0660, P0663, P2004, P2005, P2006, P2007, P2008, P2011, P2014, P2015, P2016, P2017, P2019, P2020, P2021, P2022, P2070, or P2071 present?

Yes	No
For DTCs P0505 or P0506, GO to HU2. For DTCs P0660, P0663, P2070 or P2071, GO to HU6. For all others, GO to HU15.	For lack/loss of power, GO to HU6. For all other symptoms without DTCs, GO to HU2.

HU2 CHECK THE BASE IDLE SPEED

NOTE: **The vehicle must be at operating temperature and at idle for a minimum of 1 minute.**

- Ignition ON, engine running.
- Determine if the idle speed is incorrect. Refer to the **TYPICAL REFERENCE VALUE** Charts, if necessary.
- Access the PCM and monitor the RPM (RPM) PID.

Is vehicle idle speed correct?

Yes	No
GO to HU4.	GO to HU3.

HU3 CHECK FOR VACUUM LEAKS

- Listen for vacuum leaks.
- Inspect the entire intake air system from the mass airflow (MAF) sensor to the intake manifold for leaks such as:
- cracked or punctured intake air tube.
- loose connections on the intake air tube at the air cleaner housing or throttle body
- EGR valve gasket leak to intake manifold
- intake manifold assembly or gasket
- EGR valve diaphragm or control solenoid
- vacuum supply connectors and hose

Are any leaks present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to HU4.

HU4 CHECK THE INTAKE AIR SYSTEM FOR LEAKS, OBSTRUCTIONS AND DAMAGE

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NOTE: **The Focus air cleaner element is integral to the air cleaner assembly. Inspect the air restriction gauge (if equipped) for a restriction indication.**

- Ignition OFF.
- Remove the air cleaner element. Check the air cleaner for restrictions.
- Check for restrictions between the air inlet and the throttle body.

Are any concerns present?

Yes	No
REMOVE the restriction. INSTALL a new air cleaner element. REFER to the appropriate Intake Air Distribution and Filtering article. Clear the PCM DTCs. REPEAT the self-test.	REINSTALL the air cleaner element. GO to HU5.

HU5 CHECK THE POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

NOTE: **A high idle may indicate a vacuum leak.**

- Check for any PCV system leaks.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	For Continental, EcoSport 1.0L, EcoSport 2.0L, Edge, Escape/Kuga, Expedition, F-150, F-650/F-750, F-Series Super Duty, Flex, Fusion, MKC, MKT 3.5L, MKT 3.7L, MKX, MKZ, Motorhome/Stripped Chassis/Step Van, Mustang, Navigator, Taurus, Transit, and Transit Connect, GO to HU24. For all others, Unable to duplicate or identify the concern at this time. RETURN to **SYMPTOM CHARTS** for further direction.

HU6 VISUAL INSPECTION OF THE INTAKE MANIFOLD TUNING VALVE

- Inspect the component for signs of damage.
- Check the harness and connection.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to HU7.

HU7 CHECK THE VPWR CIRCUIT FOR AN OPEN

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- IMTV Actuator connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) IMTV Actuator Connector, Harness Side	(-) Vehicle Battery
VPWR - Pin 1	Negative terminal

Is the voltage greater than 10.5 V?

Yes	No
GO to HU8.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HU8 CHECK THE IMTV CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) IMTV Actuator Connector, Harness Side	(-) PCM Connector, Harness Side
IMTV - Pin 3	IMTV

Is the resistance less than 5 ohms?

Yes	No
GO to HU9.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HU9 CHECK THE IMTV CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
IMTV	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to HU10.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

HU10 CHECK THE IMTV CIRCUIT FOR A SHORT TO VOLTAGE

- Measure the voltage between:

(+) IMTV Actuator Connector, Harness Side	(-)
IMTV - Pin 3	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to HU11.

HU11 CHECK THE IMTV DRIVER CIRCUIT WITH THE PCM CONNECTED

- IMTV Actuator connector disconnected.
- PCM connector connected.
- Ignition ON, engine OFF.
- Connect a non-powered test lamp between:

Point A IMTV Actuator Connector, Harness Side	Point B IMTV Actuator Connector, Harness Side
VPWR - Pin 1	IMTV - Pin 3

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Does the test lamp illuminate?

Yes	No
GO to HU26.	GO to HU12.

HU12 CHECK THE IMTV PCM DRIVER CIRCUIT WHEN COMMANDED ON

- Connect a non-powered test lamp between:

Point A IMTV Actuator Connector, Harness Side	Point B IMTV Actuator Connector, Harness Side
VPWR - Pin 1	IMTV - Pin 3

- Carry out the PCM KOEO self-test.

Does the test lamp illuminate?

Yes	No
GO to HU13.	GO to HU26.

HU13 CHECK THE IMTV FOR DAMAGE

- Ignition OFF.
- Remove the IMTV. Refer to the appropriate Engine System article or appropriate Electronic Engine Controls article.
- Visually inspect the shutter for damage.
- Manually rotate the shutter.

Is a concern present?

Yes	No
INSTALL a new IMTV actuator. REFER to the appropriate Engine System article. Clear the PCM DTCs. REPEAT the self-test.	GO to HU14.

HU14 CHECK THE IMTV FOR FUNCTIONALITY WHEN COMMANDED ON

- IMTV Actuator connector connected.
- Carry out the PCM KOEO self-test.

Does the IMTV shutter rotate?

Yes	No
The concern is an intermittent. GO to **PINPOINT TEST Z**.	INSTALL a new IMTV actuator. REFER to the appropriate Engine System article. Clear the PCM DTCs. REPEAT the self-test.

HU15 VISUAL INSPECTION FOR DISCONNECTED IMRC LINKAGE

- Inspect the IMRC for any disconnected or damaged linkages.
- Inspect the IMRC solenoid and vacuum lines for correct connection, damage, vacuum leaks or restrictions.
- Disconnect the IMRC linkage.
- Inspect the linkage for restrictions. Spring tension in one direction is normal.
- Rotate the IMRC plate to fully open and to fully closed, contacting both limits.
- Check for restrictions during rotation.

Is a concern present?

Yes	No

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Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to HU16.

HU16 CHECK THE FUNCTIONALITY OF THE IMRC

WARNING: **KEEP FINGERS CLEAR OF THE MECHANISM. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

NOTE: **On vacuum operated systems the engine must run for 20 seconds to restore vacuum between state commands.**

- Connect the IMRC linkage.
- Ignition ON, engine running.
- Access the PCM and monitor the IMRC1M (VOLT) and IMRC2M (VOLT) PIDs.
- Access the PCM and control the IMRC (MODE) PID.
- Command the IMRC PID to ON and then to OFF.

Do the IMRC1M and IMRC2M PIDs indicate full travel of the IMRC plates?

Yes	No
The concern is an intermittent. GO to **PINPOINT TEST Z**.	For DTCs P2008 or P2011, GO to HU17. For all others, GO to HU20.

HU17 CHECK IMRC SOLENOID COIL FOR AN OPEN

- Ignition OFF.
- For DTC P2008,
- IMRC1 Solenoid connector disconnected.
- Measure the resistance between:

(+) IMRC1 Solenoid Connector, Component Side	(-) IMRC1 Solenoid Connector, Component Side
IMRC1A - Pin 2	VPWR - Pin 1

- For all others,
- IMRC2 Solenoid connector disconnected.
- Measure the resistance between:

(+) IMRC2 Solenoid Connector, Component Side	(-) IMRC2 Solenoid Connector, Component Side
IMRC2A - Pin 2	VPWR - Pin 1

Is the resistance between 22 - 26 ohms?

Yes	No
GO to HU18.	INSTALL a new IMRC solenoid. REFER to the appropriate Engine System article. Clear the PCM DTCs. REPEAT the self-test.

HU18 CHECK THE VPWR CIRCUIT FOR AN OPEN

- Ignition OFF.
- For DTC P2008,
- IMRC1 Solenoid connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) IMRC1 Solenoid Connector, Harness Side	(-)

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(+) IMRC1 Solenoid Connector, Harness Side	(-)
VPWR - Pin 1	Ground

- For all others,
- IMRC2 Solenoid connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) IMRC2 Solenoid Connector, Harness Side	(-)
VPWR - Pin 1	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to HU19.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HU19 CHECK THE IMRC CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- For DTC P2008,
- Measure the resistance between:

(+) IMRC1 Solenoid Connector, Harness Side	(-) PCM Connector, Harness Side
IMRC1A - Pin 2	IMRC1A

- For all others,
- Measure the resistance between:

(+) IMRC2 Solenoid Connector, Harness Side	(-) PCM Connector, Harness Side
IMRC2A - Pin 2	IMRC2A

Is the resistance less than 5 ohms?

Yes	No
INSTALL a new IMRC solenoid. REFER to the appropriate Engine System article.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HU20 CHECK THE VREF CIRCUIT FOR AN OPEN

- Ignition OFF.
- For DTCs P2004, P2006, P2014, P2015, P2016, or P2017,
- IMRC1 Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) IMRC1 Sensor Connector, Harness Side	(-) IMRC1 Sensor Connector, Harness Side
VREF	SIGRTN

- For all others,
- IMRC2 Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) IMRC2 Sensor Connector, Harness Side	(-) IMRC2 Sensor Connector, Harness Side
VREF	SIGRTN

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Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to HU21.	GO to **PINPOINT TEST C**.

HU21 CHECK THE IMRCM CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- For DTCs P2004, P2006, P2014, P2015, P2016, or P2017,
- Measure the resistance between:

(+) IMRC1 Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IMRC1	IMRC1

- For all others,
- Measure the resistance between:

(+) IMRC2 Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
IMRC2	IMRC2

Is the resistance less than 5 ohms?

Yes	No
GO to HU22.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HU22 CHECK FOR A SHORT TO GROUND

- For DTCs P2004, P2006, P2014, P2015, P2016, or P2017,
- Measure the resistance between:

(+) IMRC1 Sensor Connector, Harness Side	(-)
IMRC1	Ground

- For all others,
- Measure the resistance between:

(+) IMRC2 Sensor Connector, Harness Side	(-)
IMRC2	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to HU23.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

HU23 CHECK THE IMRC1 OR IMRC2 CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For DTCs P2004, P2006, P2014, P2015, P2016, or P2017,
- Measure the voltage between:

(+) IMRC1 Sensor Connector, Harness Side	(-)
VREF	Ground

- For all others,
- Measure the voltage between:

(+) IMRC2 Sensor Connector, Harness Side	(-)
VREF	Ground

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Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new IMRC1 or IMRC2 sensor. REFER to the appropriate Engine System article. Clear the PCM DTCs. REPEAT the self-test.

HU24 PRELIMINARY DIAGNOSIS FOR IDLE AIR CONCERNS

- Ignition ON, engine OFF.

Are any DTCs present other than P0505 or P0506?

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 HU25.

HU25 MONITOR THE INTAKE AIR SYSTEM RELATED PIDS

NOTE: **Verify the vehicle has reached the normal engine coolant operating temperature of 77Â°C (170Â° F). Allow the engine to idle an additional 5 minutes.**

NOTE: **All PIDs may not be available on all vehicles.**

- Access the PCM and monitor the ECT (TEMP) and ECT1 (TEMP) PIDs.
- Access the PCM and monitor the ETC_TRIM (ANGL) PID.
- Access the PCM and monitor the IACTRIM (NUM) and IACKAM2 (NUM) PIDs.
- Mathematically add and record the value of the IACTRIM PID to the IACKAM2 PID value, for the total IAC value at idle.

Is the ETC_TRIM PID angle equal to 3.5 degrees or is the total IAC value greater than 0.5 lb/min?

Yes	No
INSTALL a new throttle body assembly. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. Clear the PCM DTCs. REPEAT the self-test.	RETURN to **SYMPTOM CHARTS** for further direction.

HU26 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.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS HV: ELECTRIC COOLING FAN CLUTCH

INTRODUCTION

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WARNING: **TO AVOID THE POSSIBILITY OF PERSONAL INJURY OR DAMAGE TO THE VEHICLE, DO NOT OPERATE THE ENGINE UNTIL THE FAN BLADE HAS BEEN FIRST EXAMINED FOR POSSIBLE CRACKS AND SEPARATION. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY OR DEATH.**

NOTE: **Before starting this pinpoint test, turn the clutch fan assembly by hand and check for mechanical binding around the fan shroud or surrounding components. If binding is present, correct the problem then continue with the pinpoint test. If no binding is present, start the engine and warm up to normal operating temperature then continue with the pinpoint test.**

This pinpoint test is intended to diagnose the following:

- cooling fan clutch
- harness circuits: fan speed sensor (FSS), FSS PWRGND, FSS VPWR, fan control variable (FCV), and FCV VPWR
- powertrain control module (PCM) (12A650)

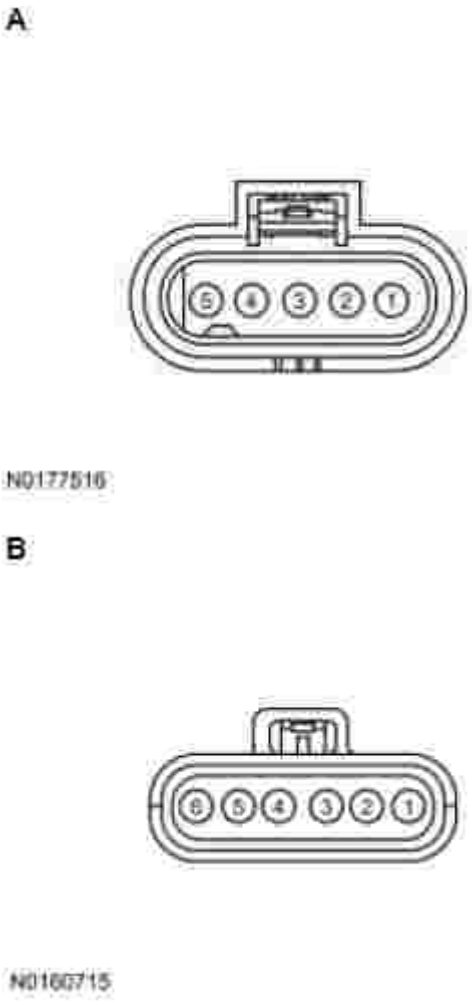

Fig. 123: Cooling Fan Clutch Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series	A	3 2 1 5 4	FSS PWRGND VBPWR VPWR FCV

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Vehicle	Connector	Pin	Circuit
F-Series Super Duty	B	4 5 2 1 6	FSS PWRGND VBPWR VPWR FCV

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Pin	Circuit
F-650/F-750	B97, B99 B86 B100, B102, B103, B5	VPWR FSS PWRGND
F-Series Super Duty 6.2L	B97, B99 B86 B100, B102, B103, B5 B1, E17, E36, T3 E86	VPWR FSS PWRGND VBPWR FCV
F-Series Super Duty 6.8L	B97, B99 B86 B100, B102, B103, B5 B1, E36, T3	VPWR FSS PWRGND VBPWR
All other vehicles	B97, B99 B2 B100, B102, B103, B5 B1, E17, E36, T3 E86	VPWR FSS PWRGND VBPWR FCV

TEST PROCEDURE

HV1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

Are DTCs P0480 or P0528 present?

Yes	No
For KOEO and KOER DTC P0480, GO to HV4. For KOEO and KOER DTC P0528, GO to HV2. For all others, GO to HV10.	For symptoms without DTCs, GO to HV2. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

HV2 CHECK THE ELECTRIC COOLING FAN FOR MECHANICAL BINDING

NOTE: **The electric cooling fan uses a viscous coupling. The viscous drag should be smooth during fan rotation. The amount of resistance is dependant upon the final cooling fan operational state before engine shutdown.**

- Ignition OFF.
- Manually rotate the cooling fan.

Does the electric cooling fan rotation feel rough or binding?

Yes	No
INSTALL a new Cooling Fan. REFER to the appropriate Engine Cooling article. Clear the PCM DTCs. REPEAT the self-test.	GO to HV3.

HV3 CHECK THE ELECTRIC COOLING FAN OPERATION

- Ignition ON, engine running.

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- Set the heater controls to OFF.
- Access the PCM and monitor the FANSS (RPM) PID.

Does the FANSS PID indicate any RPM?

Yes	No
GO to HV4.	GO to HV11.

HV4 CHECK THE ELECTRIC COOLING FAN ACTUATOR VALVE SOLENOID RESISTANCE

NOTE: **If necessary, install pin adapters on the component side pins to carry out the resistance measurement.**

- Ignition OFF.
- Cooling Fan Clutch connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Component Side	(-) Cooling Fan Clutch Connector, Component Side
FCV	VPWR

Is the resistance between 6 - 12 ohms?

Yes	No
GO to HV5.	INSTALL a new Cooling Fan. REFER to the appropriate Engine Cooling article. Clear the PCM DTCs. REPEAT the self-test.

HV5 CHECK THE ELECTRIC COOLING FAN ACTUATOR VALVE SOLENOID FOR A SHORT

- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Component Side	(-)
FCV	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to HV6.	INSTALL a new Cooling Fan. REFER to the appropriate Engine Cooling article. Clear the PCM DTCs. REPEAT the self-test.

HV6 CHECK THE VPWR VOLTAGE TO THE ELECTRIC COOLING FAN ACTUATOR VALVE SOLENOID

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

(+) Cooling Fan Clutch Connector, Harness Side	(-)
VPWR	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to HV7.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HV7 CHECK THE FCV CIRCUIT FOR AN OPEN CIRCUIT

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

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(+) Cooling Fan Clutch Connector, Harness Side	(-) PCM Connector, Harness Side
FCV	FCV

Is the resistance less than 5 ohms?

Yes	No
GO to HV8.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HV8 CHECK THE FCV CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
FCV	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to HV9.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

HV9 CHECK THE FCV CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) Cooling Fan Clutch Connector, Harness Side	(-)
FCV	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to HV19.

HV10 CONTINUOUS MEMORY DTCS P0480 OR P0528: INTERMITTENT CHECK

NOTE: **Keep the coil arm of the electric cooling fan secure while checking the wiring harness. If the coil arm rotates, incorrect readings may occur.**

- Ignition ON, engine OFF.
- Access the PCM and monitor the FANSS (RPM) PID.
- Access the PCM and monitor the FANDC (PER) PID.
- While observing the PID wiggle, shake, and bend small sections of the wiring harness while working from the electric cooling fan to the PCM.
- Check the electric cooling fan and the PCM connectors for damage and corrosion.

Is a concern present?

Yes	No
ISOLATE the concern and REPAIR as necessary.	DISREGARD the current diagnostic trouble code (DTC) at this time. DIAGNOSE the next DTC. GO to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

HV11 CHECK THE VOLTAGE AND GROUND CIRCUITS TO THE FSS

- Cooling Fan Clutch connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	(-) Cooling Fan Clutch Connector, Harness Side

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(+) Cooling Fan Clutch Connector, Harness Side	(-) Cooling Fan Clutch Connector, Harness Side
VBPWR	PWRGND

Is the voltage greater than 10.5 V?

Yes	No
GO to HV15.	GO to HV12.

HV12 CHECK THE VOLTAGE TO THE FSS

- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
VBPWR	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to HV14.	GO to HV13.

HV13 CHECK THE VOLTAGE CIRCUIT TO THE FSS FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-) PCM Connector, Harness Side
VBPWR	VBPWR

Is the resistance less than 5 ohms?

Yes	No
GO to HV19.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HV14 CHECK THE GROUND CIRCUIT TO THE FSS FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-) PCM Connector, Harness Side
PWRGND	PWRGND

Is the resistance less than 5 ohms?

Yes	No
GO to HV19.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HV15 CHECK THE FSS CIRCUIT FOR AN OPEN CIRCUIT

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-) PCM Connector, Harness Side
FSS	FSS

Is the resistance less than 5 ohms?

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Yes	No
GO to HV16.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HV16 CHECK THE FSS CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
FSS	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to HV17.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

HV17 CHECK THE FSS CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) Cooling Fan Clutch Connector, Harness Side	(-)
FSS	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to HV18.

HV18 CHECK THE FUNCTIONALITY OF THE FSS CIRCUIT

- Ignition OFF.
- PCM connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Cooling Fan Clutch Connector, Harness Side	(-)
FSS	Ground

Is the voltage greater than 10.5 V?

Yes	No
INSTALL a new Cooling Fan. REFER to the appropriate Engine Cooling article. Clear the PCM DTCs. REPEAT the self-test.	GO to HV19.

HV19 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.
- Verify the concern is still present.

Is the concern still present?

Yes	No

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

PINPOINT TESTS HX: EVAPORATIVE EMISSION (EVAP) SYSTEM AND MONITOR

INTRODUCTION

WARNING: **BEFORE REPAIRING OR INSTALLING A NEW COMPONENT IN THE FUEL SYSTEM, REDUCE THE POSSIBILITY OF INJURY OR FIRE BY FOLLOWING THE WARNING, CAUTION, AND HANDLING DIRECTIONS IN PINPOINT TEST HC. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

NOTE: **Use this pinpoint test only when directed here.**

Using a soap solution around the fuel filler cap or capless fuel tank filler pipe (if equipped) or using the hydrocarbon emission analyzer to determine an evaporative emission system leak is not recommended.

When using the Evaporative Emission Leak Detector With On Board Nitrogen Generator 218-522C or equivalent, the fuel level in the fuel tank must be less than 85% full.

This pinpoint test is intended to diagnose the following:

- EVAP canister vent valve (9F945)
- fuel filler cap (9030)
- capless fuel tank filler pipe (9034)
- fuel tank pressure (FTP) sensor (9C052)
- EVAP purge valve (9C915)
- EVAP check valve
- EVAP ejector
- EVAP vapor blocking valve
- EVAP system leaks using the Evaporative Emission Leak Detector With On Board Nitrogen Generator 218-522C or equivalent
- harness circuits: B+, CANV, EVAPCP, FTP, SIGRTN, VBV, VPWR and VREF
- PCM (12A650)

For additional information on the EVAP system, refer to **EVAPORATIVE EMISSION (EVAP) SYSTEMS** , or the appropriate Evaporative Emissions article.

Fig. 124: Evaporative Emission (EVAP) Canister Vent Valve Connector
Courtesy of FORD MOTOR CO.

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For applications using the engine off natural vacuum (EONV) EVAP leak check monitor, KAPWR provides voltage to the EVAP canister vent valve instead of VPWR.

Pin	Circuit
2	CANV (Canister Vent)
1	KAPWR (Keep Alive Memory Power)

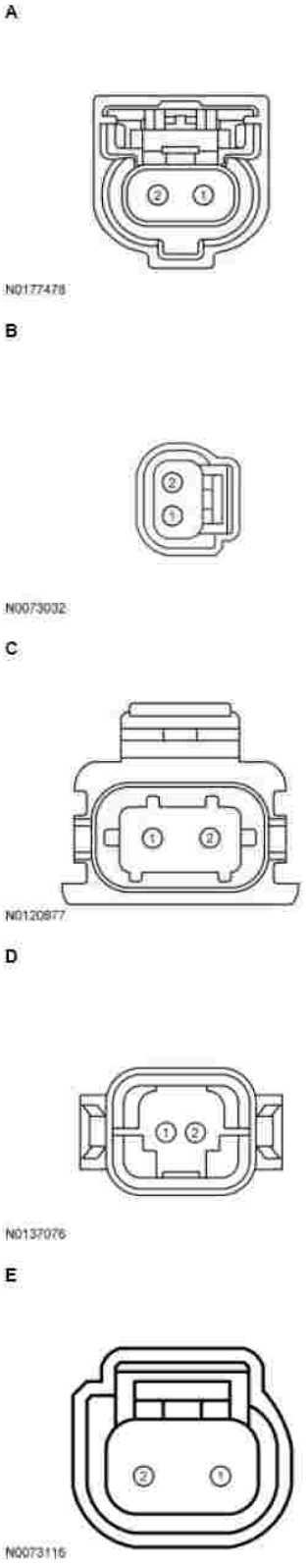

Fig. 125: Evaporative Emission (EVAP) Purge Valve Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
EcoSport, Expedition, F-150, Ford GT, Navigator	A	1 2	EVAPCP VPWR

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Vehicle	Connector	Pin	Circuit
Escape/Kuga 2.5L, Explorer, F-Series Super Duty, Motorhome/Stripped Chassis/Step Van, Transit Connect	B	1 2	EVAPCP VPWR
Escape/Kuga 2.0L, Escape/Kuga 1.5L, Fiesta GTDI 1.6L, Fiesta 1.0L, KA 1.0L, MKC, Ranger	C	1 2	EVAPCP VPWR
Fiesta TiVCT 1.6L	C	2 1	EVAPCP VPWR
Focus	D	1 2	EVAPCP VPWR
MKT 2.0L, Taurus 2.0L	E	2 1	EVAPCP VPWR
All other vehicles	E	1 2	EVAPCP VPWR

Fig. 126: Evaporative Emission (EVAP) Vapor Blocking Valve Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	VPWR (Vehicle Power)
1	VBV (Vapor Blocking Valve)

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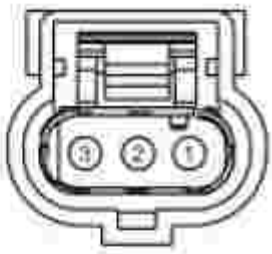
A

N0073092

B



N0117200

C

N0073203

Fig. 127: Fuel Tank Pressure (FTP) Sensor Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series, F-650/F-750, Motorhome/Stripped Chassis/Step Van, Ranger, Taurus, Transit, Transit Connect	A	1 2 3	FTP SIGRTN VREF
Ford GT	B	1 2 3	FTP SIGRTN VREF
All other vehicles	C	1 2 3	FTP SIGRTN VREF

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Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 3.7L, E-Series, Edge 3.5L, Explorer TiVCT 3.5L, Explorer 3.7L, F-650/F-750, F-Series Super Duty, Flex TiVCT 3.5L, MKT 3.7L, MKX 3.7L, Motorhome/Stripped Chassis/Step Van, Mustang 5.2L, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L	198 PIN	B39 B46 E71	CANV FTP EVAPCP
EcoSport 1.0L, Focus 2.3L, Fusion 1.5L	198 PIN	B60 B20 B73 B22	VBV CANV FTP EVAPCP
EcoSport 1.5L Automatic Transmission	198 PIN	E14	EVAPCP
EcoSport 1.5L Manual Transmission	112 PIN	E27	EVAPCP
EcoSport 2.0L, Escape/Kuga 2.0L, Fusion 2.0L, Fusion 2.7L, MKZ	198 PIN	B40 B20 B73 B22	VBV CANV FTP EVAPCP
Edge 2.0L, Focus 1.0L, MKX 2.0L	198 PIN	B80 B20 B73 B22	VBV CANV FTP EVAPCP
Escape/Kuga 1.5L	198 PIN	B39 B56 B49 E3	VBV CANV FTP EVAPCP
Escape/Kuga 2.5L, Fusion 2.5L, Transit Connect	198 PIN	B39 B46 E14	CANV FTP EVAPCP
Expedition, F-150 3.5L, Navigator	198 PIN	B40 B20 B73 E59	VBV CANV FTP EVAPCP
F-150 2.7L, F-150 3.3L, F-150 5.0L	306 PIN	B48 B34 B57 E46	VBV CANV FTP EVAPCP
Fiesta TiVCT 1.6L	128 PIN	E22 E18 E23	CANV FTP EVAPCP
Focus GDI 2.0L	154 PIN	B44 E59 E91	CANV FTP EVAPCP
Ford GT	198 PIN	B20 B73 B3	CANV FTP EVAPCP

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Vehicle	Connector	Pin	Circuit
KA	128 PIN	E43	EVAPCP
Mustang 2.3L	198 PIN	B22 B24 B1	CANV FTP EVAPCP
Mustang 5.0L	306 PIN	B34 B46 E46	CANV FTP EVAPCP
Ranger	128 PIN	E12	EVAPCP
All other vehicles	198 PIN	B20 B73 B22	CANV FTP EVAPCP

TEST PROCEDURE

HX1 CARRY OUT THE EVAPORATIVE EMISSION (EVAP) TEST

NOTE: **The IDS test referenced in this step may not be available on all vehicles. Proceed to the next step if the IDS test is not available.**

- Carry out the EVAP Test. Refer to the instruction manual provided by the scan tool manufacturer.

Does the test pass?

Yes	No
For DTCs P0442 or P0457, the system is operating correctly at this time. Clear the PCM DTCs. REPEAT the self-test. For all others, GO to HX2.	GO to HX2.

HX2 CHECK FOR DTCS

Are DTCs P00FE, P0442, P0443, P0446, P0451, P0452, P0453, P0454, P0455, P0456, P0457, P0460, P0461, P0462, P0463, P0496, P04F0, P144A, P144C, P1450, P2418, P2450 or P260F present?

Yes	No
For DTC P0443, GO to HX3. For DTC P0446, GO to HX24. For DTC P0460, GO to HX38. For DTC P2418, GO to HX30. For DTCs P04F0 or P144C, GO to HX14. For DTCs P0496 or P1450, GO to HX9. For DTCs P00FE, P0451, P144A or P2450, GO to HX10. For DTCs P0461 through P0463, GO to HX36. For DTCs P0442, P0455, P0456 or P0457, GO to HX39. For DTCs P0452, P0453 or P0454, GO to HX19. For all others, GO to HX50.	For symptoms without DTCs, GO to HX12. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

HX3 CHECK THE PCM OUTPUT TO EVAP PURGE VALVE

- Ignition OFF.
- Evaporative Emission (EVAP) Purge Valve connector disconnected.
- Connect a non-powered test lamp between:

Point A Evaporative Emission (EVAP) Purge Valve Connector, Harness Side	Point B Evaporative Emission (EVAP) Purge Valve Connector, Harness Side
VPWR	EVAPCP

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- Ignition ON, engine OFF.
- Access the PCM and control the EVAPCP (PER) PID.

Does the test lamp turn ON and OFF when the output is commanded ON and OFF?

Yes	No
GO to HX4.	GO to HX5.

HX4 CHECK THE EVAP PURGE VALVE RESISTANCE

- Ignition OFF.
- Measure the resistance between:

(+) Evaporative Emission (EVAP) Purge Valve Connector, Component Side	(-) Evaporative Emission (EVAP) Purge Valve Connector, Component Side
EVAPCP	VPWR

Is the resistance between 15 - 25 ohms?

Yes	No
Unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**.	INSTALL a new Evaporative Emission (EVAP) Purge valve. REFER to the appropriate Evaporative Emissions article. CARRY OUT the EVAP Test. REFER to the instruction manual provided by the scan tool manufacturer. Clear the PCM DTCs. REPEAT the self-test.

HX5 CHECK THE VPWR VOLTAGE TO THE EVAP PURGE VALVE

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

(+) Evaporative Emission (EVAP) Purge Valve Connector, Harness Side	(-)
VPWR	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to HX6.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HX6 CHECK THE EVAPCP CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) Evaporative Emission (EVAP) Purge Valve Connector, Harness Side	(-) PCM Connector, Harness Side
EVAPCP	EVAPCP

Is the resistance less than 5 ohms?

Yes	No
GO to HX7.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HX7 CHECK THE EVAPCP CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

(+) Evaporative Emission (EVAP) Purge Valve Connector, Harness Side	(-)
EVAPCP	Ground

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Is the resistance greater than 10K ohms?

Yes	No
GO to HX8.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

HX8 CHECK THE EVAPCP CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) Evaporative Emission (EVAP) Purge Valve Connector, Harness Side	(-)
EVAPCP	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to HX54.

HX9 CHECK FOR VISUAL CAUSES OF EXCESSIVE FUEL TANK VACUUM

NOTE: **If the EVAP canister vent valve and the fuel tank assemblies are not accessible during this step, refer to the appropriate Evaporative Emissions article and appropriate Fuel Tank and Lines article for removal instructions.**

- Check for kinks or bends in the fuel vapor hoses and tubes (EVAP purge valve outlet tube and EVAP canister tube).
- Visually inspect the EVAP canister inlet port, EVAP canister vent valve filter, and canister vent hose assembly for blockage, contamination or debris.

Is a concern present?

Yes	No
REMOVE any blockage, contamination or debris around the fuel vapor hose and tubes and EVAP canister vent valve assembly. REMOVE kinks or bends in the EVAP purge valve outlet tube, EVAP canister tube, and canister vent hose assembly. Clear the PCM 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 HX10.

HX10 CHECK THE FTP SENSOR VOLTAGE WITH THE FUEL FILLER CAP REMOVED OR THE CAPLESS FUEL TANK FILLER PIPE OPENED

NOTE: **After installing the supplemental refueling adaptor or removing the fuel filler cap, wait one minute to allow the pressure in the fuel tank to equalize with the ambient air pressure before accessing the PID.**

- For vehicles with a capless fuel filler pipe,
- Install the supplemental refueling adaptor provided with the vehicle to open the capless fuel tank filler pipe.
- For all others,
- Remove the fuel filler cap.
- Ignition ON, engine OFF.
- Access the PCM and monitor the FTP (PRESS) PID.

Measurement Unit	Minimum Pressure	Maximum Pressure
kPa	-0.50	0.50
psi	-0.07	0.07
in-H20	-2.0	2.0

Measurement Unit	Minimum Pressure	Maximum Pressure
V	2.1	2.9

Is the pressure within specifications?

Yes	No
For DTC P0451, GO to HX19. For DTCs P00FE or P144A, GO to HX16. For DTCs P0496 or P1450, GO to HX17. For all others, GO to HX30.	GO to HX11.

HX11 CHECK FOR ANY OTHER DTC

- Check for other 3 wire sensor DTCs (KOEO, KOER, or continuous memory) present with the DTC P00FE, P0496, P144A, P1450 or P2450.

Are any other 3 wire 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 HX19.

HX12 CHECK IF THE ENGINE IDLES

- Ignition ON, engine running.

Does the engine stall or is it unable to maintain idle?

Yes	No
GO to HX13.	GO to HX14.

HX13 CHECK THE EVAP SYSTEM FOR A STUCK OPEN EVAP PURGE VALVE

- Ignition OFF.
- Disconnect the fuel vapor to intake manifold line at the EVAP purge valve and cap the line at the EVAP purge valve.
- Ignition ON, engine running.

Does the engine stall or is it unable to maintain idle?

Yes	No
The EVAP system is not the cause of the symptom. RETURN to **SYMPTOM CHARTS** for further direction.	INSTALL a new Evaporative Emission (EVAP) Purge valve. REFER to the appropriate Evaporative Emissions article. CARRY OUT the EVAP Test. REFER to the instruction manual provided by the scan tool manufacturer. Clear the PCM DTCs. REPEAT the self-test.

HX14 CHECK FOR BLOCKAGE IN THE FUEL TANK VENT SYSTEM

NOTE: **Do not allow FTP sensor voltage drop to less than 1.2 volts during this step. Excessive vacuum inside the fuel tank could trigger the vacuum release in the fuel filler cap or capless fuel filler system.**

NOTE: **The EVAP canister vent valve is normally open and venting to the atmosphere.**

- Ignition ON, engine running.
- Access the PCM and monitor the EVAPCV (MODE) PID.
- Access the PCM and monitor the FTP (VOLT) PID.
- Access the PCM and control the EVAPCP (PER) PID.

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- While monitoring the FTP PID, ramp open the EVAP purge valve by incrementally commanding the EVAPCP PID to 100%.

Does the FTP sensor voltage drop below 1.5 volts when the EVAP purge valve is commanded fully open?

Yes	No
GO to HX15.	For DTCs P04F0 or P144C, GO to HX49. For all others, GO to HX17.

HX15 VISUAL INSPECTION

- Visually inspect the following for blockage or contamination:
- the EVAP canister vent valve
- the EVAP canister vent valve filter
- the EVAP canister

Is a concern present?

Yes	No
REPAIR as necessary. CARRY OUT the EVAP Test. REFER to the instruction manual provided by the scan tool manufacturer. Clear the PCM DTCs. REPEAT the self-test.	For DTCs P04F0 or P144C, GO to HX49. For all others, INSTALL a new Evaporative Emission (EVAP) Canister Vent valve. REFER to the appropriate Evaporative Emissions article. CARRY OUT the EVAP Test. REFER to the instruction manual provided by the scan tool manufacturer. Clear the PCM DTCs. REPEAT the self-test.

HX16 CHECK FOR A BLOCKED FUEL VAPOR TUBE BETWEEN THE FTP SENSOR AND THE FUEL TANK

- Ignition OFF.
- Remove the fuel vapor tube assembly. Refer to the appropriate Evaporative Emissions article.
- Visually inspect the fuel vapor tube for a blockage between the FTP sensor and the connection to the fuel tank or fuel pump module.
- Visually inspect the connection at the fuel tank or fuel pump module for a blockage.

Is a concern present?

Yes	No
REMOVE the blockage. GO to HX17.	GO to HX17.

HX17 CHECK FOR A STUCK OPEN EVAP PURGE VALVE

- Install the fuel vapor tube assembly if removed in the previous step.
- Install the fuel filler cap or remove the supplemental refueling adaptor.
- Ignition ON, engine OFF.
- Access the PCM and monitor the FTP (PRESS) PID.
- Record the FTP PID value.
- Ignition ON, engine running.
- Access the PCM and control the EVAPCP (PER) PID.
- Close the EVAP purge valve by commanding the EVAPCP PID to 0%.
- Access the PCM and control the EVAPCV (MODE) PID.
- Close the EVAP canister vent valve by commanding the EVAPCV PID to ON (100% duty cycle).

Does the FTP PID decrease?

Yes	No

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Yes	No
INSTALL a new Evaporative Emission (EVAP) Purge valve. REFER to the appropriate Evaporative Emissions article. CARRY OUT the EVAP Test. REFER to the instruction manual provided by the scan tool manufacturer. Clear the PCM DTCs. REPEAT the self-test.	For DTCs P00FE or P144A, Clear the PCM DTCs. REPEAT the self-test. For all others, GO to HX18.

HX18 EVAP PURGE VALVE TEST

- Access the PCM and control the (MODE) PID.
- Ignition ON, engine running.
- Access the PCM and control the EVAPCV (MODE) PID.
- Close the EVAP canister vent valve by commanding the EVAPCV PID to ON (100% duty cycle).
- Access the PCM and monitor the FTP (PRESS) PID.
- Access the PCM and control the EVAPCP (PER) PID.
- While monitoring the FTP PID, ramp open the EVAP purge valve by incrementally commanding the EVAPCP PID to 100%.

Does the FTP PID decrease?

Yes	No
For DTCs P0496 or P1450, unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**. For all others, CHECK the EVAP system for leaks. GO to HX39.	CHECK for blockages between the fuel tank, the EVAP purge valve, and the engine intake manifold. CHECK for obstructions in the EVAP purge valve diaphragm and ports. If OK, INSTALL a new EVAP purge valve. REFER to the appropriate Evaporative Emissions article. CARRY OUT the EVAP Test. REFER to the instruction manual provided by the scan tool manufacturer. Clear the PCM DTCs. REPEAT the self-test.

HX19 CHECK THE VOLTAGE TO THE FTP SENSOR

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

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

Is the voltage between 4.5 - 5.5 V?

Yes	No
For DTCs P00FE, P0496, P144A or P1450, INSTALL a new FTP sensor. REFER to the appropriate Evaporative Emissions article. For some vehicles, the FTP sensor is integral to the fuel vapor tube assembly. Clear the PCM DTCs. CARRY OUT the EVAP Test. REFER to the instruction manual provided by the scan tool manufacturer. For repair verification, CARRY OUT the evaporative emission leak check monitor repair verification drive cycle. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . For all others, GO to HX20.	GO to **PINPOINT TEST C**.

HX20 CHECK THE FTP CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

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

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Is the resistance less than 5 ohms?

Yes	No
GO to HX21.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HX21 CHECK FOR A SHORT BETWEEN CIRCUITS

- Measure the resistance between:

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

- Measure the resistance between:

(+) FTP Sensor Connector, Harness Side	(-)
FTP	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to HX22.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

HX22 CHECK THE FTP CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) FTP Sensor Connector, Harness Side	(-)
FTP	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to HX23.

HX23 INTERMITTENT CHECK

- Ignition OFF.
- FTP Sensor connector connected.
- PCM connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the FTP (VOLT) PID.
- While monitoring the PID, wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.

Does the PID value remain steady?

Yes	No

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Yes	No
For DTC P0451, CHECK for kinks or bends in the fuel vapor hoses and tubes between the fuel tank and dust separator. CHECK the EVAP canister ports and canister vent hose assembly for contamination or debris. CHECK the dust separator for blockage. REPAIR as necessary. If no concern is present, INSTALL a new FTP sensor. REFER to the appropriate Evaporative Emissions article. Clear the PCM DTCs. For repair verification, CARRY OUT the evaporative emission leak check monitor repair verification drive cycle. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . REFER to the instruction manual provided by the scan tool manufacturer. Clear the PCM DTCs. REPEAT the self-test. For all others, INSTALL a new FTP sensor. REFER to the appropriate Evaporative Emissions article. Clear the PCM DTCs. For repair verification, CARRY OUT the evaporative emission leak check monitor repair verification drive cycle. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . CARRY OUT the EVAP Test. REFER to the instruction manual provided by the scan tool manufacturer. Clear the PCM DTCs. REPEAT the self-test.	REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.

HX24 CHECK THE PCM OUTPUT TO THE EVAP CANISTER VENT VALVE

NOTE: **For applications using the EONV EVAP leak check monitor, KAPWR provides voltage to the EVAP canister vent valve instead of VPWR.**

- Ignition OFF.
- Evaporative Emission (EVAP) Canister Vent Valve connector disconnected.
- Connect a non-powered test lamp between:

Point A Evaporative Emission (EVAP) Canister Vent Valve Connector, Harness Side	Point B Evaporative Emission (EVAP) Canister Vent Valve Connector, Harness Side
KAPWR - Pin 1	CANV - Pin 2
VPWR	CANV - Pin 2

- Ignition ON, engine OFF.
- Access the PCM and control the EVAPCV (MODE) PID.

Does the test lamp turn ON and OFF when the output is commanded ON and OFF?

Yes	No
GO to HX25.	GO to HX26.

HX25 CHECK THE EVAP CANISTER VENT VALVE RESISTANCE

NOTE: **For applications using the EONV EVAP leak check monitor, KAPWR provides voltage to the EVAP canister vent valve instead of VPWR.**

- Ignition OFF.
- Measure the resistance between:

(+) Evaporative Emission (EVAP) Canister Vent Valve Connector, Component Side	(-) Evaporative Emission (EVAP) Canister Vent Valve Connector, Component Side
KAPWR - Pin 1	CANV - Pin 2
VPWR	CANV - Pin 2

Are the resistances between 40 - 70 ohms?

Yes	No

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Yes	No
Unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**.	INSTALL a new Evaporative Emission (EVAP) Canister Vent valve. REFER to the appropriate Evaporative Emissions article. CARRY OUT the EVAP Test. REFER to the instruction manual provided by the scan tool manufacturer. Clear the PCM DTCs. REPEAT the self-test.

HX26 CHECK THE VPWR VOLTAGE TO THE EVAP CANISTER VENT VALVE

NOTE: **For applications using the EONV EVAP leak check monitor, KAPWR provides voltage to the EVAP canister vent valve instead of VPWR.**

- Measure the voltage between:

(+) Evaporative Emission (EVAP) Canister Vent Valve Connector, Harness Side	(-)
KAPWR - Pin 1	Ground
VPWR	Ground

Are the voltages greater than 10.5 V?

Yes	No
GO to HX27.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HX27 CHECK THE CANV CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) Evaporative Emission (EVAP) Canister Vent Valve Connector, Harness Side	(-) PCM Connector, Harness Side
CANV - Pin 2	CANV

Is the resistance less than 5 ohms?

Yes	No
GO to HX28.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HX28 CHECK THE CANV CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

(+) Evaporative Emission (EVAP) Canister Vent Valve Connector, Harness Side	(-)
CANV - Pin 2	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to HX29.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

HX29 CHECK THE CANV CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) Evaporative Emission (EVAP) Canister Vent Valve Connector, Harness Side	(-)
CANV - Pin 2	Ground

Is any voltage present?

Yes	No

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Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to HX54.

HX30 CHECK THE EVAP VAPOR BLOCKING VALVE

- Ignition OFF.
- Connect the Evaporative Emission Leak Detector With On Board Nitrogen Generator 218-522C or equivalent. Refer to the tool manufacturer's instruction manual.
- Disconnect the fuel vapor to EVAP canister line at the EVAP purge valve.
- Connect a suitable hose adapter to the fuel vapor to EVAP canister line connection.
- Connect the supply hose to the suitable hose adapter.
- Access the PCM and control the EVAPCV (PER) PID.
- Command the EVAPCV PID to ON (100% duty cycle).
- Access the PCM and control the EVBV (PER) PID.
- Command the EVBV PID to ON (100% duty cycle).
- Start the pressure supply.
- Monitor the flowmeter and verify the EVAP system is being pressurized.
- Command the EVBV PID to OFF (0% duty cycle).

Does the flowmeter reading change to indicate the VBV is open?

Yes	No
Unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**.	GO to HX31.

HX31 CHECK THE EVAP VAPOR BLOCKING VALVE RESISTANCE

- Ignition OFF.
- Evaporative Emission (EVAP) Vapor Blocking Valve connector disconnected.
- Measure the resistance between:

(+) Evaporative Emission (EVAP) Vapor Blocking Valve Connector, Component Side	(-) Evaporative Emission (EVAP) Vapor Blocking Valve Connector, Component Side
VBV - Pin 1	VPWR - Pin 2

Is the resistance between 23 - 30 ohms?

Yes	No
GO to HX32.	INSTALL a new Evaporative Emission (EVAP) Vapor Blocking valve. REFER to the appropriate Evaporative Emissions article. Clear the PCM DTCs. REPEAT the self-test.

HX32 CHECK THE VOLTAGE TO THE EVAP VAPOR BLOCKING VALVE

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

(+) Evaporative Emission (EVAP) Vapor Blocking Valve Connector, Harness Side	(-)
VPWR - Pin 2	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to HX33.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HX33 CHECK THE VBV CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.

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- Measure the resistance between:

(+) Evaporative Emission (EVAP) Vapor Blocking Valve Connector, Harness Side	(-) PCM Connector, Harness Side
VBV - Pin 1	VBV

Is the resistance less than 5 ohms?

Yes	No
GO to HX34.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

HX34 CHECK THE VBV CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

(+) Evaporative Emission (EVAP) Vapor Blocking Valve Connector, Harness Side	(-)
VBV - Pin 1	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to HX35.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

HX35 CHECK THE VBV CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) Evaporative Emission (EVAP) Vapor Blocking Valve Connector, Harness Side	(-)
VBV - Pin 1	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new Evaporative Emission (EVAP) Vapor Blocking valve. REFER to the appropriate Evaporative Emissions article. Clear the PCM DTCs. REPEAT the self-test.

HX36 CHECK THE INSTRUMENT PANEL CLUSTER (IPC) FOR DTCS

- Ignition ON, engine OFF.
- Carry out the IC (IPC) self-test.

Are any DTCs present?

Yes	No
REFER to the appropriate Instrumentation, Message Center, And Warning Chimes article, DTC Charts, to continue diagnosis.	GO to HX37.

HX37 CHECK THE FLI PID

- Ignition ON, engine running.
- Access the PCM and monitor the FLI (PER) PID.

Does the FLI PID match the fuel gauge?

Yes	No
GO to HX38.	GO to HX54.

HX38 CHECK FOR FUEL TANK FLOAT LEVEL RESPONSE

NOTE: **A dual-container (saddle type) fuel tank has two fuel level sensors. The FLI**

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PID in the PCM is the average value of both fuel level sensors. Some dual-container tanks may require the fuel level to be greater 3/4 full before the fuel level equalizes.

- Ignition ON, engine running.
- Access the PCM and monitor the FLI (PER) PID.
- Ignition OFF.
- If the fuel level is less than 1/4 (25% on FLI), add approximately 1/4 tank of fuel.
- If the fuel level is greater than 3/4 (75% on FLI), drain approximately 1/4 tank of fuel.
- Ignition ON, engine running.

Does the FLI PID indicate a movement upward or downward as fuel is either added or drained?

Yes	No
Unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**.	REFER to the appropriate Instrumentation, Message Center, And Warning Chimes article, Symptom Charts, to diagnose the incorrect fuel gauge indication symptom.

HX39 CHECK THE FUEL FILLER CAP OR CAPLESS FUEL TANK FILLER PIPE

- For vehicles with a fuel filler cap, visually inspect the fuel filler cap without initially disturbing it.
  - Verify the fuel filler cap tether is visible and free to move.
  - Check for missing or loose fuel filler cap.
  - Check the fuel filler cap for damage.
- For vehicles with a capless fuel tank filler pipe, visually inspect the capless fuel tank filler pipe inlet without initially disturbing it.
  - Check the capless fuel tank filler pipe inlet for an obstruction that prevents it from sealing.
  - Check the capless fuel tank filler pipe for damage.
- Install and remove the supplemental fueling adapter five times in the capless fuel tank filler pipe to clear debris on the seal and repeat the test. Refer to the Owner Literature for the location of the supplemental fueling adapter in the vehicle.

Is a concern present?

Yes	No
For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. REPAIR as necessary. GO to HX45.	For DTCs P0442 or P0456, GO to HX45. For DTCs P0455 or P0457, GO to HX40.

HX40 CHECK FOR FLI DTCS

- Ignition ON, engine OFF.
- Carry out the PCM self-test.

Are DTCs P0460, P0461, P0462 or P0463 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 HX41.

HX41 CHECK THE OPERATION OF THE FUEL GAUGE

NOTE: **A fuel gauge that always indicates a fuel level less than a 1/2 tank or always a full tank, may be caused by a fuel level input (FLI) concern.**

- Check operation of the fuel gauge.

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Is the fuel gauge functioning correctly?

Yes	No
GO to HX42.	CHECK the functionality of the FLI circuit. RETURN to **SYMPTOM CHARTS** for further direction.

HX42 EVAPORATIVE EMISSION SYSTEM VISUAL INSPECTION

- Ignition OFF.
- Visually inspect for:
- EVAP system lines and hoses (check for correct connections, damage or blockage)
- loose fuel vapor hose and tube connections to the EVAP system components
- blocked vacuum hose between the EVAP purge valve and the engine intake manifold
- damaged fuel tank or fuel filler pipe

Are there any concerns found 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 HX45.	GO to HX43.

HX43 CHECK THE FTP SENSOR VOLTAGE WITH THE FUEL FILLER CAP REMOVED OR THE CAPLESS FUEL TANK FILLER PIPE OPENED

- For vehicles with a capless fuel filler pipe,
- Install the supplemental refueling adaptor provided with the vehicle to open the capless fuel tank filler pipe.
- For all others,
- Remove the fuel filler cap.
- Ignition ON, engine OFF.
- Access the PCM and monitor the FTP (VOLT) PID.

Is the voltage between 2.1 - 2.9 V?

Yes	No
GO to HX44.	INSTALL a new FTP sensor. REFER to the appropriate Evaporative Emissions article. REPEAT the test and VERIFY the results. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to HX45.

HX44 EVAP PURGE VALVE TEST

- Ignition OFF.
- Install the fuel filler cap or remove the supplemental refueling adaptor.
- Ignition ON, engine running.
- Access the PCM and control the EVAPCV (MODE) PID.
- Close the EVAP canister vent valve by commanding the EVAPCV PID to ON (100% duty cycle).
- Access the PCM and monitor the FTP (PRESS) PID.
- Access the PCM and control the EVAPCP (PER) PID.
- While monitoring the FTP PID, ramp open the EVAP purge valve by incrementally commanding the EVAPCP PID to 100%.

Does the FTP PID decrease, the engine RPM change, or the engine stall as an indication that the EVAP purge valve is opening?

Yes	No

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Yes	No
GO to HX45.	INSTALL a new Evaporative Emission (EVAP) Purge valve. REFER to the appropriate Evaporative Emissions article. REPEAT the test and VERIFY the results. For repair verification, CARRY OUT the Smoke Machine PHASE 1 - Leak Verification Pressure Test. GO to HX45.

HX45 HOOK UP THE TEST EQUIPMENT

NOTE: **The smoke and air flow from the Evaporative Emission Leak Detector With On Board Nitrogen Generator 218-522C or equivalent will not pass through liquid fuel. Liquid fuel may be present in the fuel tank filler pipe.**

- Ignition OFF.
- Connect the Evaporative Emission Leak Detector With On Board Nitrogen Generator 218-522C or equivalent. Refer to the tool manufacturer's instruction manual.
- Disconnect the fuel vapor to EVAP canister line at the EVAP purge valve.
- Connect a suitable hose adapter to the fuel vapor to EVAP canister line connection.

Is the test equipment hook up complete?

Yes	No
For leak detection, GO to HX46. For leak repair verification, GO to HX47.	REFER to the tool manufacturer's instruction manual for additional instructions and for helpful tips.

HX46 CARRY OUT PHASE 2 - LEAK DETECTION SMOKE TEST

NOTE: **Check the EVAP hoses, EVAP purge valve, EVAP canister vent valve, EVAP canister, fuel tank, fuel filler pipe, the fuel tank area, at the fuel filler cap or capless fuel tank filler pipe inlet for leaks. Wiggle the components and connections and look for signs of leaking smoke. Smoke under pressure may not reach a leak in the fuel tank filler pipe between the check valve and the fuel filler cap or capless fuel tank filler pipe inlet. If leaking smoke is not found, carry out a visual inspection of the fuel tank filler pipe, fuel filler cap or capless fuel tank filler pipe inlet.**

- Remove the fuel filler cap or install the supplemental refueling adaptor.
- Connect the supply hose into the suitable hose adapter.
- Set the Evaporative Emission Leak Detector With On Board Nitrogen Generator 218-522C or equivalent to SMOKE.
- Ignition ON, engine OFF.
- Access the PCM and control the EVAPCV (PER) PID.
- Close the EVAP canister vent valve by commanding the EVAPCV PID to ON (100% duty cycle).
- Start the smoke supply.
- Verify the connection at the fuel vapor to EVAP canister line connection at the EVAP purge valve is not leaking.
- If smoke does not exit the fuel tank filler pipe after the system is pressurized, command the EVAPCV PID to open the EVAP canister vent valve. Once smoke is seen at the EVAP canister vent valve, command the EVAPCV PID close.
- Install the fuel filler cap or remove the supplemental refueling adaptor once smoke exits the fuel tank filler pipe.
- Continue to apply smoke to the EVAP system.
- Use the halogen spotlight along the EVAP system path and look for smoke exiting at the leak.

Is the EVAP leak located?

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Yes	No
REPAIR as necessary. CONNECT all the disconnected components. For repair verification, CARRY OUT the PHASE 1 - Leak Verification Pressure Test. GO to HX47.	The test passed. CONNECT all the disconnected components. CARRY OUT the PHASE 1 - Leak Verification Pressure Test. GO to HX47.

HX47 CARRY OUT THE PHASE 1 - LEAK VERIFICATION PRESSURE TEST

- Calibrate the flowmeter using the 0.020 standard. Refer to the tool manufacturer's instruction manual.
- Connect the supply hose to the vehicle using the suitable hose adapter.
- Set the Evaporative Emission Leak Detector With On Board Nitrogen Generator 218-522C or equivalent to the 0.020 standard.
- Ignition ON, engine OFF.
- Access the PCM and control the EVAPCV (MODE) PID.
- Close the EVAP canister vent valve by commanding the EVAPCV PID to ON (100% duty cycle).
- Start the pressure supply. Notice that the ball in the flowmeter is all the way at the top. This indicates the system is being pressurized.
- Continue to pressurize the EVAP system 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 leak verification pressure test?

Yes	No
For DTCs P0455 or P0456, GO to HX48. For all others, the test passed and no concerns are present. Clear the PCM DTCs. REPEAT the self-test.	GO to HX46.

HX48 CARRY OUT THE EVAP PURGE VALVE LEAK TEST

- Remove the EVAP purge valve from the vehicle. Refer to the appropriate Evaporative Emissions article.
- Connect a suitable hose adapter to the EVAP purge valve at the fuel vapor to EVAP canister connection.
- Connect the supply hose into the suitable hose adapter.
- Start the pressure supply. Notice that the ball in the flowmeter is all the way at the top. This indicates the system is being pressurized.
- Continue to pressurize the EVAP purge valve 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 EVAP purge valve has passed the pressure test. If the measurement is above the indicator flag, the EVAP purge valve has an unacceptable leak.

Does the EVAP purge valve pass the leak verification test?

Yes	No
The test passed and no concerns are present. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new Evaporative Emission (EVAP) Purge valve. REFER to the appropriate Evaporative Emissions article. CARRY OUT the EVAP Test. REFER to the instruction manual provided by the scan tool manufacturer. Clear the PCM DTCs. REPEAT the self-test.

HX49 CHECK THE EVAP EJECTOR CONNECTIONS

NOTE: **On some vehicles the EVAP ejector is integrated with the EVAP purge valve assembly. Refer to ENGINE CONTROL COMPONENTS for additional**

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information.

- Remove the EVAP ejector from the vehicle. Refer to the appropriate Evaporative Emissions article.
- Visually inspect the EVAP ejector connections at the intake air system tube for a restriction.
- Visually inspect the EVAP ejector connections for a restriction.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	For F-150 2.7L, F-150 3.5L, Ford GT and Transit 3.5L, INSTALL a new EVAP Ejector. REFER to the appropriate Evaporative Emissions article. Clear the PCM DTCs. REPEAT the self-test. For all others, INSTALL a new Evaporative Emission (EVAP) Purge valve. REFER to the appropriate Evaporative Emissions article. Clear the PCM DTCs. REPEAT the self-test.

HX50 CHECK FOR THE PRESENCE OF ANY MODULE COMMUNICATION CONCERNS

- Ignition ON, engine OFF.
- 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 applicable Service Information article to diagnose the communication DTC.	GO to HX51.

HX51 CHECK THE PERFORMANCE OF THE PROCESSOR

- Ignition OFF.
- Disconnect the battery and wait for 1 minute. Refer to the appropriate Charging System - Battery, Mounting and Cables.
- Connect the battery.
- Ignition ON, engine running.
- Allow the engine idle to stabilize.
- Access the PCM and monitor the FTP (VOLT) PID.

Is the voltage between 2.1 - 2.9 V?

Yes	No
GO to HX53.	GO to HX52.

HX52 CHECK FOR SELF-TEST DTC P260F

- Idle the engine for 2 minutes.
- Carry out the PCM self-test.

Is DTC P260F present?

Yes	No
GO to HX53.	RETURN the vehicle to the customer.

HX53 CHECK THE PCM FOR THE LATEST CALIBRATION

- Program the PCM to the latest calibration.
- Ignition ON, engine running.
- Idle the engine for 2 minutes.
- Carry out the PCM self-test.

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Is DTC P260F present?

Yes	No
GO to HX54.	RETURN the vehicle to the customer.

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.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS JB: SECONDARY IGNITION (COP)

INTRODUCTION

NOTE: **A damaged ignition system may cause high catalyst temperatures. Check the components next to the catalyst and muffler for heat damage.**

For 2 wire coil harness connectors, select the PCM Ignition Coil Driver Test.

For 3 wire coil harness connectors, select the Driver On Coil Ignition Test.

This pinpoint test is intended to diagnose the following:

- spark plugs (12405)
- secondary side of the coil
- exhaust spark plug wire (12286) (6.2L engine only)

Vehicle	Firing Order for Coil On Plug Applications
Fusion 1.5L	1 2 4 3
E-Series 6.2L, F-150 5.0L, F-Series Super Duty 6.2L, Mustang 5.0L	1 5 4 8 6 3 7 2
Mustang 5.2L	1 5 4 8 3 7 2 6
3-cylinder applications	1 2 3
4-cylinder applications	1 3 4 2
6-cylinder applications	1 4 2 5 3 6
8-cylinder applications	1 3 7 2 6 5 4 8
10-cylinder applications	1 6 5 10 2 7 3 8 4 9

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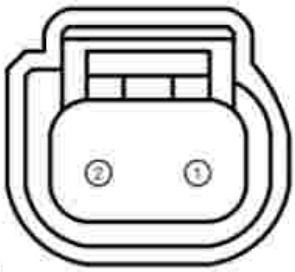
A

N0073029

B



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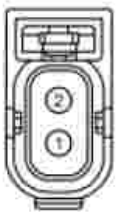

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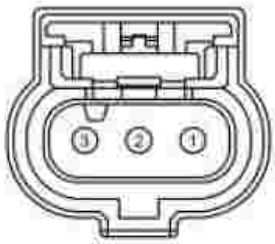

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Fig. 128: Coil On Plug (COP) Connector (1 Of 2)
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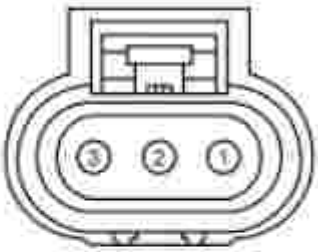
E



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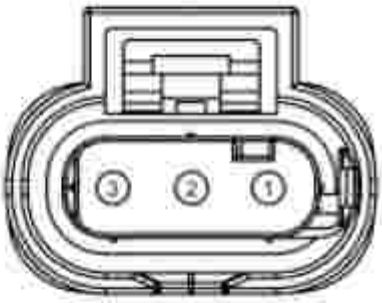

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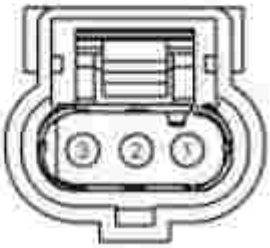

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Fig. 129: Coil On Plug (COP) Connector (2 Of 2)
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 3.7L, Edge 3.5L, Explorer TiVCT 3.5L, Explorer 3.7L, Flex TiVCT 3.5L, MKX 3.7L, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L	A	1 3	COP VPWR
E-Series 6.2L, F-Series Super Duty 6.2L	A	3 1	COP VPWR

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Vehicle	Connector	Pin	Circuit
E-Series 6.8L, F-650/F-750, F-Series Super Duty 6.8L, Motorhome/Stripped Chassis/Step Van	B	2 1	COP VPWR
EcoSport 1.5L, KA	C	1 2	COP VPWR
Escape/Kuga 2.5L, Fusion 2.5L, Ranger, Transit Connect	B	1 2	COP VPWR
Explorer GTDI 3.5L, Flex GTDI 3.5L, MKT 3.5L, Taurus GTDI 3.5L, Transit 3.5L	A	1 2 3	GND COP VPWR
F-150 3.3L, F-150 5.0L, MKT 3.7L, Mustang 5.0L, Mustang 5.2L	D	1 3	COP VPWR
Fiesta 1.0L	E	2 1 3	GND COP VPWR
Fiesta GTDI 1.6L, Focus 1.0L	F	2 1 3	GND COP VPWR
All other vehicles	G	2 1 3	GND COP VPWR

TEST PROCEDURE

JB1 CHECK FOR DTCS

NOTE: **Do not disconnect any COP while the engine is running, damage to the COP or PCM may occur.**

Are DTCs P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, P0310 or P0316 present?

Yes	No
GO to JB2.	For symptoms without DTCs, GO to JB2. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

JB2 CYLINDER POWER BALANCE TEST

NOTE: **The IDS test referenced in this step may not be available on all vehicles. Follow the YES answer if the IDS test is not available.**

- Carry out the Power Balance Test. Refer to the instruction manual provided by the scan tool manufacturer.

Are all cylinders contributing correctly during the power balance test?

Yes	No
GO to JB3.	GO to JB4.

JB3 VISUAL INSPECTION OF THE IGNITION SYSTEM

- Visually inspect the engine compartment to make sure all coils are correctly and securely connected.

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- 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 of the accessories are turned off.
- For the 6.2L engine, check the condition of the exhaust spark plug wire and boots.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to JB4.

JB4 CHECK THE VPWR TO THE SUSPECT COIL

NOTE: **Do not disconnect any COP while the engine is running, damage to the COP or PCM may occur.**

- Ignition OFF.
- Suspect Coil Assembly connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) COP Connector, Harness Side	(-)
VPWR	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to JB5.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

JB5 MISFIRE ON CYLINDERS 1 THROUGH 10

Are DTCs P0301, P0302, P0303, P0304, P0305, P0306, P0307, P0308, P0309, or P0310 present?

Yes	No
For Continental 3.7L, Edge 3.5L, Explorer 3.5L TiVCT, Explorer 3.7L, F-150 3.3L, Flex 3.5L TiVCT, MKT 3.7L, MKX 3.7L, Taurus 3.5L TiVCT, Taurus 3.7L, and Transit 3.7L, GO to JB6. For all others, GO to JB8.	GO to JB9.

JB6 CHECK FOR BANK 1 OR BANK 2 MISFIRE DTCS

NOTE: **DTCs P0301, P0302, P0303 apply to bank 1 and DTCs P0304, P0305, P0306 apply to bank 2 on 6 cylinder engines.**

Are DTCs P0301, P0302 or P0303 present?

Yes	No
GO to JB7.	GO to JB8.

JB7 CONFIRM COMPONENTS FOR CYLINDER MISFIRE

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- Remove the suspect coil (as determined from the table) for the appropriate DTC. For additional information, refer to the appropriate Engine Ignition article.
- Remove the suspect spark plug (as determined from the table) for the appropriate DTC. For additional information, refer to the appropriate Engine Ignition article.
- Remove the suspect fuel injector (as determined from the table) for the appropriate DTC. For additional information, refer to the appropriate Engine Controls - Fuel Charging And Controls article.
- Remove opposite bank coil. For additional information, refer to the appropriate Engine Ignition article.
- Remove the opposite bank spark plug. For additional information, refer to the appropriate Engine Ignition article.
- Remove the opposite bank fuel injector. For additional information, refer to the appropriate Engine Controls - Fuel Charging And Controls article.
- Install removed components from bank 1 on the opposite cylinder in bank 2 and install the components removed from bank 2 in bank 1.
- Make sure the vehicle is correctly reassembled.
- Drive the vehicle to determine if the misfire is still present.
- Carry out the PCM self-test.

Does the misfire move from the suspect cylinder in bank 1 to the opposite cylinder in bank 2?

Yes	No
GO to JB8.	GO to JB15.

JB8 CHECK FOR SPARK AT THE CYLINDERS INDICATED BY THE DTCS

NOTE: **A correctly operating ignition system only requires a spark when the spark gap is set to the 25-28 kV range.**

- Ignition OFF.
- Remove the fuel pump fuse to disable the fuel pump.
- Disconnect the ignition coils from the spark plugs.
- Connect the Adjustable Ignition Spark Tester THX458 or equivalent to the ignition coil boot.
- Set the gap on the Adjustable Ignition Spark Tester THX458 or equivalent to 40 kV.
- Crank the engine 3 times.
- Set the gap on the Adjustable Ignition Spark Tester THX458 or equivalent to 25-28 kV.
- Monitor the spark tester.
- Crank the engine.
- For the 6.2L engine,
- Connect the ignition coils to the spark plugs.
- Disconnect the exhaust spark plug wires from the spark plugs.
- Connect the Adjustable Ignition Spark Tester THX458 or equivalent to the exhaust spark plug wire.
- Set the gap on the Adjustable Ignition Spark Tester THX458 or equivalent to 40 kV.
- Crank the engine 3 times.
- Set the gap on the Adjustable Ignition Spark Tester THX458 or equivalent to 25-28 kV.
- Monitor the spark tester.
- Crank the engine.

Is a spark present when the spark gap is set to 25-28 kV while cranking the engine?

Yes	No

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Yes	No
GO to JB13.	For Continental 3.7L, E-Series, EcoSport 1.5L, Edge 3.5L, Escape/Kuga 2.5L, F-150 3.3L, F-150 5.0L, F-650/F-750, F-Series Super Duty, Fusion 2.5L, KA 1.0L, Motorhome/Stripped Chassis/Step Van, Ranger, Transit 3.7L, and Transit Connect, GO to JB10. For all others, INSTALL a new COP. Clear the PCM DTCs. REPEAT the self-test.

JB9 CHECK FOR SPARK AT ALL CYLINDERS

NOTE: **A correctly operating ignition system only requires a spark when the spark gap is set to the 25-28 kV range.**

- Ignition OFF.
- Remove the fuel pump fuse to disable the fuel pump.
- Disconnect the ignition coils from the spark plugs.
- Connect the Adjustable Ignition Spark Tester THX458 or equivalent to the ignition coil boot.
- Set the gap on the Adjustable Ignition Spark Tester THX458 or equivalent to 40 kV.
- Crank the engine 3 times.
- Set the gap on the Adjustable Ignition Spark Tester THX458 or equivalent to 25-28 kV.
- Monitor the spark tester.
- Crank the engine.
- For the 6.2L engine,
- Connect the ignition coils to the spark plugs.
- Disconnect the exhaust spark plug wires from the spark plugs.
- Connect the Adjustable Ignition Spark Tester THX458 or equivalent to the exhaust spark plug wire.
- Set the gap on the Adjustable Ignition Spark Tester THX458 or equivalent to 40 kV.
- Crank the engine 3 times.
- Set the gap on the Adjustable Ignition Spark Tester THX458 or equivalent to 25-28 kV.
- Monitor the spark tester.
- Crank the engine.

Is a spark present in all cylinders when the spark gap is set to 25-28 kV while cranking the engine?

Yes	No

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Yes	No
GO to JB13.	RECORD the cylinders with inconsistent spark. For Continental 3.7L, E-Series, EcoSport 1.5L, Edge 3.5L, Escape/Kuga 2.5L, F-150 3.3L, F-150 5.0L, F-650/F-750, F-Series Super Duty, Fusion 2.5L, KA 1.0L, Motorhome/Stripped Chassis/Step Van, Ranger, Transit 3.7L, and Transit Connect, GO to JB10. For all others, INSTALL a new COP. Clear the PCM DTCs. REPEAT the self-test.

JB10 COMPONENT INSPECTION

- Inspect the coil boots for the missing cylinders. Install a new coil boot if necessary. Refer to the appropriate Engine Ignition article.
- Inspect the spark plugs for the missing cylinders. Measure the resistance of the spark plugs. Install a new spark plug if the resistance is lower than 2, 000 ohms or higher than 12, 000 ohms at a room temperature of 25Â°C (77Â°F).
- For the 6.2L engine,
- Inspect the exhaust spark plug wires for damaged insulation, burns, and high voltage etching in either of the boots for the missing cylinders. Install a new exhaust spark plug wire if the resistance is lower than 5, 875 ohms or higher than 7, 875 ohms at a room temperature of 25Â°C (77Â°F).

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	For E-Series 6.8L, Escape/Kuga 2.5L, F-150 3.3L, F-150 5.0L, F-650/F-750, F-Series Super Duty 6.8L, Fusion 2.5L, Motorhome/Stripped Chassis/Step Van, and Transit Connect, GO to JB11. For E-Series 6.2L, and F-Series Super Duty 6.2L, GO to JB12. For all others, INSTALL a new COP. Clear the PCM DTCs. REPEAT the self-test.

JB11 CHECK THE SECONDARY COIL RESISTANCE FOR THE MISSING CYLINDERS

- Ignition OFF.
- Suspect Coil Assembly connector disconnected.
- Measure resistance between: Suspect coil connector, VPWR, component side and ignition coil spring, located in the ignition coil boot.

Is the resistance between 5, 000 and 6, 000 ohms?

Yes	No
GO to **PINPOINT TEST Z**.	INSTALL a new COP. Clear the PCM DTCs. REPEAT the self-test.

JB12 CHECK THE SECONDARY COIL RESISTANCE

- Ignition OFF.
- Measure resistance between: Suspect coil high voltage tower center pin, located on the side of the COP, and the ignition coil spring, located in the ignition coil boot.

Is the resistance between 33, 900 ohms and 41, 500 ohms at a room temperature of 25Â°C (77Â°F)?

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Yes	No
GO to **PINPOINT TEST Z**.	INSTALL a new COP. Clear the PCM DTCs. REPEAT the self-test.

JB13 CHECK THE SPARK PLUGS

NOTE: **To determine the condition of the spark plugs, refer to the appropriate Engine System article and carry out the Spark Plug Inspection.**

- Ignition OFF.
- Remove and inspect the spark plugs for damage, wear, carbon tracking or deposits and correct spark plug gap.

Are the plugs OK?

Yes	No
GO to JB14.	REPAIR the spark plugs. ADJUST the gap or INSTALL a new spark plug as necessary. REFER to the appropriate Engine Ignition article. Clear the PCM DTCs. REPEAT the self-test.

JB14 CHECK THE SPARK PLUG RESISTANCE

- Measure the spark plug resistance.

Is the resistance between 2, 000 ohms and 12, 000 ohms at a room temperature of 25Â°C (77Â°F)?

Yes	No
GO to JB15.	INSTALL a new spark plug. REFER to the appropriate Engine Ignition article. Clear the PCM DTCs. REPEAT the self-test.

JB15 TEST DIRECTION FOR SYMPTOM CHARTS

Were you directed to this pinpoint test from Symptom Charts article?

Yes	No
RETURN to **SYMPTOM CHARTS** for further direction.	GO to JB16.

JB16 TEST DIRECTION FOR PINPOINT TEST HD

Were you directed to this pinpoint test from pinpoint test step HD8?

Yes	No
GO to HD9.	The concern is intermittent. GO to **PINPOINT TEST Z**.

PINPOINT TESTS JC: SECONDARY IGNITION (COIL PACK)

INTRODUCTION

NOTE: **There is additional information available on this procedure. Copy and paste the following URL into your internet browser: mms://multimedia.ford.com/seopts/Service_Tips/ignition3.wmv.**

This pinpoint test is intended to diagnose the following:

- spark plugs (12405)
- spark plug wires (12280, 12281)

TEST PROCEDURE

JC1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

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Are DTCs P0300, P0301, P0302, P0303 or P0304?

Yes	No
For DTC P0300, GO to JC2. For all others, GO to JC10.	For symptoms without DTCs, GO to JC2. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

JC2 CYLINDER POWER BALANCE TEST

NOTE: **The IDS test referenced in this step may not be available on all vehicles. Follow the YES answer if the IDS test is not available.**

- Carry out the Power Balance Test. Refer to the instruction manual provided by the scan tool manufacturer.

Are all cylinders contributing correctly during the power balance test?

Yes	No
GO to JC3.	For a coil pack using an engine analyzer, GO to JC4. For a coil pack not using an engine analyzer, GO to JC10.

JC3 VISUAL INSPECTION OF THE IGNITION SYSTEM

- Visually inspect the engine compartment to make sure all coils and spark plug wires are correctly and securely connected.
- Examine all wiring harnesses and connectors for damaged, burned or overheated insulation and loose or broken conditions.
- Visually inspect the interior and exterior surfaces of the coil tower for damage or carbon tracking.
- Visually inspect the interior and exterior surfaces of the spark plug wire boots for damage or carbon tracking.
- Make sure the vehicle battery is in good condition and all accessories are turned off.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	For a coil pack using an engine analyzer, GO to JC4. For a coil pack not using an engine analyzer, GO to JC10.

JC4 CHECK FOR THE IGNITION PATTERN

- Connect an engine analyzer to diagnose concerns in the secondary side of the ignition system.
- Observe the pattern on a scope while cranking the engine.

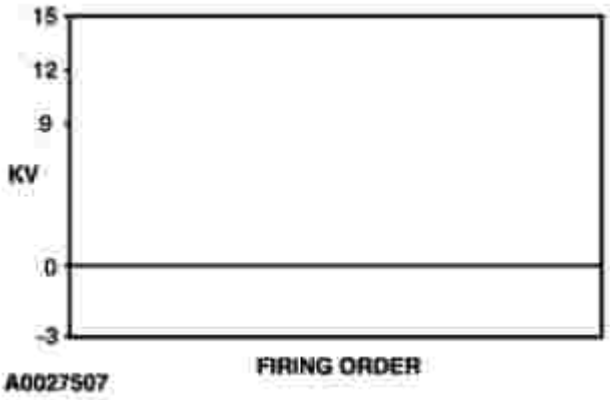

Fig. 130: Ignition Pattern
Courtesy of FORD MOTOR CO.

Is the pattern flat, which indicates no ignition spark on all cylinders?

Yes	No

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Yes	No
GO to **PINPOINT TEST JE**.	GO to JC5.

JC5 CHECK FOR A NORMAL IGNITION PATTERN

NOTE: **Spark plugs may be fired more than once per combustion event. Multi-strike operating mode is RPM dependent.**

- Ignition ON, engine running. If no start, crank the engine.

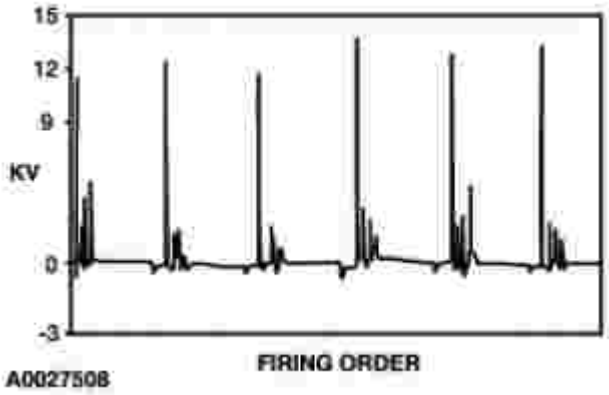

Fig. 131: Normal Ignition Pattern
Courtesy of FORD MOTOR CO.

Are the patterns even and is the average value of spark plug firing voltage between 9 kV and 15 kV (higher during engine crank/no start)?

Yes	No
GO to **PINPOINT TEST Z**.	GO to JC6.

JC6 CHECK FOR MISSING SPARK PATTERNS

- Observe for missing spark pattern.

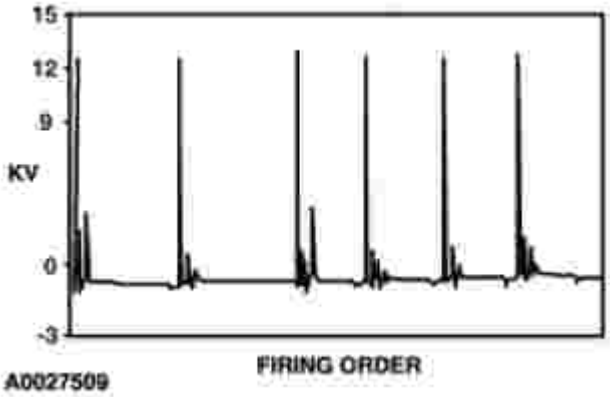

Fig. 132: Missing Spark Patterns
Courtesy of FORD MOTOR CO.

Is the spark pattern inconsistent?

Yes	No
INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire if the resistance is greater than 7, 000 ohms per 30.5 cm (1 foot). REFER to the appropriate Engine Ignition article. Clear the PCM DTCs. REPEAT the self-test. GO to JE2.	GO to JC7.

JC7 CHECK FOR A HIGH SPARK PLUG FIRING VOLTAGE

- Observe for a high spark plug firing voltage.

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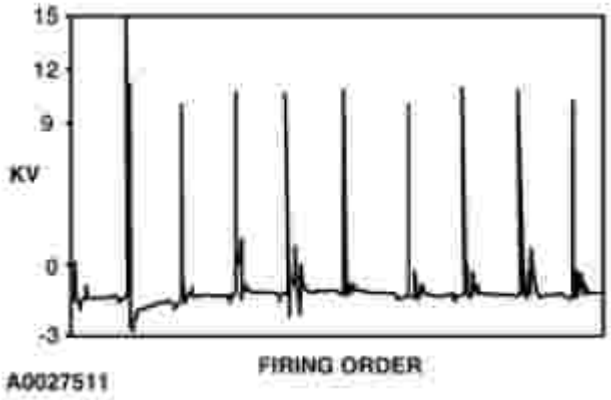

Fig. 133: High Spark Plug Firing Voltage
Courtesy of FORD MOTOR CO.

Is the average value of the spark plug firing voltage greater than 15 kV?

Yes	No
INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire if the resistance is greater than 7, 000 ohms per 30.5 cm (1 foot). REFER to the appropriate Engine Ignition article. Clear the PCM DTCs. REPEAT the self-test.	GO to JC8.

JC8 CHECK FOR LOW SPARK PLUG FIRING VOLTAGE

- Check the spark plug firing voltage average pattern.

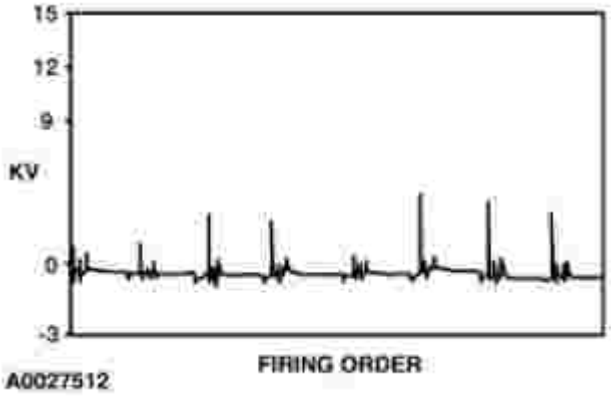

Fig. 134: Spark Plug Firing Voltage Average Pattern
Courtesy of FORD MOTOR CO.

Is there consistently low spark plug firing voltage or sloping sparkline on one or more cylinders?

Yes	No
INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire if the resistance is greater than 7, 000 ohms per 30.5 cm (1 foot). MEASURE the resistance of the spark plugs. INSTALL a new spark plugs if the resistance is lower than 2, 000 or higher than 12, 000 ohms. REFER to the appropriate Engine Ignition article. Clear the PCM DTCs. REPEAT the self-test.	GO to JC9.

JC9 CHECK FOR EVENNESS BETWEEN CYLINDERS

- Check the spark plug firing voltage average pattern.

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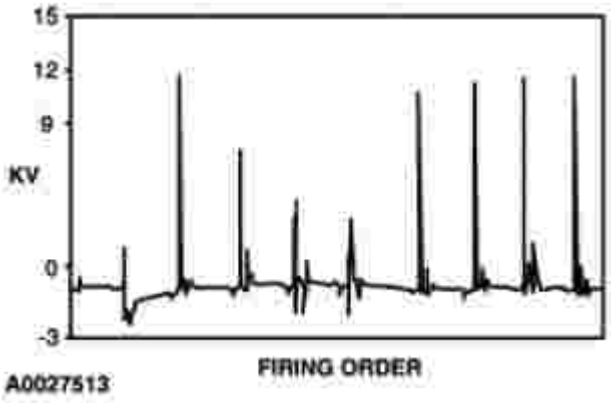

Fig. 135: Spark Plug Firing Voltage Average Pattern
Courtesy of FORD MOTOR CO.

Is the evenness of spark plug firing voltage greater than 6 kV?

Yes	No
INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wire if the resistance is greater than 7, 000 ohms per 30.5 cm (1 foot). CHECK for damaged spark plugs or narrow spark plug gaps. MEASURE the resistance of the spark plugs. INSTALL a new spark plugs if the resistance is lower than 2, 000 or higher than 12, 000 ohms. REFER to the appropriate Engine Ignition article. Clear the PCM DTCs. REPEAT the self-test.	GO to **PINPOINT TEST Z**.

JC10 CHECK FOR SPARK AT ALL CYLINDERS

NOTE: **A correctly operating ignition system only requires a spark when the spark gap is set to the 25-28 kV range.**

- Ignition OFF.
- Disconnect the spark plug wires from the spark plugs.
- Connect the Adjustable Ignition Spark Tester THX458 or equivalent to a spark plug wire.
- Set the gap on the Adjustable Ignition Spark Tester THX458 or equivalent to 40 kV.
- Crank the engine 3 times.
- Set the gap on the Adjustable Ignition Spark Tester THX458 or equivalent to 25-28 kV.
- Monitor the spark tester.
- Crank the engine.

Is a spark present when the spark gap is set to 25-28 kV while cranking the engine?

Yes	No
GO to JC12.	INSPECT the spark plug wires for missing cylinders. MEASURE the resistance of the spark plug wires. INSTALL a new spark plug wires, if the resistance is greater than 7, 000 ohms per 30.5 cm (1 foot). REFER to the appropriate Engine Ignition article. If the spark plug wires are OK, GO to JC11.

JC11 CHECK THE SECONDARY COIL RESISTANCE FOR THE MISSING CYLINDERS

NOTE: **Two adjacent coil towers share a common coil and are called a matched pair. The matched pairs are 1 and 4, and 2 and 3.**

- Ignition OFF.
- Ignition coil pack disconnected.
- Disconnect spark plug wires from the coil pack.
- Measure the resistance of each matched pair.

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Is the resistance between 8, 000 and 9, 600 ohms?

Yes	No
GO to **PINPOINT TEST Z**.	INSTALL a new ignition coil pack. REFER to the appropriate Engine Ignition article. Clear the PCM DTCs. REPEAT the self-test.

JC12 CHECK THE SPARK PLUGS

- Ignition OFF.
- Check for damaged spark plugs or narrow spark plug gaps.

Are the plugs OK?

Yes	No
GO to JC13.	REPAIR the spark plugs. ADJUST the gap or INSTALL a new spark plugs as necessary. REFER to the appropriate Engine Ignition article. Clear the PCM DTCs. REPEAT the self-test.

JC13 CHECK THE SPARK PLUG RESISTANCE

- Measure the spark plug resistance.

Is the resistance between 2, 000 and 12, 000 ohms?

Yes	No
GO to **PINPOINT TEST Z**.	INSTALL a new spark plugs. REFER to the appropriate Engine Ignition article. Clear the PCM DTCs. REPEAT the self-test.

PINPOINT TESTS JD: CRANKSHAFT POSITION (CKP) SENSOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- CKP sensor (6C315)
- harness circuits: CKP, CKP+ and CKP-
- PCM (12A650)

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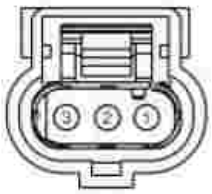
A



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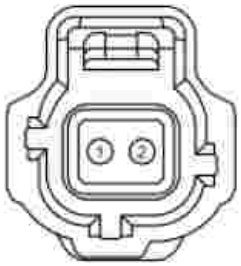

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Fig. 136: Crankshaft Position (CKP) Sensor Connector (1 Of 2)
Courtesy of FORD MOTOR CO.

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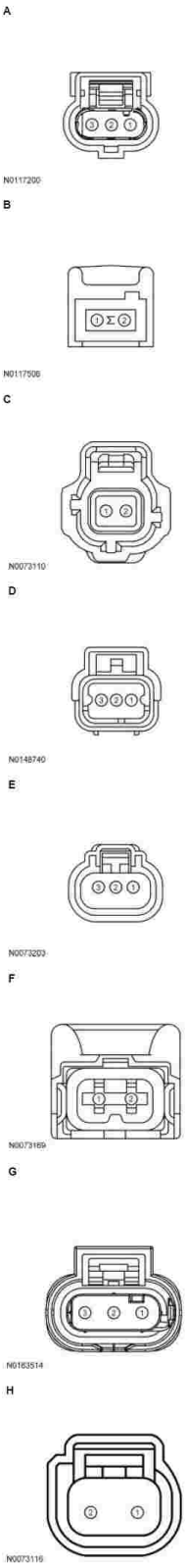

Fig. 137: Crankshaft Position (CKP) Sensor Connector (2 Of 2)
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 2.0L, EcoSport 2.0L, Edge 2.0L, Escape/Kuga 2.0L, Focus GTDI 2.0L, Focus 2.3L, Fusion 2.0L, MKC 2.0L, MKX 2.0L, MKZ 2.0L	A	2 3 1	CKP SIGRTN VREF

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Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, Edge 2.7L, F-150 2.7L, F-150 5.0L, MKX 2.7L, MKZ 3.0L, Mustang 5.0L	A	2 1 3	CKP SIGRTN VREF
EcoSport 1.0L, Escape/Kuga 1.5L, Fiesta 1.0L, Fiesta GTDI 1.6L, Focus 1.0L, KA 1.0L	B	3 2 1	CKP SIGRTN VREF
EcoSport 1.5L	A	3 2 1	CKP SIGRTN VREF
Escape/Kuga 2.5L, Fusion 2.5L, Ranger, Transit Connect	C	2 1	CKP- CKP+
Expedition, Explorer GTDI 3.5L, F-150 3.3L, F-150 3.5L, Flex GTDI 3.5L, Ford GT, MKT 3.5L, Navigator, Taurus GTDI 3.5L, Transit 3.5L	A	1 2 3	CKP SIGRTN VREF
Explorer 2.3L, Focus GDI 2.0L, MKC 2.3L, MKT 2.0L, Mustang 2.3L, Taurus 2.0L	D	2 3 1	CKP SIGRTN VREF
Fiesta TiVCT 1.6L, KA 1.5L	E	2 1	CKP- CKP+
Fusion 1.5L	F	3 2 1	CKP SIGRTN VREF
Fusion 2.7L	A	3 1 2	CKP SIGRTN VREF
All other vehicles	G	1 2	CKP- CKP+

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
Continental 3.7L, E-Series, Edge 3.5L, Explorer TiVCT 3.5L, Explorer 3.7L, F-650/F-750, F-Series Super Duty, Flex TiVCT 3.5L, MKT 3.7L, MKX 3.7L, Motorhome/Stripped Chassis/Step Van, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L	198 PIN	E70 E69	CKP+ CKP-
EcoSport 1.0L Manual Transmission, Fiesta 1.0L, Fiesta GTDI 1.6L	198 PIN	E49	CKP
EcoSport 1.5L Automatic Transmission	198 PIN	E60	CKP
EcoSport 1.5L Manual Transmission	112 PIN	E35	CKP
Escape/Kuga 1.5L	198 PIN	E38	CKP
Escape/Kuga 2.5L, Fusion 2.5L, Transit Connect	198 PIN	E60 E59	CKP+ CKP-
Expedition, F-150 3.5L, Navigator	198 PIN	E27	CKP
F-150 2.7L, F-150 3.3L, F-150 5.0L, Mustang 5.0L	306 PIN	E78	CKP
Fiesta TiVCT 1.6L, Ranger	128 PIN	T6 T14	CKP+ CKP-
Focus GDI 2.0L	154 PIN	E45	CKP
KA 1.0L	128 PIN	E37	CKP
KA 1.5L	128 PIN	E38 E37	CKP+ CKP-
Mustang 2.3L	198 PIN	E23	CKP
Mustang 5.2L	198 PIN	E70 E60	CKP+ CKP-
All other vehicles	198 PIN	E11	CKP

TEST PROCEDURE

JD1 CHECK THE CKP SENSOR SIGNAL SENT TO THE PCM

NOTE: **The battery should be fully charged and the starting system should be functioning correctly.**

- Remove the fuel pump fuse to disable the fuel pump.
- Ignition ON, engine OFF.
- Access the PCM and monitor the RPM (RPM) PID.
- Crank the engine.

Is the RPM greater than 150 RPM?

Yes	No

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Yes	No
For DTCs P0335, P0336 or P0339, GO to JD2. For DTC P1336 with no start, GO to **PINPOINT TEST A**. For DTC P1336, GO to **PINPOINT TEST HD**. For all others, the CKP, PCM, and harness are working correctly. RETURN to **SYMPTOM CHARTS** for further direction.	GO to JD2.

JD2 CHECK THE CKP SENSOR AND TRIGGER WHEEL FOR OBVIOUS PHYSICAL DAMAGE

NOTE: **A trigger wheel that is physically damaged, bent more than 1.0 mm, or has contamination present on the magnetic surfaces, may cause an intermittent CKP signal.**

- Ignition OFF.
- Check the trigger wheel for contamination or debris.
- Check the CKP sensor and trigger wheel for physical damage.

Is a concern present?

Yes	No
REPAIR as necessary. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . CARRY OUT the Misfire Monitor Neutral Profile Correction procedure using the scan tool.	For Continental 2.0L, Continental 2.7L, Continental 3.0L, EcoSport, Edge 2.0L, Edge 2.7L, Escape/Kuga 1.5L, Escape/Kuga 2.0L, Expedition, Explorer 2.3L, Explorer 3.5L GTDI, F-150, Fiesta 1.0L, Fiesta 1.6L GTDI, Flex 3.5L GTDI, Focus, Ford GT, Fusion 1.5L, Fusion 2.0L, Fusion 2.7L, KA 1.0L, MKC, MKT 2.0L, MKT 3.5L, MKX 2.0L, MKX 2.7L, MKZ, Mustang 2.3L, Mustang 5.0L, Navigator, Taurus 2.0L, Taurus 3.5L GTDI, and Transit 3.5L, GO to JD10. For all others, GO to JD3.

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JD3 CHECK FOR CORRECT CKP BIAS VOLTAGES IN THE PCM

- CKP Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) CKP Sensor Connector, Harness Side	(-) Vehicle Battery
CKP+	Negative terminal
CKP-	Negative terminal

Are the voltages between 1 - 3 V?

Yes	No
GO to JD4.	GO to JD6.

JD4 CHECK THE CKP SENSOR RESISTANCE

- Ignition OFF.
- Measure the resistance between:

(+) CKP Sensor Connector, Component Side	(-) CKP Sensor Connector, Component Side
CKP+	CKP-

Is the resistance between 0.25K - 1.1K ohms?

Yes	No
GO to JD5.	INSTALL a new CKP sensor. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . CARRY OUT the Misfire Monitor Neutral Profile Correction procedure using the scan tool.

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 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 an intermittent ground connection. Clear the PCM DTCs. REPEAT the self-test.

JD6 CHECK FOR SHORT BETWEEN CKP (+) AND CKP (-)

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

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

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Is the resistance greater than 10K ohms?

Yes	No
GO to JD7.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

JD7 CHECK THE CKP CIRCUITS FOR AN OPEN

- Measure the resistance between:

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

Are the resistances less than 5 ohms?

Yes	No
GO to JD8.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

JD8 CHECK THE CKP CIRCUITS FOR A SHORT TO GROUND

- Measure the resistance between:

(+) CKP Sensor Connector, Harness Side	(-) Vehicle Battery
CKP+	Negative terminal
CKP-	Negative terminal

Are the resistances greater than 10K ohms?

Yes	No
GO to JD9.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

JD9 CHECK THE CKP CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) CKP Sensor Connector, Harness Side	(-) Vehicle Battery
CKP+	Negative terminal
CKP-	Negative terminal

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to JD14.

JD10 CHECK FOR VOLTAGE AT THE SENSOR

- Ignition OFF.
- CKP Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

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

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to JD11.	GO to **PINPOINT TEST C**.

JD11 CHECK FOR AN OPEN

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- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

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

Is the resistance less than 5 ohms?

Yes	No
GO to JD12.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

JD12 CHECK FOR A SHORT BETWEEN CIRCUITS

- Measure the resistance between:

(+) CKP Sensor Connector, Harness Side	(-)
CKP	Ground

- Measure the resistance between:

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

Are the resistances greater than 10K ohms?

Yes	No
GO to JD13.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

JD13 CHECK FOR A SHORT TO VOLTAGE

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

(+) CKP Sensor Connector, Harness Side	(-)
CKP	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to JD14.

JD14 INTERMITTENT CHECK

NOTE: **Chafed CKP or CMP wires or other physical damage to the harness may cause an intermittent short in the CKP or CMP circuit.**

- Ignition OFF.
- PCM connector connected.
- Visually check for chafed CKP and CMP wires or other physical damage to the CKP or CMP harness.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to JD15.

JD15 CHECK FOR CORRECT OPERATION

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- Ignition OFF.
- PCM connector disconnected.
- CKP Sensor connector disconnected.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors and the CKP sensor connector. Make sure the connectors are seated correctly.
- Carry out the PCM KOEO self-test.
- Carry out the PCM KOER self-test.
- Verify the concern is still present.

Is the concern still present?

Yes	No
INSTALL a new CKP sensor. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM), REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . CARRY OUT the Misfire Monitor Neutral Profile Correction procedure using the scan tool.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS JE: INTEGRATED IGNITION COIL PACK

INTRODUCTION

NOTE: **There is additional information available on this procedure. Copy and paste the following URL into your internet browser: mms://multimedia.ford.com/seopts/Service_Tips/ignition3.wmv.**

This pinpoint test is intended to diagnose the following:

- ignition coil packs (12029)
- ignition coil harness
- VPWR circuit to coil packs
- PCM (12A650)

IGNITION COIL TO CYLINDER CORRELATION

Related DTC	Cylinder Number	Coil Driver (CD)
P0351	1, 4	A
P0352	2, 3	B

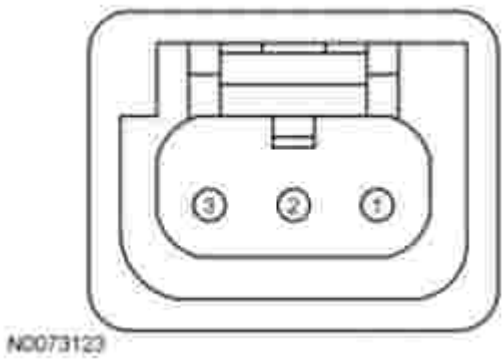

Fig. 138: Coil Pack Assembly Connector
Courtesy of FORD MOTOR CO.

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Pin	Circuit
1	CD B (Ignition Coil Driver B)
3	CD A (Ignition Coil Driver A)
2	VPWR (Vehicle Power)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Connector	Pin	Circuit
128 PIN	T24 T16	CD B CD A

TEST PROCEDURE

JE1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

Are DTCs P0351, P0352, P0353, P2300, P2301, P2303 or P2304 present?

Yes	No
For DTCs P0351, P0352 or P0353, GO to JE2. For all others, GO to JE4.	If sent to this test from JC, GO to JE3. For symptoms without DTCs, GO to JE2. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

JE2 DETERMINE WHICH COIL IS NOT FIRING CORRECTLY

NOTE: **Electronic ignition engine timing is entirely controlled by the PCM. Electronic ignition timing is not adjustable. Do not attempt to check base timing. You will receive false readings.**

- Determine which coil is not firing correctly 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.

Is the suspect cylinder number, coil driver and PCM pin number recorded?

Yes	No
GO to JE3.	To obtain the required information, REPEAT step, GO to JE2.

JE3 CHECK VPWR VOLTAGE TO THE COIL PACK

- Suspect Coil Assembly connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Coil Pack Assembly Connector, Harness Side	(-)
VPWR - Pin 2	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to JE4.	REPAIR the open circuit. CARRY OUT the misfire monitor drive cycle. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . Clear the PCM DTCs. REPEAT the self-test.

JE4 CHECK THE FUNCTIONALITY OF THE SUSPECT COIL DRIVER (CD) CIRCUIT

- Ignition OFF.

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- Remove the fuel pump fuse to disable the fuel pump.
- Connect a test lamp between VPWR and the suspect CD circuit (determined from the table) at the coil pack harness connector.
- Monitor the test lamp.
- Crank the engine.

Does the test lamp blink consistently?

Yes	No
GO to JE8.	GO to JE5.

JE5 CHECK THE SUSPECT CD CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) Coil Pack Assembly Connector, Harness Side	(-) PCM Connector, Harness Side
Suspect coil driver	Suspect coil driver

Is the resistance less than 5 ohms?

Yes	No
GO to JE6.	REPAIR the open circuit. CARRY out the misfire monitor drive cycle. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . Clear the PCM DTCs. REPEAT the self-test.

JE6 CHECK THE SUSPECT CD CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) Coil Pack Assembly Connector, Harness Side	(-)
Suspect coil driver	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. CARRY out the misfire monitor drive cycle. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . Clear the PCM DTCs. REPEAT the self-test.	GO to JE7.

JE7 CHECK THE SUSPECT CD CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure the resistance between:

(+) Coil Pack Assembly Connector, Harness Side	(-)
Suspect coil driver	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to JE9.	REPAIR the short circuit. CARRY out the misfire monitor drive cycle. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . Clear the PCM DTCs. REPEAT the self-test.

JE8 CHECK THE SUSPECT COIL FOR DAMAGE

NOTE: **A correctly operating ignition system only requires a spark when the spark**

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gap is set to the 25-28 kV range.

- Ignition OFF.
- Remove the spark plug wire from the suspect coil tower (as determined from the table).
- Connect the Adjustable Ignition Spark Tester THX458 or equivalent to the suspect spark plug wire.
- Set the gap on the Adjustable Ignition Spark Tester THX458 or equivalent to 40 kV.
- Crank the engine 3 times.
- Set the gap on the Adjustable Ignition Spark Tester THX458 or equivalent to 25-28 kV.
- Monitor the spark tester.
- Crank the engine.

Is a spark present when the spark gap is set to 25-28 kV while cranking the engine?

Yes	No
GO to **PINPOINT TEST Z**.	INSTALL a new coil pack as needed. REFER to the appropriate Engine Ignition article. CARRY out the misfire monitor drive cycle. REFER to **ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE** . Clear the PCM DTCs. REPEAT the self-test.

JE9 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.
- 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)** , Programming the VID Block for a Replacement PCM.	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 TESTS JF: INTEGRATED IGNITION COIL ON PLUG COILS A THROUGH J FAILURE

INTRODUCTION

For 2 wire coil harness connectors, select the PCM Ignition Coil Driver Test.

For 3 wire coil harness connectors, select the Driver On Coil Ignition Test.

This pinpoint test is intended to diagnose the following:

- ignition coils (12029)
- ignition coil harness
- PCM (12A650)

A

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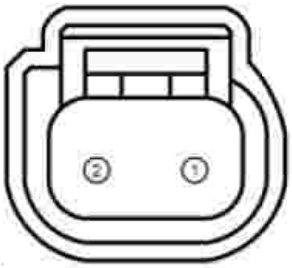
B



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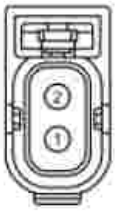

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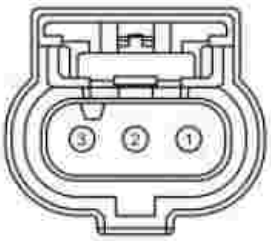

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Fig. 139: Coil On Plug (COP) Connector (1 Of 2)
Courtesy of FORD MOTOR CO.

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E

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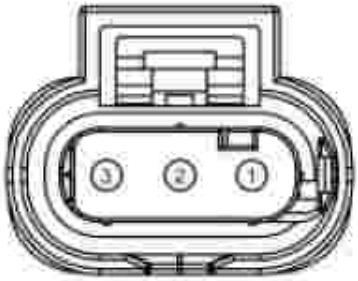
F



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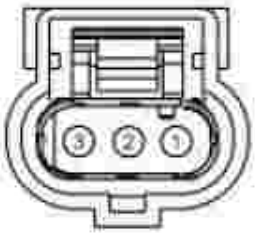

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Fig. 140: Coil On Plug (COP) Connector (2 Of 2)
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 3.7L, Edge 3.5L, Explorer TiVCT 3.5L, Explorer 3.7L, Flex TiVCT 3.5L, MKX 3.7L, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L	A	1 3	COP VPWR
E-Series 6.2L, F-Series Super Duty 6.2L	A	3 1	COP VPWR

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Vehicle	Connector	Pin	Circuit
E-Series 6.8L, F-650/F-750, F-Series Super Duty 6.8L, Motorhome/Stripped Chassis/Step Van	B	2 1	COP VPWR
EcoSport 1.5L, KA	C	1 2	COP VPWR
Escape/Kuga 2.5L, Fusion 2.5L, Ranger, Transit Connect	B	1 2	COP VPWR
Explorer GTDI 3.5L, Flex GTDI 3.5L, MKT 3.5L, Taurus GTDI 3.5L, Transit 3.5L	A	2 1 3	COP GND VPWR
F-150 3.3L, F-150 5.0L, MKT 3.7L, Mustang 5.0L, Mustang 5.2L	D	1 3	COP VPWR
Fiesta 1.0L	E	1 2 3	COP GND VPWR
Fiesta GTDI 1.6L, Focus 1.0L	F	1 2 3	COP GND VPWR
All other vehicles	G	1 2 3	COP GND VPWR

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 2.7L, Continental 3.0L, Edge 2.7L, Explorer GTDI 3.5L, Flex GTDI 3.5L, Ford GT, Fusion 2.7L, MKT 3.5L, MKX 2.7L, MKZ 3.0L, Taurus GTDI 3.5L, Transit 3.5L	198 PIN	E73 E58 E43 E72 E57 E42	COP6 COP5 COP4 COP3 COP2 COP1
Continental 3.7L, Edge 3.5L, Explorer TiVCT 3.5L, Explorer 3.7L, Flex TiVCT 3.5L, MKT 3.7L, MKX 3.7L, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L	198 PIN	E94 E90 E89 E88 E92 E93	COP6 COP5 COP4 COP3 COP2 COP1

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Vehicle	Connector	Pin	Circuit
E-Series 6.2L, F-Series Super Duty 6.2L	198 PIN	E90 E87 E88 E89 E92 E94 E95 E93	COP8 COP7 COP6 COP5 COP4 COP3 COP2 COP1
E-Series 6.8L, F-650/F-750, F-Series Super Duty 6.8L, Motorhome/Stripped Chassis/Step Van	198 PIN	E92 E95 E94 E80 E89 E85 E87 E88 E90 E93	COP10 COP9 COP8 COP7 COP6 COP5 COP4 COP3 COP2 COP1
EcoSport 1.0L Automatic Transmission, Focus 1.0L	198 PIN	E72 E57 E42	COP3 COP2 COP1
EcoSport 1.0L Manual Transmission	198 PIN	E52 E51 E50	COP3 COP2 COP1
EcoSport 1.5L Automatic Transmission	198 PIN	E89 E84 E79	COP3 COP2 COP1
EcoSport 1.5L Manual Transmission	112 PIN	E54 E52 E53	COP3 COP2 COP1
Escape/Kuga 1.5L	198 PIN	E48 E33 E18 E19	COP4 COP3 COP2 COP1
Escape/Kuga 2.5L, Fusion 2.5L, Transit Connect	198 PIN	E89 E84 E94 E79	COP4 COP3 COP2 COP1
Expedition, F-150 3.5L, Navigator	198 PIN	E57 E56 E71 E70 E55 E41	COP6 COP5 COP4 COP3 COP2 COP1
F-150 2.7L, F-150 3.3L	306 PIN	E63 E105 E62 E42 E84 E21	COP6 COP5 COP4 COP3 COP2 COP1
F-150 5.0L	306 PIN	E126 E84 E42 E63 E83 E62 E105 E21	COP8 COP7 COP6 COP5 COP4 COP3 COP2 COP1

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Vehicle	Connector	Pin	Circuit
Fiesta	198 PIN	E53 E52 E51 E50	COP4 COP3 COP2 COP1
Focus GDI 2.0L	154 PIN	E93 E69 E94 E70	COP4 COP3 COP2 COP1
KA	128 PIN	T8 T24 T16	COP3 COP2 COP1
Mustang 2.3L	198 PIN	E58 E59 E45 E60	COP4 COP3 COP2 COP1
Mustang 5.0L	306 PIN	E105 E83 E42 E62 E84 E63 E126 E21	COP8 COP7 COP6 COP5 COP4 COP3 COP2 COP1
Mustang 5.2L	198 PIN	E90 E94 E95 E89 E92 E88 E87 E93	COP8 COP7 COP6 COP5 COP4 COP3 COP2 COP1
Ranger	128 PIN	T8 T24 T7 T16	COP4 COP3 COP2 COP1
All other vehicles	198 PIN	E43 E72 E57 E42	COP4 COP3 COP2 COP1

TEST PROCEDURE

JF1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: **Electronic ignition engine timing is entirely controlled by the PCM. Electronic ignition timing is not adjustable. Do not attempt to check base timing. You will receive false readings.**

NOTE: **Pull on the suspect coil connector to determine if it is correctly seated before proceeding with the current diagnostic path. If the suspect coil connector is not seated correctly, reconnect the suspect connector until an audible click can be heard.**

NOTE: **Coil letter A through J corresponds with cylinder number 1 through 10.**

Are DTCs P0351, P0352, P0353, P0354, P0355, P0356, P0357, P0358, P0359, P0360, P2300, P2301, P2303, P2304, P2306, P2307, P2309, P2310, P2312, P2313, P2315 OR P2316 present?

Yes	No

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Yes	No
For Continental 2.0L, Continental 2.7L, Continental 3.0L, EcoSport 1.0L, EcoSport 2.0L, Edge 2.0L, Edge 2.7L, Escape/Kuga 1.5L, Escape/Kuga 2.0L, Expedition, Explorer 2.3L, Explorer 3.5L GTDI, Explorer 3.5L, F-150 2.7L, F-150 3.5L, Fiesta 1.0L, Fiesta 1.6L GTDI, Flex 3.5L GTDI, Focus, Ford GT, Fusion 1.5L, Fusion 2.0L, Fusion 2.7L, MKC, MKT 2.0L, MKT 3.5L, MKX 2.0L, MKX 2.7L, MKZ, Mustang 2.3L, Navigator, Taurus 2.0L, Taurus 3.5L GTDI, and Transit 3.5L, GO to JF4. For all others, GO to JF2.	For symptoms without DTCs, GO to JF4. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

JF2 CHECK THE FUNCTIONALITY OF THE SUSPECT COIL DRIVER CIRCUIT

NOTE: **Do not disconnect any COP while the engine is running, damage to the COP or PCM may occur.**

- Ignition OFF.
- Suspect Coil Assembly connector disconnected.
- Remove the fuel pump fuse to disable the fuel pump.
- Connect the Deluxe Noid Lite and Signal Test Light Set AST7898 or equivalent between the COP and VPWR circuits in the suspect coil harness side connector.
- Monitor the noid light.
- Crank the engine.

Does the noid light blink consistently?

Yes	No
GO to JF3.	GO to JF4.

JF3 CHECK THE FUNCTIONALITY OF THE SUSPECT COIL

NOTE: **A correctly operating ignition system only requires a spark when the spark gap is set to the 25-28 kV range.**

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- Ignition OFF.
- Carry out a visual inspection. Closely inspect the coil case and boot for carbon tracking, cracks and torn or incorrectly installed boots.
- Remove the suspect COP from the spark plug.
- Connect the Adjustable Ignition Spark Tester THX458 or equivalent.
- Suspect Coil Assembly connector connected.
- Set the gap on the Adjustable Ignition Spark Tester THX458 or equivalent to 40 kV.
- Crank the engine 3 times.
- Set the gap on the Adjustable Ignition Spark Tester THX458 or equivalent to 25-28 kV.
- Monitor the spark tester.
- Crank the engine.

Is a spark present when the spark gap is set to 25-28 kV while cranking the engine?

Yes	No
GO to **PINPOINT TEST Z**.	INSTALL a new coil. If necessary, INSTALL a new spark plug. REFER to the appropriate Engine Ignition article. Clear the PCM DTCs. REPEAT the self-test. If the concern or DTC is still present, GO to JF10.

JF4 CHECK THE VPWR TO THE SUSPECT COIL

NOTE: **Do not disconnect any COP while the engine is running, damage to the COP or PCM may occur.**

- Ignition OFF.
- Suspect Coil Assembly connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) COP Connector, Harness Side	(-) Vehicle Battery
VPWR	Negative terminal

Is the voltage greater than 10.5 V?

Yes	No

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Yes	No
For Continental 2.0L, Continental 2.7L, Continental 3.0L, EcoSport 1.0L, EcoSport 2.0L, Edge 2.0L, Edge 2.7L, Escape/Kuga 1.5L, Escape/Kuga 2.0L, Expedition, Explorer 2.3L, Explorer 3.5L GTDI, Explorer 3.5L, F-150 2.7L, F-150 3.5L, Fiesta 1.0L, Fiesta 1.6L GTDI, Flex 3.5L GTDI, Focus, Ford GT, Fusion 1.5L, Fusion 2.0L, Fusion 2.7L, MKC, MKT 2.0L, MKT 3.5L, MKX 2.0L, MKX 2.7L, MKZ, Mustang 2.3L, Navigator, Taurus 2.0L, Taurus 3.5L GTDI, and Transit 3.5L, GO to JF5. For all others, GO to JF6.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

JF5 CHECK THE SUSPECT COIL GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- Measure the resistance between:

(+) COP Connector, Harness Side	(-)
GND	Ground

Is the resistance less than 5 ohms?

Yes	No
GO to JF6.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

JF6 CHECK THE SUSPECT COIL DRIVER CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Suspect Coil Assembly connector disconnected.
- Measure the resistance between:

(+) PCM Connector, Harness Side (-)	COP Connector, Harness Side
COP	COP

Is the resistance less than 5 ohms?

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Yes	No
GO to JF7.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

JF7 CHECK THE SUSPECT COIL DRIVER CIRCUIT FOR A SHORT TO VOLTAGE

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

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

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to JF8.

JF8 CHECK THE SUSPECT COIL DRIVER CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure the resistance between:

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

Is the resistance greater than 10K ohms?

Yes	No

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Yes	No
For Continental 2.0L, Continental 2.7L, Continental 3.0L, EcoSport 1.0L, EcoSport 2.0L, Edge 2.0L, Edge 2.7L, Escape/Kuga 1.5L, Escape/Kuga 2.0L, Expedition, Explorer 2.3L, Explorer 3.5L GTDI, Explorer 3.5L, F-150 2.7L, F-150 3.5L, Fiesta 1.0L, Fiesta 1.6L GTDI, Flex 3.5L GTDI, Focus, Ford GT, Fusion 1.5L, Fusion 2.0L, Fusion 2.7L, MKC, MKT 2.0L, MKT 3.5L, MKX 2.0L, MKX 2.7L, MKZ, Mustang 2.3L, Navigator, Taurus 2.0L, Taurus 3.5L GTDI, and Transit 3.5L, GO to JF9. For all others, GO to JF10.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test. If the concern or DTC is still present, GO to JF9.

JF9 CHECK THE SUSPECT COIL FOR DAMAGE

NOTE: **A correctly operating ignition system only requires a spark when the spark gap is set to the 25-28 kV range.**

- PCM connector connected.
- Connect the Adjustable Ignition Spark Tester THX458 or equivalent to the suspect coil.
- Set the gap on the Adjustable Ignition Spark Tester THX458 or equivalent to 40 kV.
- Crank the engine 3 times.
- Set the gap on the Adjustable Ignition Spark Tester THX458 or equivalent to 25-28 kV.
- Monitor the spark tester.
- Crank the engine.

Is a spark present when the spark gap is set to 25-28 kV while cranking the engine?

Yes	No

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Yes	No
If necessary, INSTALL a new spark plug. REFER to the appropriate Engine Ignition article. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new coil. REFER to the appropriate Engine Ignition article. Clear the PCM DTCs. REPEAT the self-test. If the concern or DTC is still present, GO to JF10.

JF10 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.
- 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)**, Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS KC: FUEL PUMP CONTROL MODULE

INTRODUCTION

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 FUEL PRESSURE TEST KIT 310-D009 (D95L-7211A) OR EQUIVALENT.**
- **GRADUALLY OPEN THE TESTING KIT VALVE TO RELIEVE THE FUEL PRESSURE IN THE VEHICLE FUEL SYSTEM AND DRAIN THE FUEL INTO A SUITABLE CONTAINER OR RETURN IT TO THE FUEL TANK.**
- **TO AVOID UNNECESSARY FUEL SPILLAGE AND FIRE HAZARD, ANY TIME FUEL LINES ARE DISCONNECTED, THE IGNITION SWITCH MUST BE IN THE OFF POSITION UNLESS FUEL PUMP OPERATION IS REQUIRED FOR TEST PURPOSES.**

FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

WARNING: **BEFORE WORKING ON OR DISCONNECTING ANY OF THE FUEL TUBES OR FUEL SYSTEM COMPONENTS, RELIEVE THE FUEL SYSTEM PRESSURE TO PREVENT ACCIDENTAL SPRAYING OF FUEL. FUEL IN THE FUEL SYSTEM REMAINS UNDER HIGH PRESSURE, EVEN WHEN THE ENGINE IS NOT RUNNING. FAILURE TO FOLLOW THIS INSTRUCTION MAY RESULT IN SERIOUS PERSONAL INJURY.**

WARNING: **DO NOT SMOKE, CARRY LIGHTED TOBACCO OR HAVE AN OPEN FLAME OF ANY TYPE WHEN WORKING ON OR NEAR ANY FUEL-RELATED COMPONENT. HIGHLY FLAMMABLE MIXTURES ARE ALWAYS PRESENT AND MAY BE**

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IGNITED. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN SERIOUS PERSONAL INJURY.

WARNING: **DO NOT CARRY PERSONAL ELECTRONIC DEVICES SUCH AS CELL PHONES, PAGERS OR AUDIO EQUIPMENT OF ANY TYPE WHEN WORKING ON OR NEAR ANY FUEL-RELATED COMPONENT. HIGHLY FLAMMABLE MIXTURES ARE ALWAYS PRESENT AND MAY BE IGNITED. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN SERIOUS PERSONAL INJURY.**

WARNING: **WHEN HANDLING FUEL, ALWAYS OBSERVE FUEL HANDLING PRECAUTIONS AND BE PREPARED IN THE EVENT OF FUEL SPILLAGE. SPILLED FUEL MAY BE IGNITED BY HOT VEHICLE COMPONENTS OR OTHER IGNITION SOURCES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN SERIOUS PERSONAL INJURY.**

WARNING: **CLEAN ALL FUEL RESIDUE FROM THE ENGINE COMPARTMENT. IF NOT REMOVED, FUEL RESIDUE MAY IGNITE WHEN THE ENGINE IS RETURNED TO OPERATION. FAILURE TO FOLLOW THIS INSTRUCTION MAY RESULT IN SERIOUS PERSONAL INJURY.**

This pinpoint test is intended to diagnose the following:

- fuel pump (9H307)
- fuel pump control module (9D370)
- fuel pump control module 2 (9D370)
- fuel pump control module relay
- fuel pump control module relay 2
- inertia fuel shutoff (IFS) switch (9341)
- harness circuits: B+, GND, FP, FPC, FPGND, FPM, FPM2, FPPWR, FP2PWR, FPRTN, FP2RTN, IES, VPWR, and VPWR Fuel
- PCM (12A650)

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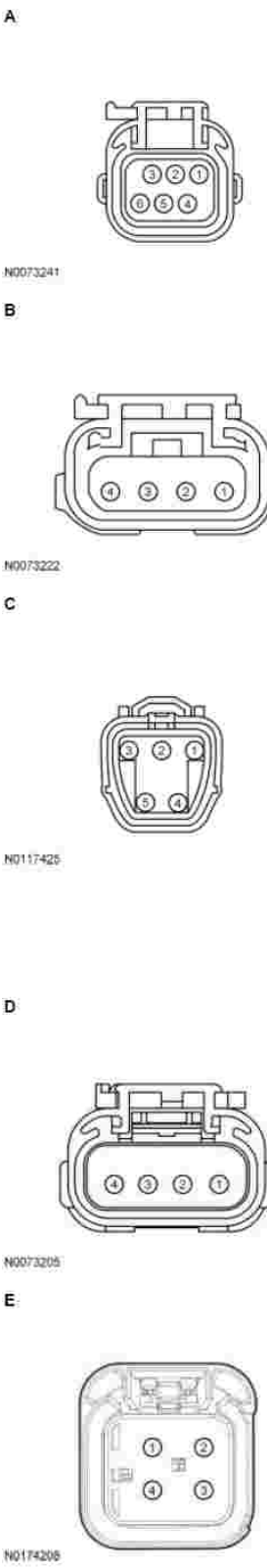

Fig. 141: Fuel Pump (FP) Assembly Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 3.0L, Focus 2.3L, Mustang 5.2L	A	6 3 1 4	FPRTN FPPWR FP2RTN FP2PWR
E-Series, Expedition, F-150, Mustang 2.3L, Mustang 5.0L, Navigator, Transit	B	3 4	FPRTN FPPWR

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Vehicle	Connector	Pin	Circuit
EcoSport 1.5L, EcoSport 1.0L Manual Transmission, KA	C	4 5	FPGND FPPWR
F-650/F-750, F-Series Super Duty, Motorhome/Stripped Chassis/Step Van	D	3 4	FPRTN FPPWR
Ford GT	E	1 4 3 2	FPRTN FPPWR FP2RTN FP2PWR
MKZ 3.0L	C	1 2 5 4	FPRTN FPPWR FP2RTN FP2PWR
All other vehicles	C	4 5	FPRTN FPPWR

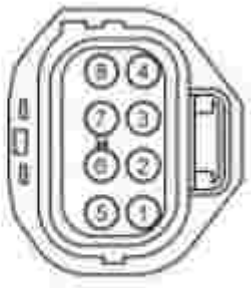

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Fig. 142: Fuel Pump Control Module Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
EcoSport 2.0L, EcoSport 1.0L Automatic Transmission, F-150, F-650/F-750, F-Series Super Duty, Focus, Ford GT, Fusion, MKC, MKZ, Motorhome/Stripped Chassis/Step Van, Mustang	A	8 5 7 3 4 1	FPRTN FPPWR FPM FPC GND VPWR Fuel
All other vehicles	A	6 8 5 7 3 4 1	ENS FPRTN FPPWR FPM FPC GND VPWR Fuel

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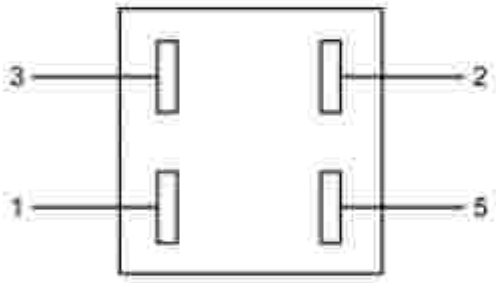
N0073034

Fig. 143: Fuel Pump Control 2 Module Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
8	FP2RTN (Fuel Pump 2 Return)
5	FP2PWR (Fuel Pump 2 Power)
7	FPM2 (Fuel Pump Monitor 2)
3	FPC (Fuel Pump Command)
4	GND (Ground)
1	VPWR Fuel

A



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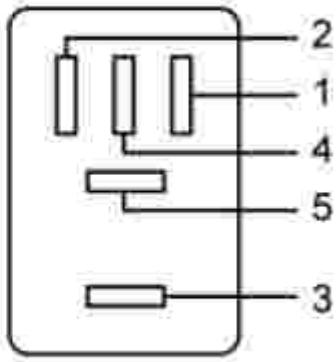
B



A0077584

Fig. 144: Fuel Pump Control Module Relay Connector
Courtesy of FORD MOTOR CO.

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Refer to the appropriate Wiring Diagrams article for schematic and connector information.

Vehicle	Connector	Pin	Circuit
Continental, Explorer, Fusion, MKZ, Taurus	A	1 2, 3 5	FP B+ VPWR Fuel
E-Series, Motorhome/Stripped Chassis/Step Van	B	2 1 3 5	GND VPWR B+ VPWR Fuel
Fiesta	A	2 1 3 5	GND VPWR B+ VPWR Fuel
KA	B	2 1, 3	FP B+
MKC, Mustang, Transit	B	2 1, 3 5	FP B+ VPWR Fuel
All other vehicles	A	2 1, 3 5	FP B+ VPWR Fuel

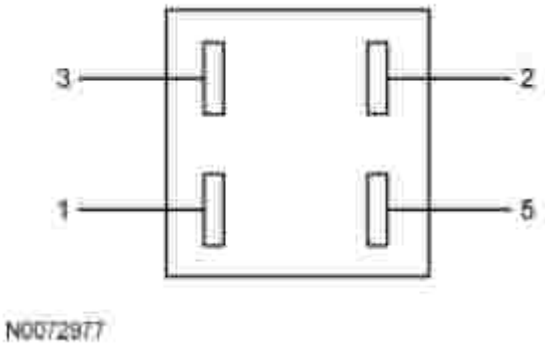

Fig. 145: Fuel Pump Control Module 2 Relay Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 3.0L, Ford GT, Mustang 5.2L	A	2 1, 3 5	FP B+ VPWR Fuel
Focus 2.3L	A	1 2 3 5	FP GND B+ VPWR Fuel

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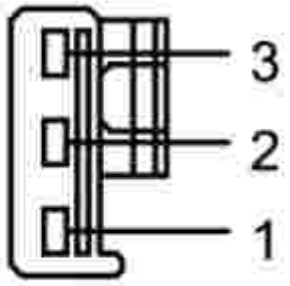

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Fig. 146: Inertia Fuel Shutoff (IFS) Switch Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	VPWR Fuel - B
2	VPWR Fuel - A

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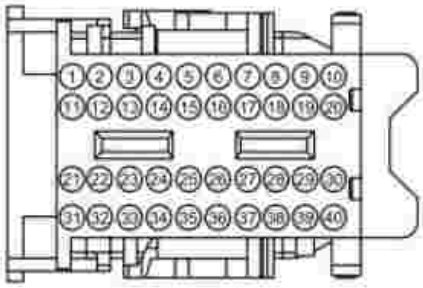
A



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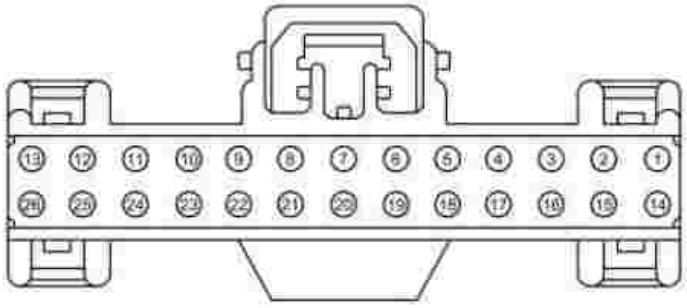
B



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C

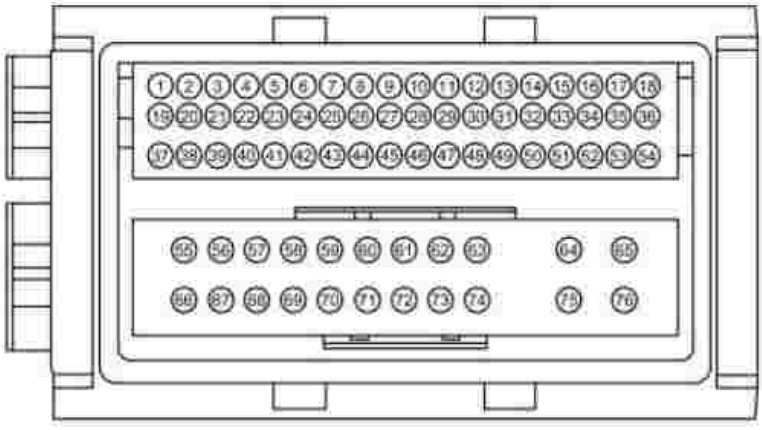

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Fig. 147: Body Control Module-C (BCM-C) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental, Edge, Fusion, MKZ	A	29 26	IES FP
KA	B	5 7	IES FP
Transit	C	12	FP
All other vehicles	A	26	FP

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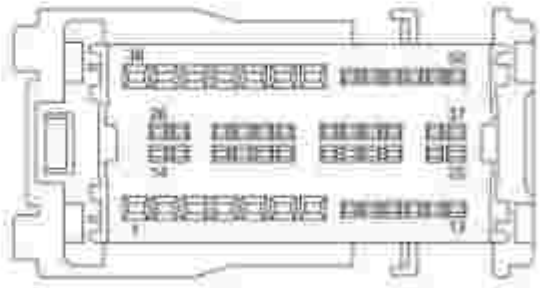
A



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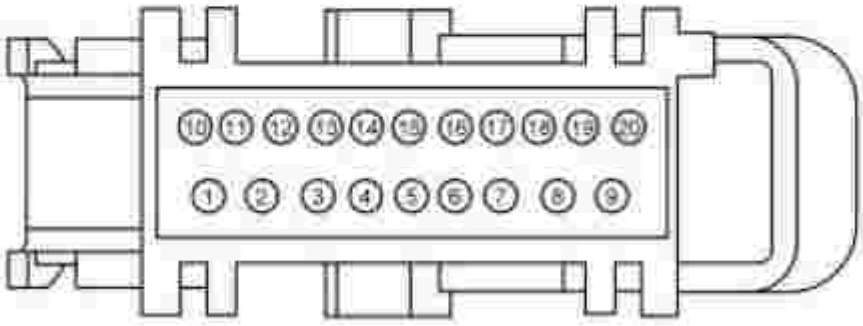
B



N0126528

Fig. 148: Body Control Module-E (BCM-E) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
EcoSport	A	11 24	IES FP
All other vehicles	B	9	VPWR Fuel

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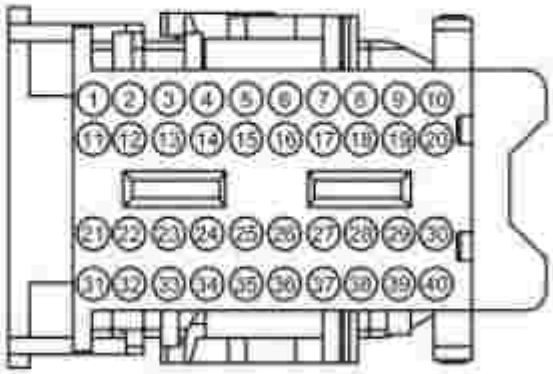
A



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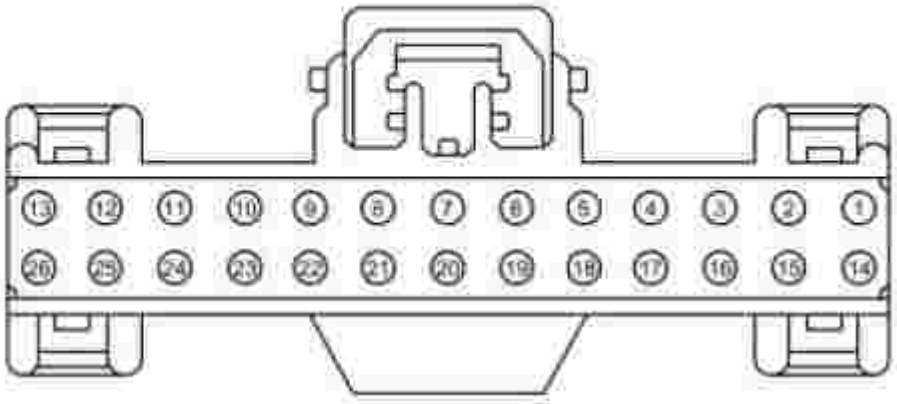

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Fig. 149: Body Control Module-F (BCM-F) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Explorer	A	29 49	IES FP
F-Series Super Duty, Ford GT, Mustang	A	29 26	IES FP
All other vehicles	B	6	FP

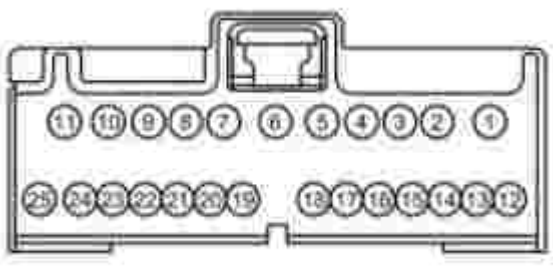

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Fig. 150: Battery Junction Box-A (BJB-A) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
24	FP (Fuel Pump)
25	VPWR Fuel

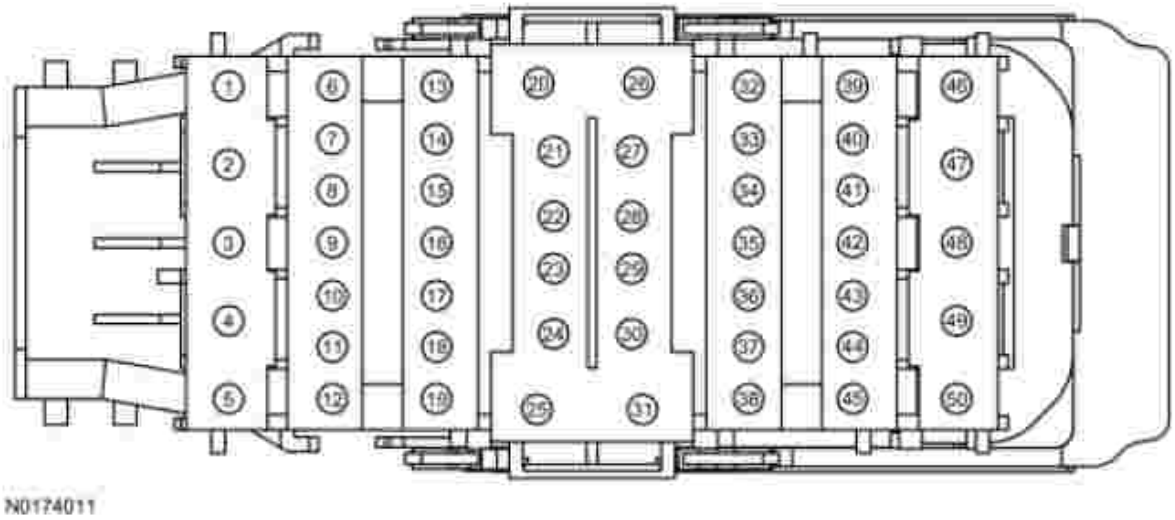

Fig. 151: Battery Junction Box-B (BJB-B) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
50	VPWR Fuel

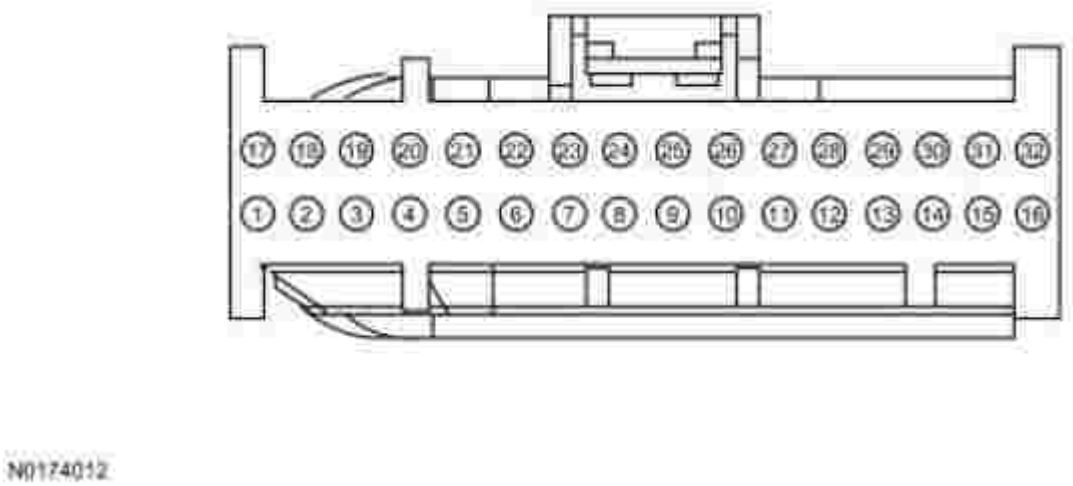

Fig. 152: Battery Junction Box-C (BJB-C) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	FPRPWR (Fuel Pump Relay Power)
3	FP (Fuel Pump)

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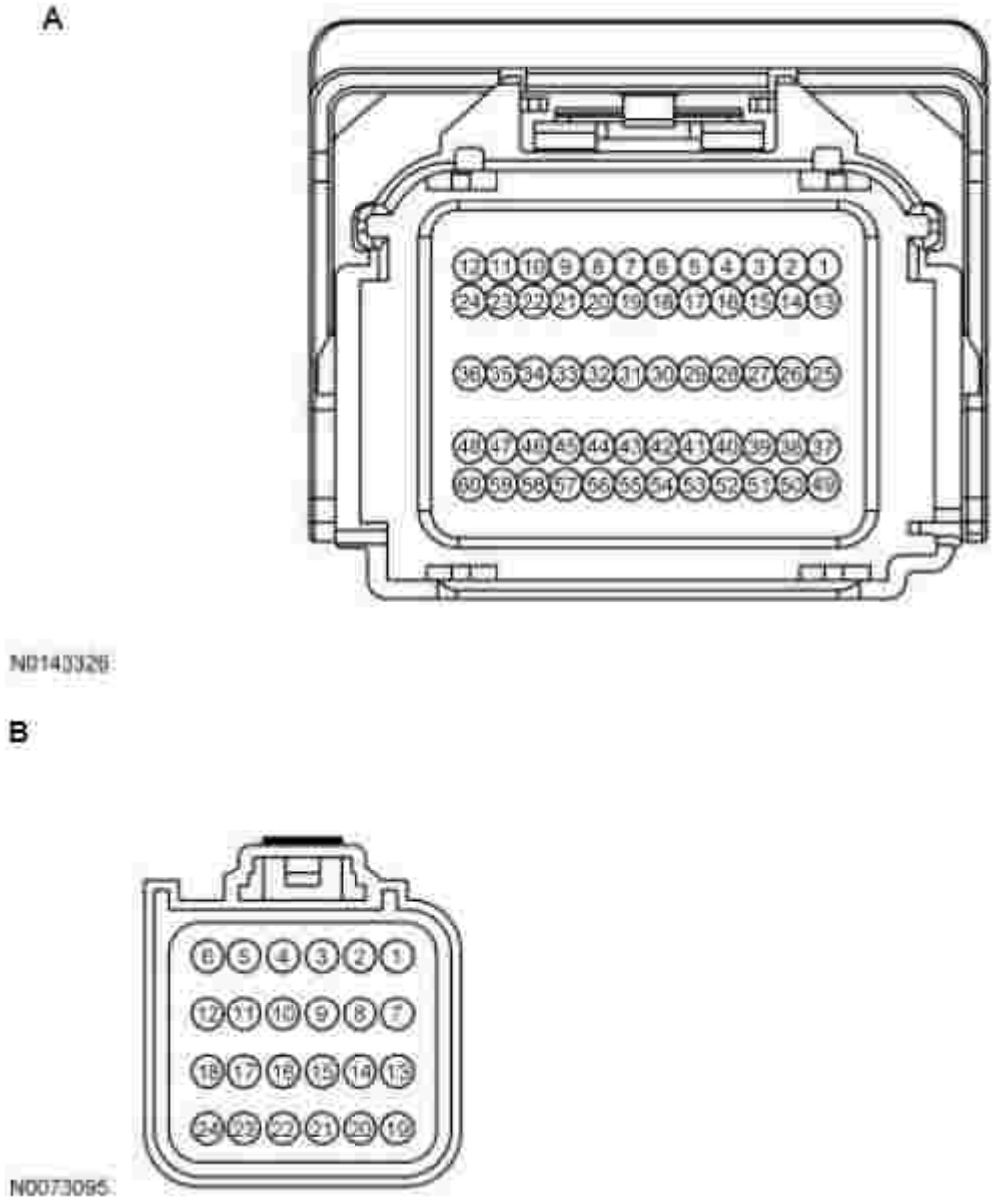

Fig. 153: Restraints Control Module (RCM) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Expedition, Explorer, Fiesta, Navigator, Taurus, Transit	A	42	ENS
All other vehicles	B	19	ENS

Powertrain Control Module (PCM) Connector

For PCM connector views or **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
Continental 2.0L, Continental 2.7L, EcoSport 1.0L Automatic Transmission, EcoSport 2.0L, Edge 2.0L, Edge 2.7L, Explorer 2.3L, Explorer GTDI 3.5L, Fusion 1.5L, Fusion 2.0L, Fusion 2.7L, MKZ 2.0L	198 PIN	B29 B27 B39	IES FPM FPC
Continental 3.0L, Ford GT, MKZ 3.0L	198 PIN	B29 B27 B85 B39	IES FPM FPM2 FPC
Continental 3.7L, Edge 3.5L, Explorer TiVCT 3.5L, Explorer 3.7L, F-Series Super Duty	198 PIN	B49 B27 B14	IES FPM FPC
E-Series, F-650/F-750, Flex TiVCT 3.5L, MKT 3.7L, MKX 3.7L, Motorhome/Stripped Chassis/Step Van, Taurus TiVCT 3.5L, Taurus 3.7L	198 PIN	B27 B14	FPM FPC
EcoSport 1.0L Manual Transmission	198 PIN	B29 B27	IES FPM
EcoSport 1.5L Automatic Transmission	198 PIN	B49 B27	IES FPM
EcoSport 1.5L Manual Transmission	112 PIN	B17 B48	IES FPM
Escape/Kuga 1.5L	198 PIN	B23 B6 B41	IES FPM FPC
Escape/Kuga 2.5L, Transit Connect	198 PIN	B27 B65	FPM FPC
Expedition, Navigator	198 PIN	B27 B67 B23	IES FPM FPC
F-150 2.7L, F-150 3.3L, F-150 5.0L	306 PIN	B37 B14 B29 B52 B3	IES FPRPWR FP FPM FPC
F-150 3.5L	198 PIN	B90 B24 B57 B67 B23	IES FPRPWR FP FPM FPC
Fiesta GTDI 1.6L	198 PIN	B4 B37	FPM FPC
Fiesta TiVCT 1.6L	128 PIN	E13 B37	FPM FPC

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Vehicle	Connector	Pin	Circuit
Focus GDI 2.0L	154 PIN	B12 B45	FPM FPC
Focus 2.3L	198 PIN	B27 B85 B39	FPM FPM2 FPC
Fusion 2.5L	198 PIN	B49 B27 B65	IES FPM FPC
KA	128 PIN	B17 B4	IES FPM
Mustang 2.3L	198 PIN	B29 B27 B58	IES FPM FPC
Mustang 5.0L	306 PIN	B27 B52 B3	IES FPM FPC
Mustang 5.2L	198 PIN	B49 B27 B31 B14	IES FPM FPM2 FPC
Ranger	128 PIN	B4 B34	IES FPM
All other vehicles	198 PIN	B27 B39	FPM FPC

TEST PROCEDURE

KC1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

Are DTCs P00BA, P00BB, P0148, P0231, P0232, P025A, P025B, P025C, P025D, P027B, P0627, P166A, P2632, U0109, U016C or U210B present?

Yes	No
For DTCs P0627 or P2632, GO to KC9. For DTC P166A, GO to KC37. For DTC U210B, GO to KC31. For DTCs P0231 or P0232, GO to KC18. For all others, GO to KC2.	For symptoms without DTCs, GO to KC2. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

KC2 CHECK THE VOLTAGE TO THE FUEL PUMP CONTROL MODULE

NOTE: **The Continental 3.0L, Focus 2.3L, Ford GT, MKZ 3.0L and Mustang 5.2L are equipped with two fuel pump control modules. Diagnose the fuel pump control module related to the current DTC.**

NOTE: **Verify the IFS switch is set (button pressed) (if equipped).**

- Ignition OFF.
- For DTCs P027B or U016C,
- Fuel Pump Control Module 2 Module connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Fuel Pump Control Module 2 Module Connector, Harness Side	(-)
VPWR Fuel - Pin 1	Ground

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- For all others,
- Fuel Pump Control Module connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Fuel Pump Control Module Connector, Harness Side	(-)
VPWR Fuel	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to KC3.	GO to KC7.

KC3 CHECK THE GND CIRCUIT FOR AN OPEN

- Ignition OFF.
- For DTCs P027B or U016C,
- Measure the resistance between:

(+) Fuel Pump Control Module 2 Module Connector, Harness Side	(-)
GND - Pin 4	Ground

- For all others,
- Measure the resistance between:

(+) Fuel Pump Control Module Connector, Harness Side	(-)
GND	Ground

Is the resistance less than 5 ohms?

Yes	No
GO to KC4.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KC4 CHECK THE FPC AND FPM CIRCUITS FOR AN OPEN

- PCM connector disconnected.
- For DTCs P027B or U016C,
- Measure the resistance between:

(+) Fuel Pump Control Module 2 Module Connector, Harness Side	(-) PCM Connector, Harness Side
FPC - Pin 3	FPC
FPM2 - Pin 7	FPM2

- For all others,
- Measure the resistance between:

(+) Fuel Pump Control Module Connector, Harness Side	(-) PCM Connector, Harness Side
FPC	FPC
FPM	FPM

Are the resistances less than 5 ohms?

Yes	No
GO to KC5.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KC5 CHECK THE FPC AND FPM CIRCUITS FOR A SHORT TO GROUND

- For DTCs P027B or U016C,

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- Measure the resistance between:

(+) Fuel Pump Control Module 2 Module Connector, Harness Side	(-)
FPC - Pin 3	Ground
FPM2 - Pin 7	Ground

- For all others,
- Measure the resistance between:

(+) Fuel Pump Control Module Connector, Harness Side	(-)
FPC	Ground
FPM	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to KC6.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KC6 CHECK THE FPC AND FPM CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For DTCs P027B or U016C,
- Measure the voltage between:

(+) Fuel Pump Control Module 2 Module Connector, Harness Side	(-)
FPC - Pin 3	Ground
FPM2 - Pin 7	Ground

- For all others,
- Measure the voltage between:

(+) Fuel Pump Control Module Connector, Harness Side	(-)
FPC	Ground
FPM	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new suspect Fuel Pump Control Module. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. Clear the PCM DTCs. REPEAT the self-test.

KC7 CHECK THE VPWR FUEL CIRCUIT FOR AN OPEN

- Ignition OFF.
- For DTCs P027B or U016C,
- Fuel Pump Control Module 2 Relay connector disconnected.
- Measure the resistance between:

(+) Fuel Pump Control Module 2 Module Connector, Harness Side	(-) Fuel Pump Control Module 2 Relay Connector, Harness Side
VPWR Fuel - Pin 1	VPWR Fuel

- For F-150,
- BJB-B connector disconnected.
- Measure the resistance between:

(+) Fuel Pump Control Module Connector, Harness Side	(-) BJB-B Connector, Harness Side

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(+) Fuel Pump Control Module Connector, Harness Side	(-) BJB-B Connector, Harness Side
VPWR Fuel	VPWR Fuel - Pin 50

- For F-Series Super Duty,
- BJB-A connector disconnected.
- Measure the resistance between:

(+) Fuel Pump Control Module Connector, Harness Side	(-) BJB-A Connector, Harness Side
VPWR Fuel	VPWR Fuel - Pin 25

- For Escape, Focus and Transit Connect,
- BCM-E connector disconnected.
- Measure the resistance between:

(+) Fuel Pump Control Module Connector, Harness Side	(-) BCM-E Connector, Harness Side
VPWR Fuel	VPWR Fuel

- For all others,
- Fuel Pump Control Module Relay connector disconnected.
- Measure the resistance between:

(+) Fuel Pump Control Module Connector, Harness Side	(-) Fuel Pump Control Module Relay Connector, Harness Side
VPWR Fuel	VPWR Fuel

Is the resistance less than 5 ohms?

Yes	No
For Focus 2.3L with DTCs P027B or U016C, GO to KC18. For F-150, and F-Series Super Duty, GO to KC8. For Escape/Kuga, Focus, and Transit Connect, GO to KC8. For all others, GO to KC18.	For Motorhome/Stripped Chassis/Step Van, GO to KC29. For all others, REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KC8 CHECK THE BODY CONTROL MODULE FOR CRASH STATUS PIDS

- BCM-C connector connected.
- BCM-E connector connected.
- BCM-F connector connected.
- Ignition ON, engine OFF.
- Access the BdyCM and monitor the CRASH (MODE) PID.

Is the PID state NO?

Yes	No
For DTCs P00BA, P00BB or P0148, the system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. Clear the PCM DTCs. REPEAT the self-test. For symptoms without DTCs, RETURN to **SYMPTOM CHARTS** for further direction. For F-150 and F-Series Super Duty, GO to KC22. For all others, FOLLOW the directions for the Guided Routine (BCM) in the Service Information DTC Chart to continue diagnosis. REFER to the appropriate Electronic Engine Controls article, Diagnosis and Testing. Clear the PCM DTCs. REPEAT the self-test.	RESET the PID. Clear the PCM DTCs. REPEAT the self-test.

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KC9 CHECK THE FPPWR CIRCUIT, FPRTN CIRCUIT, AND INTERNAL FUEL PUMP CIRCUIT RESISTANCE

NOTE: **The Continental 3.0L, Focus 2.3L, Ford GT, MKZ 3.0L and Mustang 5.2L are equipped with two fuel pump control modules. Diagnose the fuel pump control module related to the current DTC.**

- Ignition OFF.
- For DTC P2632,
- Measure the resistance between:

(+) Fuel Pump Control Module 2 Module Connector, Harness Side	(-) Fuel Pump Control Module 2 Module Connector, Harness Side
FP2PWR - Pin 5	FP2RTN - Pin 8

- For all others,
- Fuel Pump Control Module connector disconnected.
- Measure the resistance between:

(+) Fuel Pump Control Module Connector, Harness Side	(-) Fuel Pump Control Module Connector, Harness Side
FPPWR	FPRTN

Is the resistance less than 10 ohms?

Yes	No
GO to KC12.	GO to KC10.

KC10 CHECK THE FPPWR AND FPRTN CIRCUITS FOR AN OPEN

- FP Assembly connector disconnected.
- For DTC P2632,
- Measure the resistance between:

(+) Fuel Pump Control Module 2 Module Connector, Harness Side	(-) FP Assembly Connector, Harness Side
FP2PWR - Pin 5	FP2PWR
FP2RTN - Pin 8	FP2RTN

- For all others,
- Measure the resistance between:

(+) Fuel Pump Control Module Connector, Harness Side	(-) FP Assembly Connector, Harness Side
FPPWR	FPPWR
FPRTN	FPRTN

Are the resistances less than 5 ohms?

Yes	No
GO to KC11.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KC11 CHECK THE FP FOR AN OPEN

- For DTC P2632,
- Measure the resistance between:

(+) FP Assembly Connector, Component Side	(-) FP Assembly Connector, Component Side
FP2PWR	FP2RTN

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- For all others,
- Measure the resistance between:

(+) FP Assembly Connector, Component Side	(-) FP Assembly Connector, Component Side
FPPWR	FPRTN

Is the resistance less than 10 ohms?

Yes	No
GO to KC12.	INSTALL a new FP assembly. REFER to the appropriate Fuel Tank and Lines article. Clear the PCM DTCs. REPEAT the self-test.

KC12 CHECK THE FPPWR AND FPRTN CIRCUITS FOR A SHORT TO GROUND

- For DTC P2632,
- Measure the resistance between:

(+) Fuel Pump Control Module 2 Module Connector, Harness Side	(-)
FP2PWR - Pin 5	Ground
FP2RTN - Pin 8	Ground

- For all others,
- Measure the resistance between:

(+) Fuel Pump Control Module Connector, Harness Side	(-)
FPPWR	Ground
FPRTN	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to KC13.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KC13 CHECK FOR FPPWR AND FPRTN CIRCUITS SHORTED TOGETHER

- For DTC P2632,
- Measure the resistance between:

(+) FP Assembly Connector, Harness Side	(-) FP Assembly Connector, Harness Side
FP2PWR	FP2RTN

- For all others,
- Measure the resistance between:

(+) FP Assembly Connector, Harness Side	(-) FP Assembly Connector, Harness Side
FPPWR	FPRTN

Is the resistance greater than 10K ohms?

Yes	No
GO to KC14.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KC14 CHECK THE FPPWR AND FPRTN CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For DTC P2632,
- Measure the voltage between:

(+) Fuel Pump Control Module 2 Module Connector, Harness Side	(-)

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(+) Fuel Pump Control Module 2 Module Connector, Harness Side	(-)
FP2PWR - Pin 5	Ground
FP2RTN - Pin 8	Ground

- For all others,
- Measure the voltage between:

(+) Fuel Pump Control Module Connector, Harness Side	(-)
FPPWR	Ground
FPRTN	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to KC15.

KC15 INTERMITTENT CHECK

- Ignition OFF.
- For DTC P2632,
- Measure the resistance between:

(+) Fuel Pump Control Module 2 Module Connector, Harness Side	(-) FP Assembly Connector, Harness Side
FP2PWR - Pin 5	FP2PWR
FP2RTN - Pin 8	FP2RTN

- For all others,
- Measure the resistance between:

(+) Fuel Pump Control Module Connector, Harness Side	(-) FP Assembly Connector, Harness Side
FPPWR	FPPWR
FPRTN	FPRTN

- While monitoring the resistance measurement, wiggle, shake, and bend small sections of the wiring harness while working from the FP to the fuel pump control module.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to KC16.

KC16 CHECK THE FUEL PUMP CONTROL MODULE FOR CORRECT OPERATION

NOTE: **During output state control, the fuel pump stays commanded on for only about 5 seconds. Be aware that output state control turns the FP off after a calibrated time. If this happens, command the output ON to continue testing.**

- For DTC P2632,
- Fuel Pump Control Module 2 Module connector connected.
- Measure the voltage between:

(+) FP Assembly Connector, Harness Side	(-) FP Assembly Connector, Harness Side
FP2PWR	FP2RTN

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- For all others,
- Fuel Pump Control Module connector connected.
- Measure the voltage between:

(+) FP Assembly Connector, Harness Side	(-) FP Assembly Connector, Harness Side
FPPWR	FPRTN

- Ignition ON, engine OFF.
- Access the PCM and control the FP (MODE) PID.
- Command the FP PID ON.

Does the voltage increase with the PID commanded ON?

Yes	No
GO to KC17.	INSTALL a new suspect Fuel Pump Control Module. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. Clear the PCM DTCs. REPEAT the self-test.

KC17 CHECK THE FUEL PRESSURE

NOTE: Refer to the fuel system WARNING information at the beginning of this pinpoint test.

- Ignition OFF.
- FP Assembly connector connected.
- Relieve the fuel pressure. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure.
- Mechanical fuel pressure gauge connected.
- Ignition ON, engine OFF.
- Pressurize the fuel system. Refer to the appropriate Fuel System article for the Fuel System Pressure Release procedure to pressurize the fuel system.
- Cycle the ignition several times to charge the fuel system.

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

Yes	No
The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.	INSTALL a new FP assembly. REFER to the appropriate Fuel Tank and Lines article. Clear the PCM DTCs. REPEAT the self-test.

KC18 CHECK THE FUEL PUMP CONTROL MODULE RELAY FOR CORRECT OPERATION

NOTE: The Continental 3.0L, Focus 2.3L, Ford GT and Mustang 5.2L are equipped with two fuel pump control module relays. Diagnose the fuel pump control module relay related to the current DTC.

- Carry out the fuel pump control module relay component test. Refer to the appropriate Wiring Diagrams, Component Testing article.

Is a concern present?

Yes	No
INSTALL a new Fuel Pump Control Module relay. Clear the PCM DTCs. REPEAT the self-test.	GO to KC19.

KC19 CHECK THE B+ CIRCUITS FOR AN OPEN

- For DTCs P027B or U016C,
- Measure the voltage between:

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(+) Fuel Pump Control Module 2 Relay Connector, Harness Side	(-)
B+	Ground

- For all others,
- Measure the voltage between:

(+) Fuel Pump Control Module Relay Connector, Harness Side	(-)
B+	Ground

Is the voltage greater than 10.5 V?

Yes	No
For E-Series, Fiesta, and Motorhome/Stripped Chassis/Step Van, GO to KC20. For Focus 2.3L, GO to KC21. For all others, GO to KC22.	A B+ circuit concern is present. 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.

KC20 CHECK THE VPWR VOLTAGE TO THE FUEL PUMP CONTROL MODULE RELAY

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

(+) Fuel Pump Control Module Relay Connector, Harness Side	(-)
VPWR	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to KC21.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KC21 CHECK THE FUEL PUMP CONTROL MODULE RELAY GROUND CIRCUIT FOR AN OPEN

- Ignition OFF.
- For Focus 2.3L,
- Measure the resistance between:

(+) Fuel Pump Control Module 2 Relay Connector, Harness Side	(-)
GND	Ground

- For all others,
- Measure the resistance between:

(+) Fuel Pump Control Module Relay Connector, Harness Side	(-)
GND	Ground

Is the resistance less than 5 ohms?

Yes	No
For Focus 2.3L, GO to KC22. For all others, The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KC22 CHECK THE CIRCUITS FOR AN OPEN

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- Ignition OFF.
- For Focus 2.3L with DTCs P027B or U016C,
- BCM-E connector disconnected.
- Measure the resistance between:

(+) Fuel Pump Control Module 2 Relay Connector, Harness Side	(-) BCM-E Connector, Harness Side
FP	VPWR

- For Ford GT and Mustang 5.2L with DTCs P027B or U016C,
- BCM-F connector disconnected.
- Measure the resistance between:

(+) Fuel Pump Control Module 2 Relay Connector, Harness Side	(-) BCM-F Connector, Harness Side
FP	FP

- For Continental 3.0L with DTCs P027B or U016C,
- BCM-C connector disconnected.
- Measure the resistance between:

(+) Fuel Pump Control Module 2 Relay Connector, Harness Side	(-) BCM-C Connector, Harness Side
FP	FP

- For EcoSport 1.0L Manual Transmission and EcoSport 1.5L,
- BCM-E connector disconnected.
- Measure the resistance between:

(+) FP Relay Connector, Harness Side	(-) BCM-E Connector, Harness Side
FP	FP

- For EcoSport 1.0L Automatic Transmission and EcoSport 2.0L,
- BCM-E connector disconnected.
- Measure the resistance between:

(+) Fuel Pump Control Module Relay Connector, Harness Side	(-) BCM-E Connector, Harness Side
FP	FP

- For Continental, Edge, Fusion, KA, MKZ and Transit,
- BCM-C connector disconnected.
- Measure the resistance between:

(+) Fuel Pump Control Module Relay Connector, Harness Side	(-) BCM-C Connector, Harness Side
FP	FP

- For F-150,
- BJB-C connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) BJB-C Connector, Harness Side	(-) PCM Connector, Harness Side
FP - Pin 3	FP

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(+) BJB-C Connector, Harness Side	(-) PCM Connector, Harness Side
FPRPWR - Pin 2	FPRPWR

- For F-Series Super Duty,
- BCM-F connector disconnected.
- BJB-A connector disconnected.
- Measure the resistance between:

(+) BCM-F Connector, Harness Side	(-) BJB-A Connector, Harness Side
FP	FP - Pin 24

- For all others,
- BCM-F connector disconnected.
- Measure the resistance between:

(+) Fuel Pump Control Module Relay Connector, Harness Side	(-) BCM-F Connector, Harness Side
FP	FP

Are the resistances less than 5 ohms?

Yes	No
For symptoms without DTCs, RETURN to **SYMPTOM CHARTS** for further direction. For F-150, GO to KC23. For EcoSport 1.0L Manual Transmission, EcoSport 1.5L, and KA, GO to KC25. For DTCs P00BA, P00BB or P0148, the system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. Clear the PCM DTCs. REPEAT the self-test. For all others, FOLLOW the directions for the Guided Routine (BCM) in the Service Information article DTC Chart to continue diagnosis. REFER to the appropriate Electronic Engine Controls article, Diagnosis and Testing. Clear the PCM DTCs. REPEAT the self-test.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KC23 CHECK THE FP AND FPRPWR CIRCUITS

- Measure the resistance between:

(+) BJB-C Connector, Harness Side	(-)
FP - Pin 3	Ground
FPRPWR - Pin 2	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to KC24.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KC24 CHECK THE FP AND FPRPWR CIRCUITS FOR A SHORT

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

(+) BJB-C Connector, Harness Side	(-)
FP - Pin 3	Ground
FPRPWR - Pin 2	Ground

Is any voltage present?

Yes	No

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Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new BJB. Clear the PCM DTCs. REPEAT the self-test.

KC25 CHECK THE PUMP CIRCUITS FOR AN OPEN

- Ignition OFF.
- FP Assembly connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) FP Relay Connector, Harness Side	(-) FP Assembly Connector, Harness Side
FPPWR	FPPWR

- Measure the resistance between:

(+) FP Relay Connector, Harness Side	(-) PCM Connector, Harness Side
FPPWR	FPM

- Measure the resistance between:

(+) FP Assembly Connector, Harness Side	(-)
FPGND	Ground

Are the resistances less than 5 ohms?

Yes	No
GO to KC26.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KC26 CHECK THE INTERNAL RESISTANCE OF THE FUEL PUMP

- Measure the resistance between:

(+) FP Assembly Connector, Component Side	(-) FP Assembly Connector, Component Side
FPPWR	FPGND

Is the resistance less than 10 ohms?

Yes	No
GO to KC27.	INSTALL a new FP assembly. REFER to the appropriate Fuel Tank and Lines article. Clear the PCM DTCs. REPEAT the self-test.

KC27 CHECK THE FPM AND FPPWR CIRCUITS FOR A SHORT TO VOLTAGE

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

(+) FP Relay Connector, Harness Side	(-)
FPPWR	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to KC28.

KC28 CHECK FOR CORRECT FP OPERATION

- Ignition OFF.
- PCM connector connected.
- FP Relay connector connected.

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- FP Assembly connector connected.
- Ignition ON, engine OFF.
- For EcoSport,
- Connect a 5 amp fused jumper wire between the following:

Point A BCM-E Connector, Harness Side	Point B
FP	Ground

- For all others,
- Connect a 5 amp fused jumper wire between the following:

Point A BCM-C Connector, Harness Side	Point B
FP	Ground

- Listen for the sound of the fuel pump operating which can be heard from outside the vehicle.

Is the fuel pump running?

Yes	No
FOLLOW the directions for the Guided Routine (BCM) in the Service Information article DTC Chart to continue diagnosis. REFER to the appropriate Electronic Engine Controls article, Diagnosis and Testing. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new FP assembly. Clear the PCM DTCs. REPEAT the self-test.

KC29 ISOLATE THE OPEN IN THE VPWR FUEL CIRCUIT

- IFS Switch connector disconnected.
- Measure the resistance between:

(+) Fuel Pump Control Module Relay Connector, Harness Side	(-) IFS Switch Connector, Harness Side
VPWR Fuel	VPWR Fuel - A - Pin 2

Is the resistance less than 5 ohms?

Yes	No
GO to KC30.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KC30 CHECK THE VPWR FUEL CIRCUIT FOR AN OPEN BETWEEN THE IFS SWITCH AND FUEL PUMP CONTROL MODULE

- Measure the resistance between:

(+) IFS Switch Connector, Harness Side	(-) Fuel Pump Control Module Connector, Harness Side
VPWR Fuel - B - Pin 1	VPWR Fuel

Is the resistance less than 5 ohms?

Yes	No
INSTALL a new IFS switch. REFER to the appropriate Fuel Tank and Lines article. Clear the PCM DTCs. REPEAT the self-test.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KC31 CHECK FOR RESTRAINTS CONTROL MODULE (RCM) DTCS

- Carry out the RCM self-test.

Are any RCM DTCs present?

Yes	No

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Yes	No
DIAGNOSE the supplemental restraint system concern. REFER to the appropriate Supplemental Restraint System article. Clear the PCM DTCs. REPEAT the self-test.	GO to KC32.

KC32 INSPECT THE HARNESS BETWEEN THE FUEL PUMP CONTROL MODULE AND RESTRAINTS CONTROL MODULE (RCM)

- Ignition OFF.
- Check the harness for the following:
- damage
- corrosion
- correct routing

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to KC33.

KC33 CHECK THE ENS CIRCUIT FOR AN OPEN

NOTE: **Refer to the warnings in appropriate Supplemental Restraint System article.**

- Depower the supplemental restraint system (SRS). Refer to the appropriate Supplemental Restraint System article for the Supplemental Restraint System (SRS) Depowering and Repowering procedure.
- Ignition OFF.
- RCM connector disconnected.
- Connect the battery ground cable.
- For Transit,
- BCM-C connector disconnected.
- Fuel Pump Control Module connector disconnected.
- For all others,
- Fuel Pump Control Module connector disconnected.
- Measure the resistance between:

(+) Fuel Pump Control Module Connector, Harness Side	(-) RCM Connector, Harness Side
ENS	ENS

Is the resistance less than 5 ohms?

Yes	No
GO to KC34.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KC34 CHECK THE ENS CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

(+) Fuel Pump Control Module Connector, Harness Side	(-)
ENS	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to KC35.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KC35 CHECK THE ENS CIRCUIT FOR VOLTAGE

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

(+) Fuel Pump Control Module Connector, Harness Side	(-)
ENS	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to KC36.

KC36 CHECK THE ENS CIRCUIT FOR CORRECT RESPONSE

- Ignition OFF.
- Fuel Pump Control Module connector connected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) RCM Connector, Harness Side	(-)
ENS	Ground

Is the voltage greater than 10.5 V?

Yes	No
INSTALL a new RCM. REFER to the appropriate Supplemental Restraint System article. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new Fuel Pump Control Module. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. Clear the PCM DTCs. REPEAT the self-test.

KC37 CHECK THE IES CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- For EcoSport,
- BCM-E connector disconnected.
- Measure the resistance between:

(+) BCM-E Connector, Harness Side	(-) PCM Connector, Harness Side
IES	IES

- For Explorer, F-150, F-Series Super Duty, Ford GT, and Mustang,
- BCM-F connector disconnected.
- Measure the resistance between:

(+) BCM-F Connector, Harness Side	(-) PCM Connector, Harness Side
IES	IES

- For all others,
- BCM-C connector disconnected.
- Measure the resistance between:

(+) BCM-C Connector, Harness Side	(-) PCM Connector, Harness Side
IES	IES

Is the resistance less than 5 ohms?

Yes	No

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Yes	No
GO to KC38.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KC38 CHECK THE IES CIRCUIT FOR A SHORT TO GROUND

- For EcoSport,
- Measure the resistance between:

(+) BCM-E Connector, Harness Side	(-)
IES	Ground

- For Explorer, F-150, F-Series Super Duty, Ford GT, and Mustang,
- Measure the resistance between:

(+) BCM-F Connector, Harness Side	(-)
IES	Ground

- For all others,
- Measure the resistance between:

(+) BCM-C Connector, Harness Side	(-)
IES	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to KC39.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KC39 CHECK THE IES FOR A SHORT TO VOLTAGE

- For EcoSport,
- Measure the voltage between:

(+) BCM-E Connector, Harness Side	(-)
IES	Ground

- For Explorer, F-150, F-Series Super Duty, Ford GT, and Mustang,
- Measure the voltage between:

(+) BCM-F Connector, Harness Side	(-)
IES	Ground

- For all others,
- Measure the voltage between:

(+) BCM-C Connector, Harness Side	(-)
IES	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	FOLLOW the directions for the Guided Routine (BCM) in the Service Information article DTC Chart to continue diagnosis. REFER to the appropriate Electronic Engine Controls article, Diagnosis and Testing. Clear the PCM DTCs. REPEAT the self-test.

PINPOINT TESTS KD: ELECTRIC EXHAUST GAS RECIRCULATION (EGR)

INTRODUCTION

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This pinpoint test is intended to diagnose the following:

- electric EGR stepper motor (9D475)
- harness circuits: EGRMC1, EGRMC2, EGRMC3, EGRMC4, EGRVCH, EGRVCL, EGRVP, SIGRTN, VPWR and VREF
- PCM (12A650)

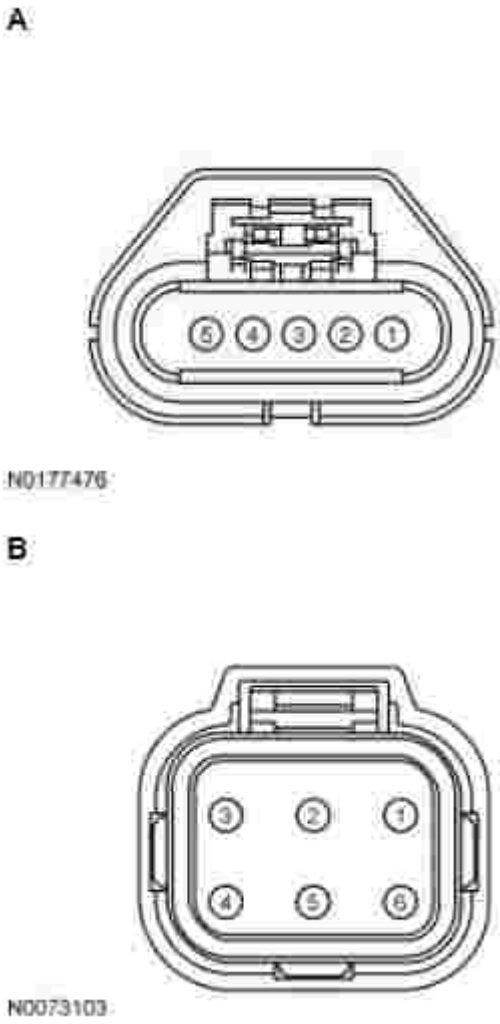

Fig. 154: Electric Exhaust Gas Recirculation (EEGR) Assembly Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
F-150 2.7L	A	2 1 3 4 5	EGRVP SIGRTN VREF EGRVCL EGRVCH
F-150 3.3L	A	4 5 3 1 2	EGRVP SIGRTN VREF EGRVCL EGRVCH
All other vehicles	B	6 4 3 1 5 2	EGRMC4 EGRMC3 EGRMC2 EGRMC1 VPWR VPWR

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

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Vehicle	Connector	Pin	Circuit
F-150	306 PIN	E49 E19 E40	EGRVP EGRVCL EGRVCH
All other vehicles	198 PIN	E31 E46 E47 E48	EGRMC4 EGRMC3 EGRMC2 EGRMC1

TEST PROCEDURE

KD1 CHECK FOR DTCS

Are DTCs P0400, P0403, P0405, P0406, P042E, P042F, P046D, P04FA or P1408 present?

Yes	No
For F-150 with DTC P1408, GO to KD10. For all others with DTC P1408, GO to KD9. For DTCs P0405, P0406 or P046D, GO to KD11. For all others, GO to KD2.	For symptoms without DTCs, GO to KD2. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

KD2 CHECK THE EEGR CONNECTOR

NOTE: **If the DTC is intermittent, wiggle the harness and connectors when taking measurements.**

- Check the connection of the EEGR connector.

Are the connector contacts clean and correctly seated?

Yes	No
For F-150, GO to KD4. For all others, GO to KD3.	REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.

KD3 CHECK THE EGR CIRCUITS FOR AN OPEN

- Ignition ON, engine OFF.
- EEGR Assembly connector disconnected.
- Measure the voltage between:

(+) EEGR Assembly Connector, Harness Side	(-) Vehicle Battery
VPWR	Negative terminal
VPWR	Negative terminal

Are the voltages greater than 10.5 V?

Yes	No
GO to KD4.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KD4 CHECK THE EGR CIRCUITS FOR AN OPEN

- Ignition OFF.
- EEGR Assembly connector disconnected.
- PCM connector disconnected.
- For F-150,
- Measure the resistance between:

(+) EEGR Assembly Connector, Harness Side	(-) PCM Connector, Harness Side

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(+) EEGR Assembly Connector, Harness Side	(-) PCM Connector, Harness Side
EGRVCH	EGRVCH
EGRVCL	EGRVCL

- For all others,
- Measure the resistance between:

(+) EEGR Assembly Connector, Harness Side	(-) PCM Connector, Harness Side
EGRMC1	EGRMC1
EGRMC2	EGRMC2
EGRMC3	EGRMC3
EGRMC4	EGRMC4

Are the resistances less than 5 ohms?

Yes	No
GO to KD5.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KD5 CHECK THE EGR CIRCUITS FOR A SHORT TO GROUND

- For F-150,
- Measure the resistance between:

(+) EEGR Assembly Connector, Harness Side	(-) Vehicle Battery
EGRVCH	Negative terminal
EGRVCL	Negative terminal

- For all others,
- Measure the resistance between:

(+) EEGR Assembly Connector, Harness Side	(-) Vehicle Battery
EGRMC1	Negative terminal
EGRMC2	Negative terminal
EGRMC3	Negative terminal
EGRMC4	Negative terminal

Are the resistances greater than 10K ohms?

Yes	No
GO to KD6.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KD6 CHECK FOR A SHORT BETWEEN EGR CIRCUITS

NOTE: **Refer to the PCM connector pin numbers in the beginning of this pinpoint test.**

- For F-150,
- Measure the resistance between:

(+) EEGR Assembly Connector, Harness Side	(-) EEGR Assembly Connector, Harness Side
EGRVCH	EGRVCL

- For all others,
- Measure the resistance between:

(+) EEGR Assembly Connector, Harness Side	(-) EEGR Assembly Connector, Harness Side
EGRMC3	EGRMC1

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(+) EEGR Assembly Connector, Harness Side	(-) EEGR Assembly Connector, Harness Side
EGRMC3	EGRMC2
EGRMC3	EGRMC4
EGRMC1	EGRMC2
EGRMC1	EGRMC4
EGRMC2	EGRMC4

Are the resistances greater than 10K ohms?

Yes	No
GO to KD7.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KD7 CHECK THE EGR CIRCUITS FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For F-150,
- Measure the voltage between:

(+) EEGR Assembly Connector, Harness Side	(-) Vehicle Battery
EGRVCH	Negative terminal
EGRVCL	Negative terminal

- For all others,
- Measure the voltage between:

(+) EEGR Assembly Connector, Harness Side	(-) Vehicle Battery
EGRMC1	Negative terminal
EGRMC2	Negative terminal
EGRMC3	Negative terminal
EGRMC4	Negative terminal

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to KD8.

KD8 CHECK THE EGR COILS FOR AN OPEN

- Ignition OFF.
- For F-150,
- Measure the resistance between:

(+) EEGR Assembly Connector, Component Side	(-) EEGR Assembly Connector, Component Side
EGRVCH	EGRVCL

- For all others,
- Measure the resistance between:

(+) EEGR Assembly Connector, Component Side	(-) EEGR Assembly Connector, Component Side
EGRMC1	VPWR
EGRMC2	VPWR
EGRMC3	VPWR
EGRMC4	VPWR

Are the resistances between 2.4 - 2.8 ohms (F-150) or between 12 - 24 ohms (all others)?

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Yes	No
GO to KD15.	INSTALL a new EEGR assembly. REFER to the appropriate Engine Emission Control article. Clear the PCM DTCs. REPEAT the self-test.

KD9 CHECK THE MAP SENSOR OPERATION

- Ignition ON, engine OFF.
- Access the PCM and monitor the MAP (PRESS) PID.
- Record the MAP PID value.
- Ignition ON, engine running.
- Record the MAP PID value.

Is the MAP PID value higher than 69 kPa (10 psi) with the ignition ON, engine OFF and lower than 69 kPa (10 psi) with the ignition ON, engine RUNNING?

Yes	No
The concern is not present at this time. Make sure the MAP sensor is correctly seated and the vacuum source is not blocked. Clear the PCM DTCs. REPEAT the self-test.	GO to KD10.

KD10 CARRY OUT THE KOER SELF-TEST

- Carry out the PCM KOER self-test.

Is DTC P1408 retrieved again?

Yes	No
GO to **PINPOINT TEST Z**.	REFER to **NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** , to continue diagnosis.

KD11 CHECK THE VREF AND SIGRTN CIRCUITS FOR AN OPEN

- Ignition OFF.
- EEGR Assembly connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) EEGR Assembly Connector, Harness Side	(-) EEGR Assembly Connector, Harness Side
VREF	SIGRTN

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to KD12.	GO to **PINPOINT TEST C**.

KD12 CHECK THE EGRVP CIRCUIT FOR AN OPEN

- PCM connector disconnected.
- Measure the resistance between:

(+) EEGR Assembly Connector, Harness Side	(-) PCM Connector, Harness Side
EGRVP	EGRVP

Is the resistance less than 5 ohms?

Yes	No
GO to KD13.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KD13 CHECK THE EGRVP CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.

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- Measure the resistance between:

(+) EEGR Assembly Connector, Harness Side	(-)
EGRVP	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to KD14.	REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.

KD14 CHECK THE EGRVP CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) EEGR Assembly Connector, Harness Side	(-)
EGRVP	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. CLEAR the DTCs. REPEAT the self-test.	GO to KD15.

KD15 CHECK FOR CORRECT OPERATION

- EEGR Assembly connector disconnected.
- Carry out the PCM self-test.
- Verify the concern is still present.

Is the concern still present?

Yes	No
INSTALL a new EEGR assembly. REFER to the appropriate Engine Emission Control article. Clear the PCM DTCs. REPEAT the self-test.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS KF: FAN CONTROL RELAYS

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- CAC fan relay
- fan control (FC1, FC2, FC3, FC4, FC5) relays
- harness circuits: CACCF, FGC, LFC, MFC, HFC and VPWR
- PCM (12A650)

Although the PCM output circuits are called LFC, MFC, and HFC, cooling fan operation is controlled by a combination of these outputs.

Cooling Fan State

Â	PCM Output	Low Speed	Medium Speed	High Speed
Vehicles With 5 Fan Control Relays	LFC	ON	ON	ON
Â	MFC	OFF	ON	ON
Â	HFC	OFF	OFF	ON
All Others	LFC	ON	N/A	ON
Â	HFC	OFF	N/A	ON

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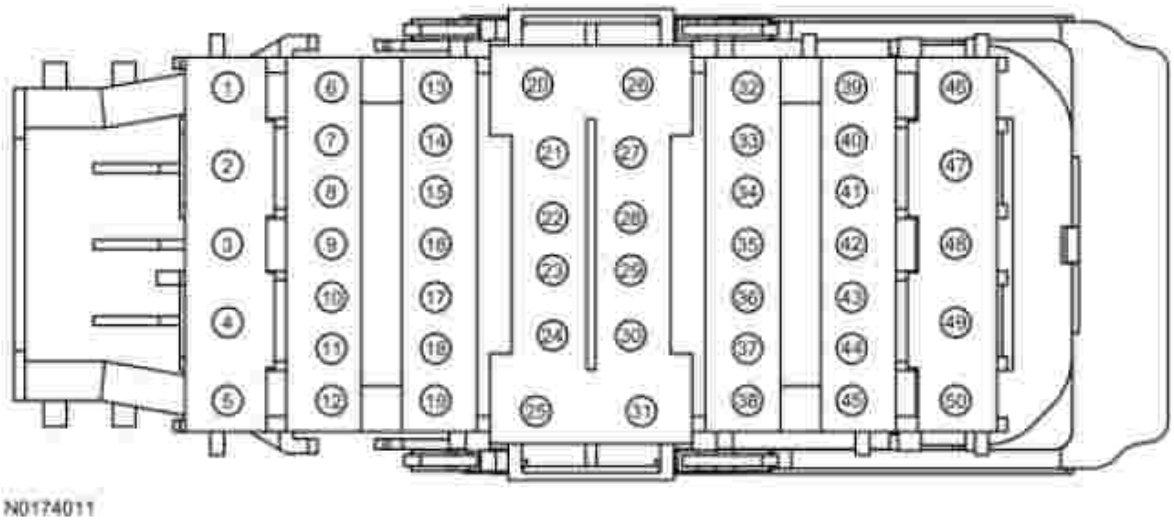

Fig. 155: Battery Junction Box-B (BJB-B) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
47	GND (Ground)
2, 26	FANPWR (Fan Power)

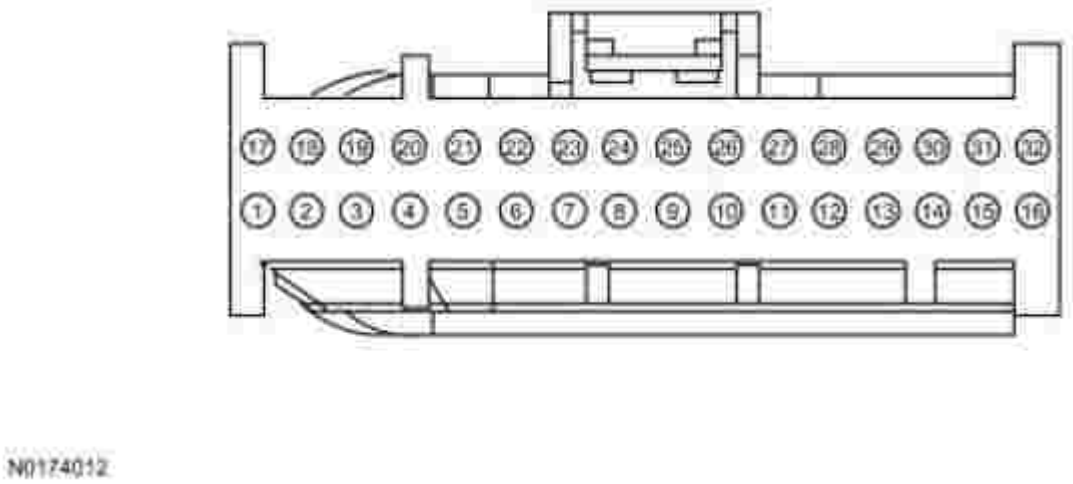

Fig. 156: Battery Junction Box-C (BJB-C) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
6	HFC (High Fan Control)
10	LFC (Low Fan Control)
19	CACCF (Charge Air Cooler Cooling Fan)

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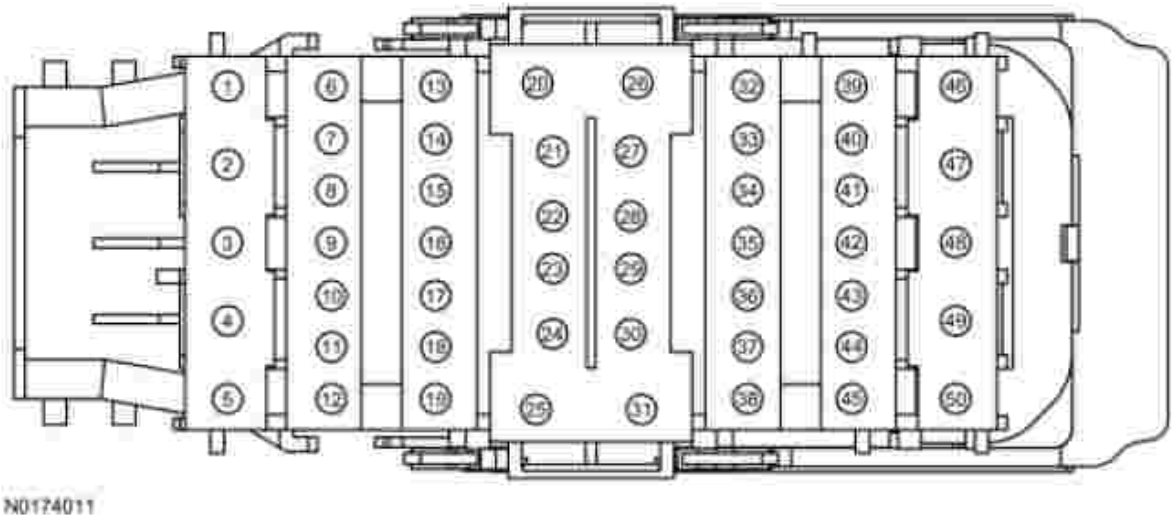

Fig. 157: Battery Junction Box-D (BJB-D) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
47	FANPWR (Fan Power)

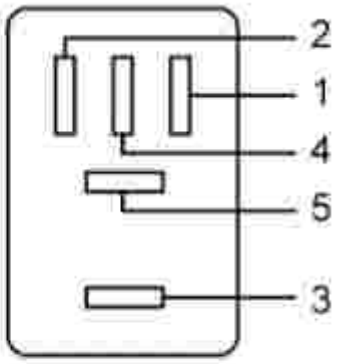

Fig. 158: Charge Air Cooler Cooling Fan Relay Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Ford GT	A	5 1 3 2	FANPWR CACCF B+ VPWR
All other vehicles	A	5 2 3 1	FANPWR CACCF B+ VPWR

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Fig. 159: Charge Air Cooler Cooling Fan Motor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	GND (Ground)
1	FANPWR (Fan Power)

Fig. 160: Charge Air Cooler Cooling Fan 2 Motor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	GND (Ground)
1	FANPWR (Fan Power)

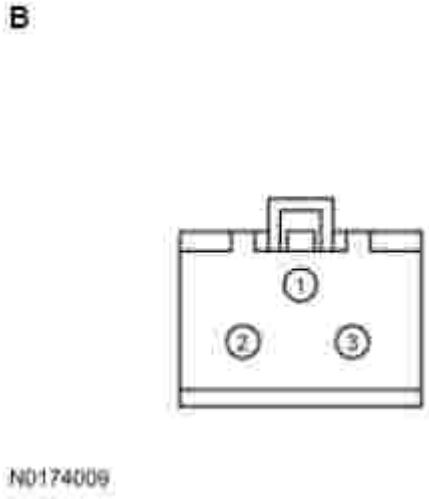

Fig. 161: Cooling Fan Motor 1 Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
EcoSport, Fiesta, Fusion, KA	A	1 2	GND FANPWR
Ranger	B	1 3 2	GND FANPWR FANPWR
All other vehicles	A	2 1	FC FANPWR

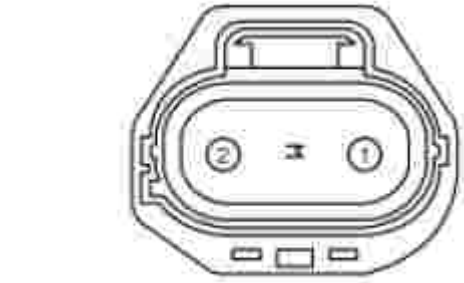

Fig. 162: Cooling Fan Motor 2 Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	GND (Ground)
1	FANPWR (Fan Power)

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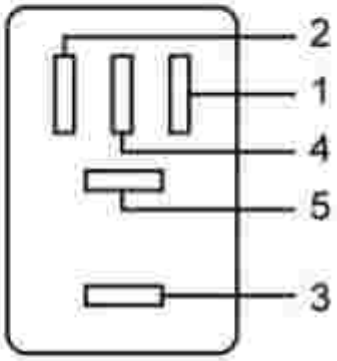
A



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B

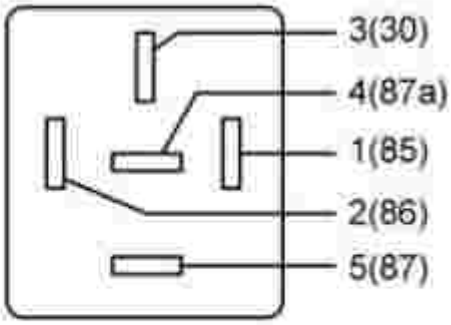

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Fig. 163: Fan Control 1 (FC1) Relay Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental, EcoSport, Edge, Explorer, Fiesta, Flex, KA, MKT, MKX	A	5 2 3 1	FANPWR LFC B+ VPWR
Escape/Kuga, Focus, MKC, Transit	B	5 2 3 1	FANPWR LFC B+ VPWR

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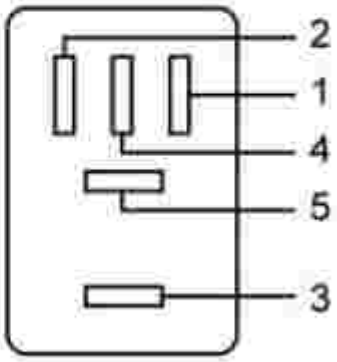
Vehicle	Connector	Pin	Circuit
Fusion, MKZ, Mustang, Taurus	A	5 1 3 2	FANPWR LFC B+ VPWR
Ranger	A	3 1 2, 5	FANPWR LFC B+

A



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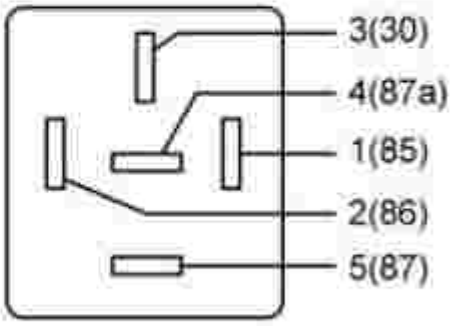

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Fig. 164: Fan Control 2 (FC2) Relay Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental, Edge, Explorer	A	5 3 4 2 1	GND FGC FANPWR HFC VPWR

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Vehicle	Connector	Pin	Circuit
EcoSport, Escape/Kuga 1.5L, Escape/Kuga 2.0L With 3 Fan Relays, Fiesta	B	5 2 1	FANPWR HFC VPWR
Escape/Kuga 2.0L With 5 Fan Relays	B	4 5 2 1	FANRSTR1 FANPWR MFC VPWR
Flex, MKC With 3 Fan Relays, MKT	B	5 3 4 2 1	GND FGC FANPWR HFC VPWR
Focus With 5 Fan Relays	B	4 5 2 1, 3	FANRSTR1 FANPWR MFC VPWR
Fusion, MKZ, Mustang, Taurus	A	5 3 4 1 2	GND FGC FANPWR HFC VPWR
MKC With 5 Fan Relays	B	4 3 5 2 1	FANRSTR1 FGC FANPWR MFC VPWR
Ranger	A	5 2	FANPWR HFC
Transit	B	4 3 2 1	FGC FANPWR HFC VPWR

NOTE: **The HFC circuit may be wired to the FC3 and FC5 relays. Refer to the appropriate Wiring Diagrams article for additional information.**

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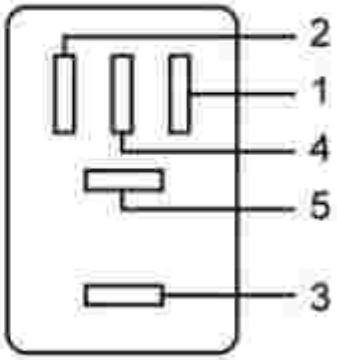

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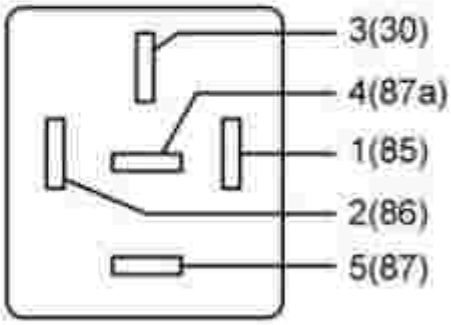

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Fig. 165: Fan Control 3 (FC3) Relay Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental, MKX	A	5 2 3 1	FANPWR HFC B+ VPWR
Edge, Mustang	A	3 1 5 2	FANPWR HFC B+ VPWR
Escape/Kuga 1.5L, Escape/Kuga 2.0L With 3 Fan Relays, Focus With 5 Fan Relays, MKC With 5 Fan Relays	A	5 3 4 2 1	GND FGC FANPWR HFC VPWR

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Vehicle	Connector	Pin	Circuit
Escape/Kuga 2.0L With 5 Fan Relays	A	5 3 4 2 1	GND FGC FANPWR MFC VPWR
Explorer, Flex, MKC With 3 Fan Relays, MKT	B	5 2 3 1	FANPWR HFC B+ VPWR
Fusion	A	3 2 5 1	FANPWR HFC B+ VPWR
MKZ	A	3 2 5 1	GND HFC B+ VPWR
Taurus	A	5 3 4 1 2	GND FGC FANPWR HFC VPWR
Transit	B	5 3 2 1	GND FGC HFC VPWR

NOTE: **The MFC circuit may be wired to the FC2 and FC4 relays. Refer to the appropriate Wiring Diagrams article for additional information.**

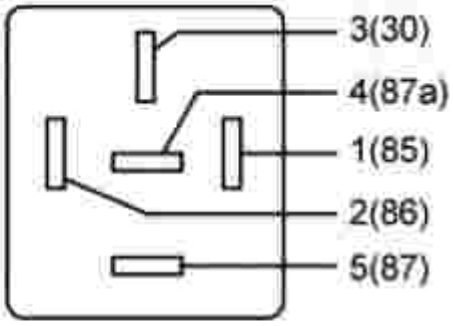

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Fig. 166: Fan Control 4 (FC4) Relay Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Kuga	A	5 4 1 2	FANPWR FANRSTR2 VPWR HFC
Focus 2.3L	A	5 4 2 1, 3	FANPWR FANRSTR2 MFC VPWR

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Vehicle	Connector	Pin	Circuit
MKC	A	5 4 2 1	FANPWR FANRSTR2 MFC VPWR

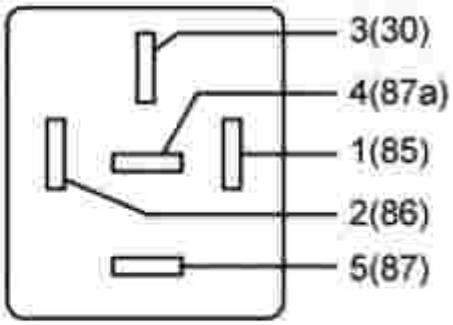

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Fig. 167: Fan Control 5 (FC5) Relay Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Escape/Kuga	A	2 1	HFC VPWR
Focus 2.3L	A	2 3 1, 5	HFC B+ VPWR
MKC	A	2 3 1	HFC B+ VPWR

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 3.7L, Edge 3.5L, Explorer TiVCT 3.5L, Explorer 3.7L, Flex TiVCT 3.5L, MKT 3.7L, MKX 3.7L, Mustang 5.2L, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L	198 PIN	B10 B17	HFC LFC
EcoSport 1.0L Automatic Transmission	198 PIN	B4 B23 E19	HFC LFC CACCF
EcoSport 1.0L Manual Transmission	198 PIN	B3 B42 B59	HFC LFC CACCF
EcoSport 1.5L Automatic Transmission, Fusion 2.5L	198 PIN	B67 B66	HFC LFC
EcoSport 1.5L Manual Transmission	112 PIN	B27 B26	HFC LFC

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Vehicle	Connector	Pin	Circuit
Escape/Kuga 1.5L	198 PIN	B7 B32	HFC LFC
Escape/Kuga 2.0L With 3 Fan Relays	198 PIN	B32 B6	HFC LFC
Escape/Kuga 2.0L With 5 Fan Relays	198 PIN	B32 B8 B6	MFC HFC LFC
Expedition, F-150 3.5L, Navigator	198 PIN	B80 B41 B43	HFC LFC CACCF
F-150 2.7L, F-150 3.3L, F-150 5.0L, Mustang 5.0L	306 PIN	B89 B59	HFC LFC
Fiesta 1.0L	198 PIN	B3 B42	HFC LFC
Fiesta 1.6L	128 PIN	B13	LFC
Focus	198 PIN	B78 B4 B23	MFC HFC LFC
Ford GT	198 PIN	B78	CACCF
KA	128 PIN	E31	LFC
MKC	198 PIN	B8 B7 B6	MFC HFC LFC
Mustang 2.3L	198 PIN	B2 B2	HFC LFC
Ranger	128 PIN	E29 B13	HFC LFC
All other vehicles	198 PIN	B4 B23	HFC LFC

TEST PROCEDURE

KF1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: **For Continental, Edge, Expedition, F-150, MKX, and Navigator with 3 pin Cooling Fan Motor 1 and Cooling Fan Motor 2 connectors, GO to PINPOINT TEST KN.**

Are DTCs P028D, P028E, P0480, P0481 or P0482 present?

Yes	No
For Expedition, F-150, and Navigator, GO to KF23. For DTC P0481, GO to KF8. For DTC P0482, GO to KF13. For all others, GO to KF3.	For Expedition, F-150, and Navigator symptoms without DTCs, GO to KF23. For all others symptoms without DTCs, GO to KF2. For all others, RETURN to SYMPTOM CHARTS for further direction.

KF2 VERIFY A/C STATUS

NOTE: **Verify the A/C system pressures are correct. Refer to the appropriate Climate Control article, General Procedure, Refrigerant System Tests for additional information.**

- Verify the A/C system is OFF.
- Ignition ON, engine running.

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- Access the PCM and monitor the AC_REQ (MODE) PID.

Is A/C being requested?

Yes	No
REFER to the appropriate Climate Control article, to diagnose the A/C system.	GO to KF3.

KF3 CHECK THE VOLTAGE TO THE RELAYS

- Ignition OFF.
- For DTCs P028D or P028E,
- Charge Air Cooler Cooling Fan Relay connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Charge Air Cooler Cooling Fan Relay Connector, Harness Side	(-)
VPWR	Ground
B+	Ground

- For all others,
- FC1 Relay connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) FC1 Relay Connector, Harness Side	(-)
VPWR	Ground
B+	Ground

Are the voltages greater than 10.5 V?

Yes	No
GO to KF4.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KF4 CHECK THE RELAYS

- Carry out the Relay Component Test. Refer to appropriate Wiring Diagrams, Component Testing article.

Is a concern present?

Yes	No
INSTALL a new relay in question. Clear the PCM DTCs. REPEAT the self-test.	For symptoms without DTCs, GO to KF8. For all others, GO to KF5.

KF5 CHECK THE CACCF AND LFC CIRCUITS FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- For DTCs P028D or P028E,
- Measure the resistance between:

(+) Charge Air Cooler Cooling Fan Relay Connector, Harness Side	(-) PCM Connector, Harness Side
CACCF	CACCF

- For all others,
- Measure the resistance between:

(+) FC1 Relay Connector, Harness Side	(-) PCM Connector, Harness Side

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(+) FC1 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
LFC	LFC

Is the resistance less than 5 ohms?

Yes	No
GO to KF6.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KF6 CHECK THE CACCF AND LFC CIRCUIT FOR A SHORT TO GROUND

- For DTCs P028D or P028E,
- Measure the resistance between:

(+) Charge Air Cooler Cooling Fan Relay Connector, Harness Side	(-)
CACCF	Ground

- For all others,
- Measure the resistance between:

(+) FC1 Relay Connector, Harness Side	(-)
LFC	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to KF7.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KF7 CHECK THE CACCF AND LFC CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For DTCs P028D or P028E,
- Measure the voltage between:

(+) Charge Air Cooler Cooling Fan Relay Connector, Harness Side	(-)
CACCF	Ground

- For all others,
- Measure the voltage between:

(+) FC1 Relay Connector, Harness Side	(-)
LFC	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	For EcoSport, Focus 1.0L, Fiesta 1.6L TIVCT and KA, GO to KF18. For DTCs P028D, P028E, or P0480, GO to KF36. For all others, GO to KF8.

KF8 CHECK THE VOLTAGE TO THE RELAYS

- Ignition OFF.
- FC3 Relay connector disconnected.
- Ignition ON, engine OFF.
- For Fiesta 1.0L,
- Measure the voltage between:

(+) FC3 Relay Connector, Harness Side	(-)

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(+) FC3 Relay Connector, Harness Side	(-)
VPWR	Ground
B+	Ground

- For Escape/Kuga 2.0L, Focus 2.3L, and MKC with 5 fan relays,
- FC3 Relay connector disconnected.
- FC5 Relay connector disconnected.
- Measure the voltage between:

(+) FC3 Relay Connector, Harness Side	(-)
VPWR	Ground

- Measure the voltage between:

(+) FC5 Relay Connector, Harness Side	(-)
VPWR	Ground
B+	Ground

- For all others,
- FC2 Relay connector disconnected.
- Measure the voltage between:

(+) FC2 Relay Connector, Harness Side	(-)
VPWR	Ground

- Measure the voltage between:

(+) FC3 Relay Connector, Harness Side	(-)
VPWR	Ground
B+	Ground

Are the voltages greater than 10.5 V?

Yes	No
GO to KF9.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KF9 CHECK FC2 AND FC3 RELAYS

- Carry out the Relay Component Test. Refer to appropriate Wiring Diagrams, Component Testing article.

Is a concern present?

Yes	No
INSTALL a new relay in question. Clear the PCM DTCs. REPEAT the self-test.	For symptoms without DTCs, GO to KF18. For all others, GO to KF10.

KF10 CHECK THE HFC CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- For Fiesta 1.0L,
- Measure the resistance between:

(+) FC3 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC	HFC

- For Escape/Kuga 2.0L with 5 fan relays,

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- Measure the resistance between:

(+) FC4 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC	HFC

- Measure the resistance between:

(+) FC5 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC	HFC

- For Focus 2.3L, and MKC with 5 fan relays,
- Measure the resistance between:

(+) FC3 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC	HFC

- Measure the resistance between:

(+) FC5 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC	HFC

- For all others,
- Measure the resistance between:

(+) FC2 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC	HFC

- Measure the resistance between:

(+) FC3 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC	HFC

Are the resistances less than 5 ohms?

Yes	No
GO to KF11.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KF11 CHECK THE HFC CIRCUIT FOR A SHORT TO GROUND

- For Fiesta 1.0L,
- Measure the resistance between:

(+) FC3 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC	HFC

- For Escape/Kuga 2.0L with 5 fan relays,
- Measure the resistance between:

(+) FC4 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC	HFC

- Measure the resistance between:

(+) FC5 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC	HFC

- For Focus 2.3L, and MKC with 5 fan relays,
- Measure the resistance between:

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(+) FC3 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC	HFC

- Measure the resistance between:

(+) FC5 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
HFC	HFC

- For all others,
- Measure the resistance between:

(+) FC2 Relay Connector, Harness Side	(-)
HFC	Ground

- Measure the resistance between:

(+) FC3 Relay Connector, Harness Side	(-)
HFC	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to KF12.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KF12 CHECK THE HFC CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) PCM Connector, Harness Side	(-)
HFC	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to KF23.

KF13 CHECK THE VOLTAGE TO THE FC2, FC3, AND FC4 RELAYS

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- FC2 Relay connector disconnected.
- FC3 Relay connector disconnected.
- FC4 Relay connector disconnected.
- Ignition ON, engine OFF.
- Access the PCM and control the LFC (MODE) PID.
- Command the PID ON.
- Access the PCM and control the MFC (MODE) PID.
- Command the PID ON.
- Access the PCM and control the HFC (MODE) PID.
- Command the PID ON.
- Measure the voltage between:

(+) FC2 Relay Connector, Harness Side	(-)
VPWR	Ground

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- Measure the voltage between:

(+) FC3 Relay Connector, Harness Side	(-)
VPWR	Ground

- Measure the voltage between:

(+) FC4 Relay Connector, Harness Side	(-)
VPWR	Ground

Are the voltages greater than 10.5 V?

Yes	No
GO to KF14.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KF14 CHECK THE FC2, FC3, AND FC4 RELAYS

- Carry out the Relay Component Test. Refer to appropriate Wiring Diagrams, Component Testing article.

Is a concern present?

Yes	No
INSTALL a new FC2 or FC4 relay in question. Clear the PCM DTCs. REPEAT the self-test.	GO to KF15.

KF15 CHECK THE MFC CIRCUIT FOR AN OPEN

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) FC2 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
MFC	MFC

- Measure the resistance between:

(+) FC3 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
MFC	MFC

- Measure the resistance between:

(+) FC4 Relay Connector, Harness Side	(-) PCM Connector, Harness Side
MFC	MFC

Are the resistances less than 5 ohms?

Yes	No
GO to KF16.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KF16 CHECK THE MFC CIRCUIT FOR A SHORT TO GROUND

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Measure the resistance between:

(+) FC2 Relay Connector, Harness Side	(-)

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(+) FC2 Relay Connector, Harness Side	(-)
MFC	Ground

- Measure the resistance between:

(+) FC3 Relay Connector, Harness Side	(-)
MFC	Ground

- Measure the resistance between:

(+) FC4 Relay Connector, Harness Side	(-)
MFC	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to KF17.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KF17 CHECK THE MFC CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) PCM Connector, Harness Side	(-)
MFC	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	For DTC P0482, GO to KF36. For all others, GO to KF18.

KF18 CHECK THE FAN PWR CIRCUIT FOR AN OPEN

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- For EcoSport 1.0L, and Focus 1.0L charge air cooler cooling fan,
- Measure the resistance between:

(+) Charge Air Cooler Cooling Fan Relay Connector, Harness Side	(-) Charge Air Cooler Cooling Fan Motor Connector, Harness Side
FANPWR	FANPWR - Pin 1

- For Ford GT charge air cooler cooling fan,
- Measure the resistance between:

(+) Charge Air Cooler Cooling Fan Relay Connector, Harness Side	(-) Charge Air Cooler Cooling Fan 2 Motor Connector, Harness Side
FANPWR	FANPWR - Pin 1

- Measure the resistance between:

(+) Charge Air Cooler Cooling Fan Relay Connector, Harness Side	(-) Charge Air Cooler Cooling Fan Motor Connector, Harness Side
FANPWR	FANPWR - Pin 1

- For EcoSport and Fiesta 1.0L,
- Measure the resistance between:

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(+) FC1 Relay Connector, Harness Side	(-) Cooling Fan Motor 1 Connector, Harness Side
FANPWR	FANPWR

- Measure the resistance between:

(+) FC2 Relay Connector, Harness Side	(-) Cooling Fan Motor 1 Connector, Harness Side
FANPWR	FANPWR

- For Ranger,
- Measure the resistance between:

(+) FC2 Relay Connector, Harness Side	(-) Cooling Fan Motor 1 Connector, Harness Side
FANPWR	FANPWR

- For all others FC1 relay,
- Measure the resistance between:

(+) FC1 Relay Connector, Harness Side	(-) Cooling Fan Motor 1 Connector, Harness Side
FANPWR	FANPWR

- For all others FC2 relay,
- Measure the resistance between:

(+) FC2 Relay Connector, Harness Side	(-) Cooling Fan Motor 1 Connector, Harness Side
FGC	FC

- Measure the resistance between:

(+) FC2 Relay Connector, Harness Side	(-) Cooling Fan Motor 2 Connector, Harness Side
FANPWR	FANPWR - Pin 1

- Measure the resistance between:

(+) FC2 Relay Connector, Harness Side	(-) Cooling Fan Motor 1 Connector, Harness Side
FANRSTR1	FANPWR
FANPWR	FANPWR

- For all others FC3 relay,
- Measure the resistance between:

(+) FC3 Relay Connector, Harness Side	(-) Cooling Fan Motor 2 Connector, Harness Side
FANPWR	FANPWR - Pin 1

- Measure the resistance between:

(+) FC3 Relay Connector, Harness Side	(-) Cooling Fan Motor 1 Connector, Harness Side
FGC	FC

- For all others FC4 relay,
- Measure the resistance between:

(+) FC4 Relay Connector, Harness Side	(-) Cooling Fan Motor 2 Connector, Harness Side
FANRSTR2	FANPWR - Pin 1
FANPWR	FANPWR - Pin 1

Are the resistances less than 5 ohms?

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Yes	No
GO to KF19.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KF19 CHECK THE FAN PWR CIRCUIT FOR A SHORT TO VOLTAGE

NOTE: **For vehicles with a single cooling fan, disregard the cooling fan motor 2 measurement in this step.**

- Ignition ON, engine OFF.
- For EcoSport 1.0L, and Focus 1.0L charge air cooler cooling fan,
- Measure the voltage between:

(+) Charge Air Cooler Cooling Fan Motor Connector, Harness Side	(-)
FANPWR - Pin 1	Ground

- For Ford GT charge air cooler cooling fan,
- Measure the voltage between:

(+) Charge Air Cooler Cooling Fan Motor Connector, Harness Side	(-)
FANPWR - Pin 1	Ground

- Measure the voltage between:

(+) Charge Air Cooler Cooling Fan 2 Motor Connector, Harness Side	(-)
FANPWR - Pin 1	Ground

- For Ranger,
- Measure the voltage between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-)
FANPWR	Ground
FANPWR	Ground

- For all others,
- Measure the voltage between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-)
FANPWR	Ground

- Measure the voltage between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-)
FANPWR - Pin 1	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to KF20.

KF20 CHECK GROUND CIRCUITS

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- For EcoSport 1.0L, and Focus 1.0L charge air cooler cooling fan,
- Measure the resistance between:

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(+) Charge Air Cooler Cooling Fan Motor Connector, Harness Side	(-)
GND - Pin 2	Ground

- For Ford GT charge air cooler cooling fan,
- Measure the resistance between:

(+) Charge Air Cooler Cooling Fan Motor Connector, Harness Side	(-)
GND - Pin 2	Ground

- Measure the resistance between:

(+) Charge Air Cooler Cooling Fan 2 Motor Connector, Harness Side	(-)
GND - Pin 2	Ground

- For EcoSport, Fiesta, KA, and Ranger,
- Measure the resistance between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-)
GND	Ground

- For all others,
- Measure the resistance between:

(+) FC2 Relay Connector, Harness Side	(-)
GND	Ground

- Measure the resistance between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-)
GND - Pin 2	Ground

- Measure the resistance between:

(+) FC3 Relay Connector, Harness Side	(-)
GND	Ground

Are the resistances less than 5 ohms?

Yes	No
GO to KF21.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KF21 COMMAND THE FANS ON AND CHECK FOR VOLTAGE TO THE COOLING FAN MOTORS

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

NOTE: **Not all vehicles will have cooling fan motor 2, charge air cooler cooling fan motor 2, HFC PID, or the MFC PID.**

- Ignition OFF.
- PCM connector connected.
- For EcoSport 1.0L, Focus 1.0L, and Ford GT charge air cooler cooling fan,
- Charge Air Cooler Cooling Fan Relay connector connected.
- Ignition ON, engine OFF.
- Access the PCM and control the CACC_FAN (PER) PID.
- Command the PID ON.
- Measure the voltage between:

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(+) Charge Air Cooler Cooling Fan Motor Connector, Harness Side	(-)
FANPWR - Pin 1	Ground

- Measure the voltage between:

(+) Charge Air Cooler Cooling Fan 2 Motor Connector, Harness Side	(-)
FANPWR - Pin 1	Ground

- For all others,
- FC1 Relay connector connected.
- FC2 Relay connector connected.
- FC3 Relay connector connected.
- FC4 Relay connector connected.
- FC5 Relay connector connected.
- Ignition ON, engine OFF.
- Access the PCM and control the LFC (MODE) PID.
- Access the PCM and control the MFC (MODE) PID.
- Access the PCM and control the HFC (MODE) PID.
- Command the PIDs ON.
- Measure the voltage between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-)
FANPWR	Ground
FANPWR	Ground

- Measure the voltage between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-)
FANPWR - Pin 1	Ground

- For EcoSport, Fiesta and KA,
- Record the voltage.
- Command the LFC PID OFF.
- Record the voltage.

Are the voltages greater than 10.5 V?

Yes	No
GO to KF22.	GO to KF36.

KF22 CHECK FOR CORRECT FAN OPERATION

NOTE: **Not all vehicles will have cooling fan motor 2, charge air cooler cooling fan motor 2, HFC PID, or the MFC PID.**

- For EcoSport 1.0L, Focus 1.0L, and Ford GT charge air cooler cooling fan,
- Ignition OFF.
- Charge Air Cooler Cooling Fan Motor connector connected.
- Charge Air Cooler Cooling Fan 2 Motor connector connected.
- Ignition ON, engine OFF.
- Access the PCM and control the CACC_FAN (PER) PID.
- Command the PID ON.
- For all others,
- Ignition OFF.

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- Cooling Fan Motor 1 connector connected.
- Cooling Fan Motor 2 connector connected.
- Ignition ON, engine OFF.
- Access the PCM and control the LFC (MODE) PID.
- Access the PCM and control the MFC (MODE) PID.
- Access the PCM and control the HFC (MODE) PID.
- Command the PIDs ON.
- For EcoSport, Fiesta and KA,
- Check for fan operation.
- Command the LFC PID OFF.
- Check for fan operation.

Do the fans operate when commanded ON?

Yes	No
The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.	INSTALL a new Cooling Fan motor in question. Clear the PCM DTCs. REPEAT the self-test.

KF23 CHECK DIAGNOSTIC TROUBLE CODES (DTCS)

Are DTCs P028D, P028E, P0480 or P0481 present?

Yes	No
For DTC P0481, GO to KF28. For all others, GO to KF25.	For symptoms without DTCs, GO to KF24. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

KF24 A/C STATUS

NOTE: **Verify the A/C system pressures are correct. Refer to the appropriate Climate Control article, General Procedure, Refrigerant System Tests for additional information.**

- Verify the A/C system is OFF.
- Ignition ON, engine running.
- Access the PCM and monitor the AC_REQ (MODE) PID.

Is A/C being requested?

Yes	No
REFER to the appropriate Climate Control article, to diagnose the A/C system.	GO to KF31.

KF25 CHECK THE CACCF AND THE LFC CIRCUITS FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- BJB-C connector disconnected.
- For DTCs P028D or P028E,
- Measure the resistance between:

(+) BJB-C Connector, Harness Side	(-) PCM Connector, Harness Side
CACCF - Pin 19	CACCF

- For all others,
- Measure the resistance between:

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(+) BJB-C Connector, Harness Side	(-) PCM Connector, Harness Side
LFC - Pin 10	LFC

Is the resistance less than 5 ohms?

Yes	No
GO to KF26.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KF26 CHECK THE CACCF AND THE LFC CIRCUIT FOR A SHORT TO GROUND

- For DTCs P028D or P028E,
- Measure the resistance between:

(+) BJB-C Connector, Harness Side	(-)
CACCF - Pin 19	Ground

- For all others,
- Measure the resistance between:

(+) BJB-C Connector, Harness Side	(-)
LFC - Pin 10	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to KF27.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KF27 CHECK THE CACCF AND THE LFC CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For DTCs P028D or P028E,
- Measure the voltage between:

(+) BJB-C Connector, Harness Side	(-)
CACCF - Pin 19	Ground

- For all others,
- Measure the voltage between:

(+) BJB-C Connector, Harness Side	(-)
LFC - Pin 10	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to KF36.

KF28 CHECK THE HFC FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- BJB-C connector disconnected.
- Measure the resistance between:

(+) BJB-C Connector, Harness Side	(-) PCM Connector, Harness Side
HFC - Pin 6	HFC

Are the resistances less than 5 ohms?

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Yes	No
GO to KF29.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KF29 CHECK THE HFC FOR A SHORT TO GROUND

- Measure the resistance between:

(+) BJB-C Connector, Harness Side	(-)
HFC - Pin 6	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to KF30.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KF30 CHECK THE HFC FOR A SHORT TO VOLTAGE

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

(+) PCM Connector, Harness Side	(-)
HFC	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to KF36.

KF31 CHECK THE FAN PWR FOR AN OPEN

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- BJB-B connector disconnected.
- BJB-D connector disconnected.
- For charge air cooler cooling fan,
- Measure the resistance between:

(+) BJB-D Connector, Harness Side	(-) Charge Air Cooler Cooling Fan Motor Connector, Harness Side
FANPWR - Pin 47	FANPWR - Pin 1

- For FC1 relay,
- Measure the resistance between:

(+) BJB-B Connector, Harness Side	(-) Cooling Fan Motor 1 Connector, Harness Side
FANPWR - Pin 2, 26	FANPWR

- For all others,
- Measure the resistance between:

(+) BJB-B Connector, Harness Side	(-) Cooling Fan Motor 2 Connector, Harness Side
FANPWR - Pin 2, 26	FANPWR - Pin 1

Are the resistances less than 5 ohms?

Yes	No
GO to KF32.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

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KF32 CHECK THE FAN PWR FOR A SHORT TO VOLTAGE

NOTE: **For vehicles with a single cooling fan, disregard the cooling fan motor 2 measurement in this step.**

- Ignition ON, engine OFF.
- For charge air cooler cooling fan,
- Measure the voltage between:

(+) Charge Air Cooler Cooling Fan Motor Connector, Harness Side	(-)
FANPWR - Pin 1	Ground

- Measure the voltage between:

(+) Charge Air Cooler Cooling Fan 2 Motor Connector, Harness Side	(-)
FANPWR - Pin 1	Ground

- For all others,
- Measure the voltage between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-)
FANPWR	Ground

- Measure the voltage between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-)
FANPWR - Pin 1	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to KF33.

KF33 CHECK THE GROUND CIRCUITS

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

- Ignition OFF.
- For charge air cooler cooling fan,
- Measure the resistance between:

(+) Charge Air Cooler Cooling Fan Motor Connector, Harness Side	(-)
GND - Pin 2	Ground

- Measure the resistance between:

(+) Charge Air Cooler Cooling Fan 2 Motor Connector, Harness Side	(-)
GND - Pin 2	Ground

- For all others,
- Measure the resistance between:

(+) BJB-B Connector, Harness Side	(-)
GND - Pin 47	Ground

Are the resistances less than 5 ohms?

Yes	No

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Yes	No
GO to KF34.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KF34 COMMAND THE FAN ON AND CHECK FOR VOLTAGE TO THE COOLING FAN MOTORS

NOTE: **Only measure the circuits that apply to the vehicle being diagnosed.**

NOTE: **Not all vehicles will have cooling fan motor 2, charge air cooler cooling fan motor 2, HFC PID, or the MFC PID.**

- Ignition OFF.
- PCM connector connected.
- For charge air cooler cooling fan,
- Charge Air Cooler Cooling Fan Relay connector connected.
- Ignition ON, engine OFF.
- Access the PCM and control the CACC_FAN (PER) PID.
- Command the PID ON.
- Measure the voltage between:

(+) Charge Air Cooler Cooling Fan Motor Connector, Harness Side	(-)
FANPWR - Pin 1	Ground

- Measure the voltage between:

(+) Charge Air Cooler Cooling Fan 2 Motor Connector, Harness Side	(-)
FANPWR - Pin 1	Ground

- For all others,
- BJB-B connector connected.
- BJB-C connector connected.
- BJB-D connector connected.
- Ignition ON, engine OFF.
- Access the PCM and control the LFC (MODE) PID.
- Access the PCM and control the HFC (MODE) PID.
- Command the PIDs ON.
- Measure the voltage between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-)
FANPWR	Ground

- Measure the voltage between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-)
FANPWR - Pin 1	Ground

Are the voltages greater than 10.5 V?

Yes	No
GO to KF35.	GO to KF36.

KF35 CHECK FOR CORRECT COOLING FAN OPERATION

NOTE: **Not all vehicles will have cooling fan motor 2, charge air cooler cooling fan motor 2, HFC PID, or the MFC PID.**

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- For charge air cooler cooling fan,
- Ignition OFF.
- Charge Air Cooler Cooling Fan Motor connector connected.
- Charge Air Cooler Cooling Fan 2 Motor connector connected.
- Ignition ON, engine OFF.
- Access the PCM and control the CACC_FAN (PER) PID.
- Command the PID ON.
- For all others,
- Ignition OFF.
- Cooling Fan Motor 1 connector connected.
- Cooling Fan Motor 2 connector connected.
- Ignition ON, engine OFF.
- Access the PCM and control the LFC (MODE) PID.
- Access the PCM and control the HFC (MODE) PID.
- Command the PIDs ON.

Do the fans operate when commanded ON?

Yes	No
The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.	INSTALL a new Cooling Fan motor in question. Clear the PCM DTCs. REPEAT the self-test.

KF36 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.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS KG: FUEL INJECTOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- fuel injectors (9F593)
- injector relay
- harness circuits: INJ1, INJ2, INJ3, INJ4, INJ5, INJ6, INJ7, INJ8, INJ9, INJ10 INJRLY, INJPWRM and VPWR
- PCM (12A650)

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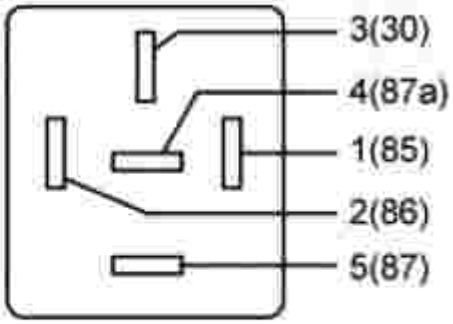

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Fig. 168: Injector Relay Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
5	VPWR (Vehicle Power)
1	INJRLY (Injector Relay)
2, 3	B+ (Battery Positive Voltage)

A

N0160717

B

N0117506

Fig. 169: Injector (INJ) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
EcoSport, Fiesta	A	2 1	INJ VPWR
KA 1.5L	B	2 1	INJ VPWR

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Vehicle	Connector	Pin	Circuit
All other vehicles	A	1 2	INJ VPWR

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
E-Series 6.2L	198 PIN	E1 E62 E46 E3 E2 E31 E61 E16	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8
E-Series 6.8L, F-650/F-750	198 PIN	E1 E31 E61 E63 E3 E2 E46 E62 E64 E16	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8 INJ9 INJ10
EcoSport 1.5L Automatic Transmission	198 PIN	E52 E53 E54 E18	INJ1 INJ2 INJ3 INJPWRM
EcoSport 1.5L Manual Transmission	112 PIN	E39 E26 E40 E22	INJ1 INJ2 INJ3 INJPWRM
Edge	198 PIN	E1 E3 E31 E2 E16 E46 B49	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJPWRM
Escape/Kuga	198 PIN	E52 E55 E53 E54	INJ1 INJ2 INJ3 INJ4
Expedition, F-150 3.5L, Navigator	198 PIN	E43 E30 E45 E58 E42 E72	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6
Explorer, MKX	198 PIN	E1 E3 E31 E2 E16 E46 E18	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJPWRM

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Vehicle	Connector	Pin	Circuit
F-150 2.7L, F-150 3.3L	306 PIN	E39 E81 E18 E38 E110 E17	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6
F-150 5.0L	306 PIN	E39 E110 E38 E123 E17 E18 E81 E36	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8
F-Series Super Duty 6.2L	198 PIN	E1 E62 E46 E3 E2 E31 E61 E16 B49	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8 INJPWRM
F-Series Super Duty 6.8L	198 PIN	E1 E31 E61 E63 E3 E2 E46 E62 E64 E16 B49	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8 INJ9 INJ10 INJPWRM
Fiesta, Ranger	128 PIN	E34 E45 E44 E46	INJ1 INJ2 INJ3 INJ4
Flex GTDI 3.5L, MKT 3.5L, Taurus GTDI 3.5L	198 PIN	B21	INJPWRM
Flex TiVCT 3.5L, MKT 3.7L, Taurus TiVCT 3.5L	198 PIN	E1 E3 E31 E2 E16 E46 B21	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJPWRM
Ford GT	198 PIN	B81 B80 B22 B40 B21 E16 B95 B42	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJPWRM INJRLY

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Vehicle	Connector	Pin	Circuit
Fusion	198 PIN	E52 E55 E53 E54 B21	INJ1 INJ2 INJ3 INJ4 INJPWRM
KA 1.0L	128 PIN	E35 E44 E45 E29	INJ1 INJ2 INJ3 INJPWRM
KA 1.5L	128 PIN	E35 E44 E45 E47 E29	INJ1 INJ2 INJ3 INJ4 INJPWRM
Motorhome/Stripped Chassis/Step Van	198 PIN	E1 E31 E61 E63 E3 E2 E46 E62 E64 E16 E18	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8 INJ9 INJ10 INJPWRM
Mustang 5.0L	306 PIN	E39 E36 E17 E81 E38 E18 E123 E110	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8
Mustang 5.2L	198 PIN	E1 E61 E31 E3 E2 E62 E46 E16	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6 INJ7 INJ8
Transit Connect	198 PIN	B52 B55 B53 B54	INJ1 INJ2 INJ3 INJ4
All other vehicles	198 PIN	E1 E3 E31 E2 E16 E46	INJ1 INJ2 INJ3 INJ4 INJ5 INJ6

TEST PROCEDURE

KG1 CHECK FOR DTCS

Are DTCs P0201, P0202, P0203, P0204, P0205, P0206, P0207, P0208, P0209, P0210, P2149, P21CF, P21D0, P21D1, P21D2, P21D3, P21D4, P21D5, P21D6, P2C27 or P2C28 present?

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Yes	No
For DTCs P2149, P2C27 or P2C28, GO to KG10. For all others, GO to KG2.	For symptoms without DTCs, GO to KG3. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

KG2 CHECK FOR OTHER DTCS

NOTE: **On some vehicles, these DTCs may be accompanied by body control module (BCM) fuel pump relay DTCs or PCM fuel system related DTCs. Diagnose any BCM fuel pump relay DTCs or PCM fuel system related DTCs first.**

- Clear the PCM DTCs.
- Crank the engine.
- Ignition ON, engine OFF.
- Carry out the PCM self-test.
- Carry out the BdyCM self-test.

Are any BCM DTCs present?

Yes	No
REFER to the applicable Service Information article to continue diagnosis.	GO to KG3.

KG3 CHECK THE VPWR CIRCUIT FOR AN OPEN

NOTE: **Disconnect the suspect fuel injector harness connector. Only the suspect injector needs to be diagnosed.**

NOTE: **On some vehicles, the injector voltage is only present when the fuel pump relay is energized. Measure the injector voltage within 2 seconds of the ignition ON.**

- Ignition OFF.
- INJ connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) INJ Connector, Harness Side	(-)
VPWR	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to KG4.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KG4 CHECK THE INJ CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) INJ Connector, Harness Side	(-) PCM Connector, Harness Side
INJ	Suspect INJ

Is the resistance less than 5 ohms?

Yes	No
GO to KG5.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

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KG5 CHECK THE INJ CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

(+) INJ Connector, Harness Side	(-)
INJ	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to KG6.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KG6 CHECK THE INJ CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) INJ Connector, Harness Side	(-)
INJ	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to KG7.

KG7 CHECK THE RESISTANCE OF THE FUEL INJECTOR

- Ignition OFF.
- Measure the resistance between:

(+) INJ Connector, Component Side	(-) INJ Connector, Component Side
VPWR	INJ

Is the resistance between 11 - 18 ohms?

Yes	No
GO to KG8.	INSTALL a new fuel injector. REFER to the appropriate Engine Controls - Fuel Charging And Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

KG8 CHECK THE FUNCTIONALITY OF THE INJ CIRCUIT

- PCM connector connected.
- Ignition ON, engine OFF.
- Connect a non-powered test lamp between:

Point A INJ Connector, Harness Side	Point B INJ Connector, Harness Side
VPWR	INJ

- Ignition ON, engine running.

Is the test lamp blinking?

Yes	No
GO to KG9.	GO to KG15.

KG9 CARRY OUT A THOROUGH WIGGLE TEST ON THE FUEL INJECTOR HARNESS

- Ignition OFF.
- INJ connector connected.
- Ignition ON, engine running.

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- Engine at normal operating temperature.
- Access the PCM and monitor the INJ_F (MODE) 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 concern and REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	Unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**.

KG10 CHECK THE INJECTOR RELAY

- Carry out the injector relay component test. Refer to the appropriate Wiring Diagrams, Component Testing article.

Does the injector relay pass the component test?

Yes	No
GO to KG11.	INSTALL a new Injector relay. Clear the PCM DTCs. REPEAT the self-test.

KG11 CHECK THE B+ VOLTAGE TO INJECTOR RELAY

- Ignition OFF.
- Injector Relay connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Injector Relay Connector, Harness Side	(-)
B+ - Pin 2, 3	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to KG12.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KG12 CHECK FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) Injector Relay Connector, Harness Side	(-) PCM Connector, Harness Side
INJRLY - Pin 1	INJRLY
VPWR - Pin 5	INJPWRM

Are the resistances less than 5 ohms?

Yes	No
GO to KG13.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KG13 CHECK FOR A SHORT TO GROUND

- Measure the resistance between:

(+) Injector Relay Connector, Harness Side	(-)
INJRLY - Pin 1	Ground
VPWR - Pin 5	Ground

Are the resistances greater than 10K ohms?

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Yes	No
GO to KG14.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KG14 CHECK FOR A SHORT TO VOLTAGE

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

(+) Injector Relay Connector, Harness Side	(-)
INJRLY - Pin 1	Ground
VPWR - Pin 5	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to KG15.

KG15 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.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS KN: VARIABLE SPEED ELECTRIC COOLING FAN MOTOR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- cooling fan (CF) module (8B658)
- cooling fan assembly (8C607)
- harness circuits: FCV, FANPWR and GND
- PCM (12A650)

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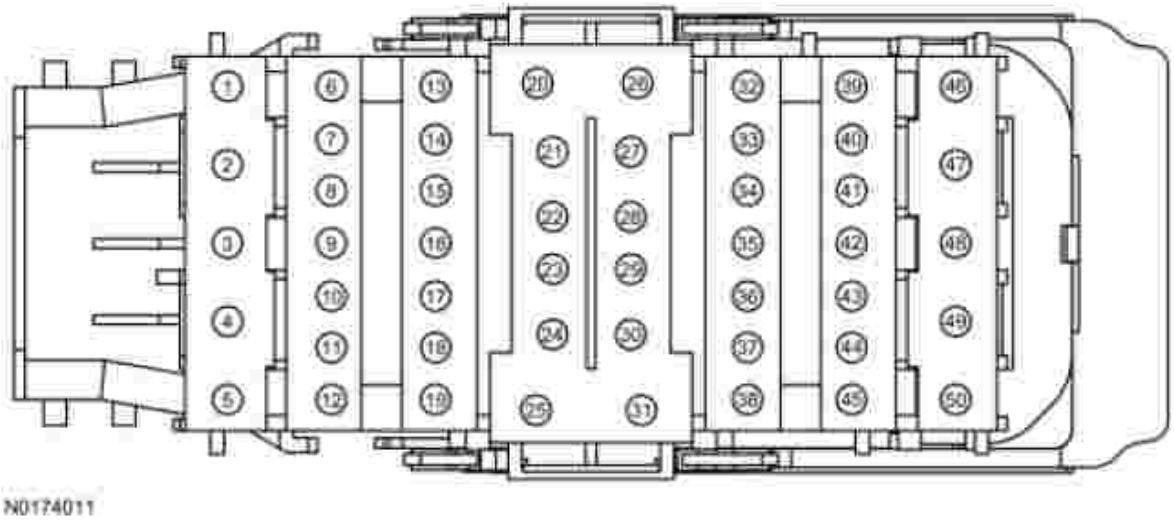

Fig. 170: Battery Junction Box-B (BJB-B) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2, 26	FANPWR (Fan Power)

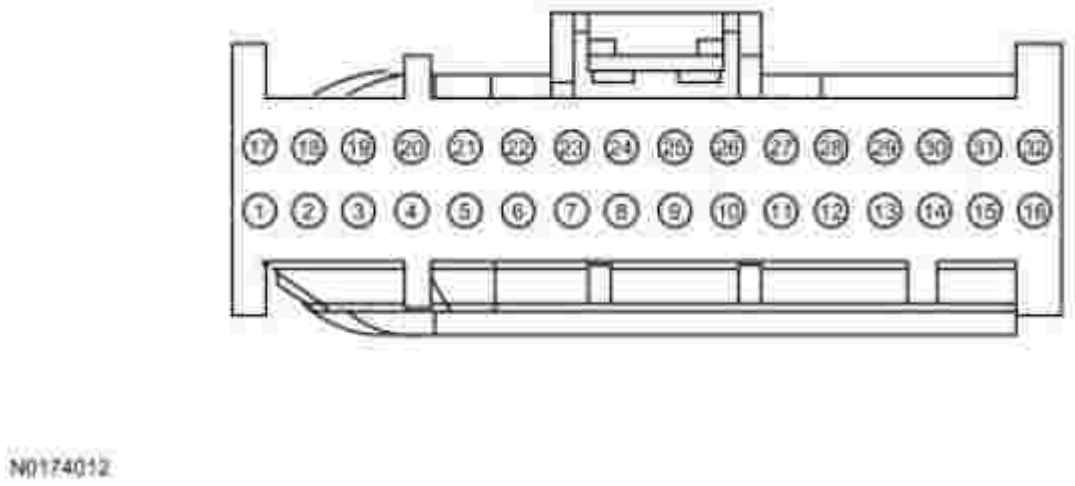

Fig. 171: Battery Junction Box-C (BJB-C) Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
10, 6	GND (Ground)

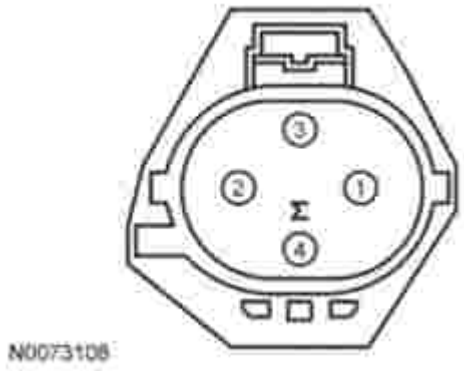

Fig. 172: Cooling Fan (CF) Module Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
4	FCV (Fan Control Variable)
2	GND (Ground)

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Pin	Circuit
1	FANPWR (Fan Power)

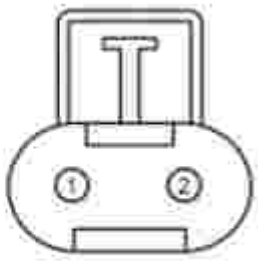

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Fig. 173: Cooling Fan (CF) Motor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	GND (Ground)
2	FANPWR (Fan Power)

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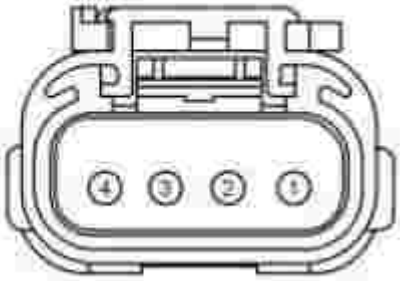
A

N0073108

B



N0073205

C

N0171309

Fig. 174: Cooling Fan Motor 1 Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 3 Pin Cooling Fan Motor, Ford GT	A	4 2 1	FCV GND FANPWR
Edge 3 Pin Cooling Fan Motor, MKX 3 Pin Cooling Fan Motor	B	4 1 2	FCV GND FANPWR
Expedition 3 Pin Cooling Fan Motor, F-150 3 Pin Cooling Fan Motor, Navigator 3 Pin Cooling Fan Motor	C	2 1 3	FCV GND FANPWR

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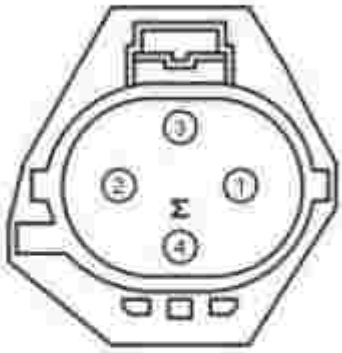
A



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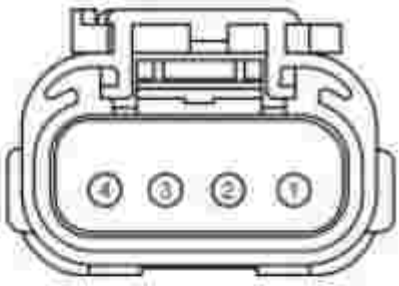
B



N0073205

C

N0171309

Fig. 175: Cooling Fan Motor 2 Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental 3 Pin Cooling Fan Motor, Ford GT	A	4 2 1	FCV GND FANPWR
Edge 3 Pin Cooling Fan Motor	B	4 1 2	FCV GND FANPWR
Expedition 3 Pin Cooling Fan Motor, F-150 3 Pin Cooling Fan Motor, Navigator 3 Pin Cooling Fan Motor	C	2 1 3	FCV GND FANPWR
MKX 3 Pin Cooling Fan Motor	C	4 1 2	FCV GND FANPWR

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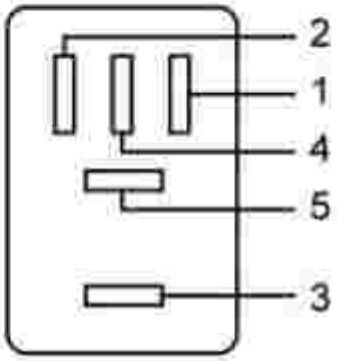
A



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B

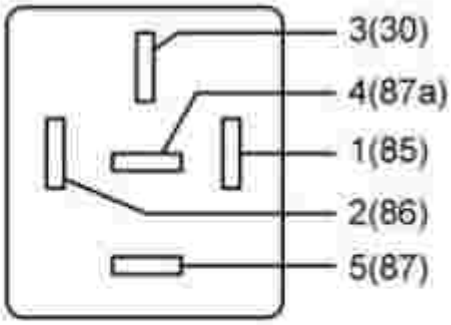

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Fig. 176: Fan Control (FC) Relay Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Fiesta	A	5 2 1 3	FANPWR GND VPWR B+
All other vehicles	B	5 2 1 3	FANPWR GND VPWR B+

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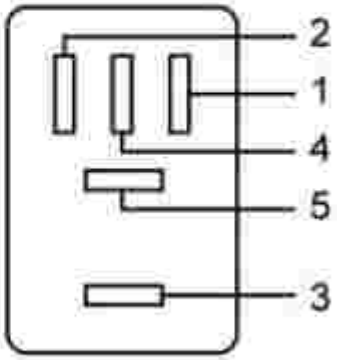
A



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B

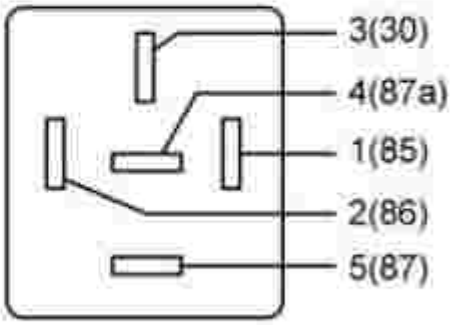

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Fig. 177: Fan Control 1 (FC1) Relay Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental, Edge, MKX	A	5 2 3 1 3	FANPWR GND B+ VPWR B+

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Vehicle	Connector	Pin	Circuit
EcoSport, Explorer, Fiesta, Flex, Fusion, KA, MKT, MKZ, Mustang, Taurus	A	3	B+
Escape/Kuga, Focus, MKC, Transit	B	3	B+
Ford GT	A	5 2 3 1	FANPWR GND B+ VPWR
Ranger	A	2, 5	B+

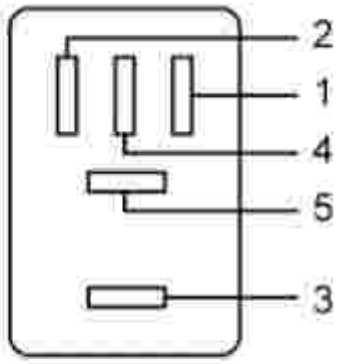

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Fig. 178: Fan Control 2 (FC2) Relay Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
5	FANPWR (Fan Power)
2	GND (Ground)
1	VPWR (Vehicle Power)
3	B+ (Battery Positive Voltage)

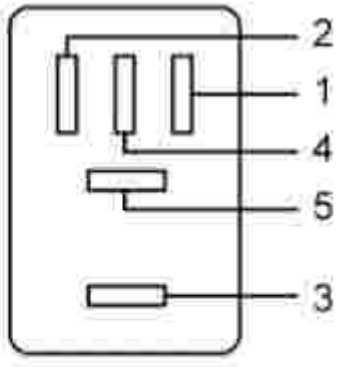

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Fig. 179: Fan Control 3 (FC3) Relay Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
Continental	A	5 2 1 3	FANPWR GND VPWR B+
Edge	A	3 1 2 5	FANPWR GND VPWR B+
MKX	A	3 2 1 5	FANPWR GND VPWR B+

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental, MKX 2.7L	198 PIN	B4	FCV
Escape/Kuga	198 PIN	B32	FCV
Explorer	198 PIN	B17	FCV
F-150 2.7L, F-150 3.3L, F-150 5.0L	306 PIN	B59	FCV
Fiesta	198 PIN	B5	FCV
Focus 1.0L	198 PIN	B23	FCV
Focus GDI 2.0L	154 PIN	B8	FCV
Focus GTDI 2.0L	198 PIN	B4	FCV
Ford GT	198 PIN	B83	FCV
MKX 3.7L	198 PIN	B10	FCV
Transit Connect	198 PIN	B66	FCV
All other vehicles	198 PIN	B41	FCV

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TEST PROCEDURE

KN1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

Is DTC P0480 present?

Yes	No
GO to KN4.	For symptoms without DTCs, GO to KN2. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

KN2 VERIFY A/C STATUS

- Verify the A/C system is OFF.
- Ignition ON, engine running.
- Access the PCM and monitor the AC_REQ (MODE) PID.

Is A/C being requested?

Yes	No

Yes	No
REFER to the appropriate Climate Control article, to diagnose the A/C system.	For electric cooling fan(s) always on, GO to KN3. For all others, GO to KN4.

KN3 CHECK THE AIR CONDITIONING PRESSURE TRANSDUCER SENSOR

- Ignition OFF.
- Air Conditioning Pressure (ACP) Transducer Sensor connector disconnected.
- Ignition ON, engine running.

Does the cooling fan turn off?

Yes	No
REFER to the appropriate Climate Control article, to diagnose the Air Conditioning Pressure (ACP) Transducer Sensor.	GO to KN4.

KN4 COMMAND THE COOLING FAN ON TO CHECK OPERATION

NOTE: **Some vehicles have more than one cooling fan. Make sure both cooling fans operate correctly.**

- Ignition ON, engine OFF.
- Access the PCM and control the FAN_DSD (PER) PID.
- Command the fan to full ON.

Does the cooling fan operate when commanded ON?

Yes	No
The concern is elsewhere. RETURN to **NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** for further direction.	GO to KN5.

KN5 CHECK THE VOLTAGE TO THE COOLING FAN

- Ignition OFF.
- For Escape, Fiesta, Focus, and Transit Connect,
- CF Module connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-)
FANPWR - Pin 1	Ground

- For all others,
- Cooling Fan Motor 1 connector disconnected.
- Cooling Fan Motor 2 connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-)
FANPWR	Ground

- Measure the voltage between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-)
FANPWR	Ground

Is the voltage greater than 10.5 V?

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Yes	No
For Expedition, F-150, and Navigator, GO to KN14. For all others, GO to KN9.	For Expedition, F-150, and Navigator, GO to KN13. For all others, GO to KN6.

KN6 CHECK FOR VOLTAGE TO THE RELAY

- Ignition OFF.
- For Escape, Fiesta, Focus, and Transit Connect,
- FC Relay connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) FC Relay Connector, Harness Side	(-)
B+	Ground
VPWR	Ground

- For Ford GT,
- FC1 Relay connector disconnected.
- FC2 Relay connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) FC1 Relay Connector, Harness Side	(-)
B+	Ground
VPWR	Ground

- Measure the voltage between:

(+) FC2 Relay Connector, Harness Side	(-)
B+ - Pin 3	Ground
VPWR - Pin 1	Ground

- For all others,
- FC1 Relay connector disconnected.
- FC3 Relay connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) FC1 Relay Connector, Harness Side	(-)
B+	Ground
VPWR	Ground

- Measure the voltage between:

(+) FC3 Relay Connector, Harness Side	(-)
B+	Ground
VPWR	Ground

Are the voltages greater than 10.5 V?

Yes	No
GO to KN7.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KN7 CHECK THE RELAY

- Carry out the Relay Component Test. Refer to appropriate Wiring Diagrams, Component Testing article.

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Is a concern present?

Yes	No
INSTALL a new FC relay in question. Clear the PCM DTCs. REPEAT the self-test.	GO to KN8.

KN8 CHECK THE RELAY GROUND

- Ignition OFF.
- For Escape, Fiesta, Focus, and Transit Connect,
- Measure the resistance between:

(+) FC Relay Connector, Harness Side	(-)
GND	Ground

- For Ford GT,
- Measure the resistance between:

(+) FC1 Relay Connector, Harness Side	(-)
GND	Ground

- Measure the resistance between:

(+) FC2 Relay Connector, Harness Side	(-)
GND - Pin 2	Ground

- For all others,
- Measure the resistance between:

(+) FC1 Relay Connector, Harness Side	(-)
GND	Ground

- Measure the resistance between:

(+) FC3 Relay Connector, Harness Side	(-)
GND	Ground

Is the resistance less than 5 ohms?

Yes	No
GO to KN9.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KN9 CHECK FOR AN OPEN CIRCUIT

- Ignition OFF.
- PCM connector disconnected.
- For Escape, Fiesta, Focus, and Transit Connect,
- Measure the resistance between:

(+) CF Module Connector, Harness Side	(-)
GND - Pin 2	Ground

- Measure the resistance between:

(+) CF Module Connector, Harness Side	(-) PCM Connector, Harness Side
FCV - Pin 4	FCV

- Measure the resistance between:

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(+) FC Relay Connector, Harness Side	(-) CF Module Connector, Harness Side
FANPWR	FANPWR - Pin 1

- For Ford GT,
- Measure the resistance between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-)
GND	Ground

- Measure the resistance between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-) PCM Connector, Harness Side
FCV	FCV

- Measure the resistance between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-) FC1 Relay Connector, Harness Side
FANPWR	FANPWR

- Measure the resistance between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-)
GND	Ground

- Measure the resistance between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-) PCM Connector, Harness Side
FCV	FCV

- Measure the resistance between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-) FC2 Relay Connector, Harness Side
FANPWR	FANPWR - Pin 5

- For all others,
- Measure the resistance between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-)
GND	Ground

- Measure the resistance between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-) PCM Connector, Harness Side
FCV	FCV

- Measure the resistance between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-) FC1 Relay Connector, Harness Side
FANPWR	FANPWR

- Measure the resistance between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-)
GND	Ground

- Measure the resistance between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-) PCM Connector, Harness Side

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(+) Cooling Fan Motor 2 Connector, Harness Side	(-) PCM Connector, Harness Side
FCV	FCV

- Measure the resistance between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-) FC3 Relay Connector, Harness Side
FANPWR	FANPWR

Are the resistances less than 5 ohms?

Yes	No
GO to KN10.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KN10 CHECK THE FCV CIRCUIT FOR A SHORT TO GROUND

- For Escape, Fiesta, Focus, and Transit Connect,
- Measure the resistance between:

(+) CF Module Connector, Harness Side	(-)
FCV - Pin 4	Ground

- For all others,
- Measure the resistance between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-)
FCV	Ground

- Measure the resistance between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-)
FCV	Ground

Are the resistances greater than 10k ohms?

Yes	No
GO to KN11.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KN11 CHECK THE FCV CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For Escape, Fiesta, Focus, and Transit Connect,
- Measure the voltage between:

(+) CF Module Connector, Harness Side	(-)
FCV - Pin 4	Ground

- For all others,
- Measure the voltage between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-)
FCV	Ground

- Measure the voltage between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-)
FCV	Ground

Is any voltage present?

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Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to KN12.

KN12 CHECK THE FCV CIRCUITS FOR INTERMITTENT CONCERNS

NOTE: **Some vehicles have more than one cooling fan. Make sure both cooling fans operate correctly.**

NOTE: **Not all vehicles have all components listed.**

- Ignition OFF.
- CF Motor connector disconnected.
- Cooling Fan Motor 1 connector disconnected.
- Cooling Fan Motor 2 connector disconnected.
- Visually inspect all connectors for:
  - pushed out pins
  - corrosion
- CF Motor connector connected.
- CF Module connector connected.
- Cooling Fan Motor 1 connector connected.
- Cooling Fan Motor 2 connector connected.
- PCM connector connected.
- FC Relay connector connected.
- FC1 Relay connector connected.
- FC2 Relay connector connected.
- FC3 Relay connector connected.
- Ignition ON, engine OFF.
- Access the PCM and control the FAN_DSD (PER) PID.
- Command the fan to full ON.
- While observing the fan, wiggle, shake, and bend small sections of the wiring harness while working from the cooling fan to the PCM.

Is a concern present?

Yes	No
REPAIR as necessary. If a wiring concern is not present, INSTALL a new cooling fan. REFER to the appropriate Engine Cooling article. Clear the PCM DTCs. REPEAT the self-test.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

KN13 CHECK THE RELAY GROUND CIRCUIT

- Ignition OFF.
- BJB-C connector disconnected.
- Measure the resistance between:

(+) BJB-C Connector, Harness Side	(-)
GND - Pin 10, 6	Ground

Is the resistance less than 5 ohms?

Yes	No
GO to KN14.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KN14 CHECK FOR AN OPEN

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- Ignition OFF.
- PCM connector disconnected.
- BJB-B connector disconnected.
- Measure the resistance between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-)
GND	Ground

- Measure the resistance between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-) PCM Connector, Harness Side
FCV	FCV

- Measure the resistance between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-) BJB-B Connector, Harness Side
FANPWR	FANPWR - Pin 2, 26

- Measure the resistance between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-)
GND	Ground

- Measure the resistance between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-) PCM Connector, Harness Side
FCV	FCV

- Measure the resistance between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-) BJB-B Connector, Harness Side
FANPWR	FANPWR - Pin 2, 26

Are the resistances less than 5 ohms?

Yes	No
GO to KN15.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KN15 CHECK THE FCV FOR A SHORT TO GROUND

- Measure the resistance between:

(+) Cooling Fan Motor 1 Connector, Harness Side	(-)
FCV	Ground

- Measure the resistance between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-)
FCV	Ground

Are the resistances greater than 10k ohms?

Yes	No
GO to KN16.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KN16 CHECK THE FCV FOR A SHORT TO VOLTAGE

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

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(+) Cooling Fan Motor 1 Connector, Harness Side	(-)
FCV	Ground

- Measure the voltage between:

(+) Cooling Fan Motor 2 Connector, Harness Side	(-)
FCV	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to KN17.

KN17 CHECK THE FCV FOR INTERMITTENT CONCERNS

NOTE: **Some vehicles have more than one cooling fan. Make sure both cooling fans operate correctly.**

NOTE: **Not all vehicles have all components listed.**

- Ignition OFF.
- BJB-B connector disconnected.
- BJB-C connector disconnected.
- Cooling Fan Motor 1 connector disconnected.
- Cooling Fan Motor 2 connector disconnected.
- Visually inspect all connectors for:
  - pushed out pins
  - corrosion
- BJB-B connector connected.
- BJB-C connector connected.
- Cooling Fan Motor 1 connector connected.
- Cooling Fan Motor 2 connector connected.
- PCM connector connected.
- Ignition ON, engine OFF.
- Access the PCM and control the FAN_DSD (PER) PID.
- Command the fan to full ON.
- While observing the fan, wiggle, shake, and bend small sections of the wiring harness while working from the cooling fan to the PCM.

Is a concern present?

Yes	No
REPAIR as necessary. If a wiring concern is not present, INSTALL a new cooling fan. REFER to the appropriate Engine Cooling article. Clear the PCM DTCs. REPEAT the self-test.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS KP: CHARGE AIR COOLER (CAC)

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- CAC coolant temperature sensor (12A648)
- CAC pump (8501)

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- harness circuits: CAC, CACCTS, SIGRTN, PUMPPWR and GND
- PCM (12A650)

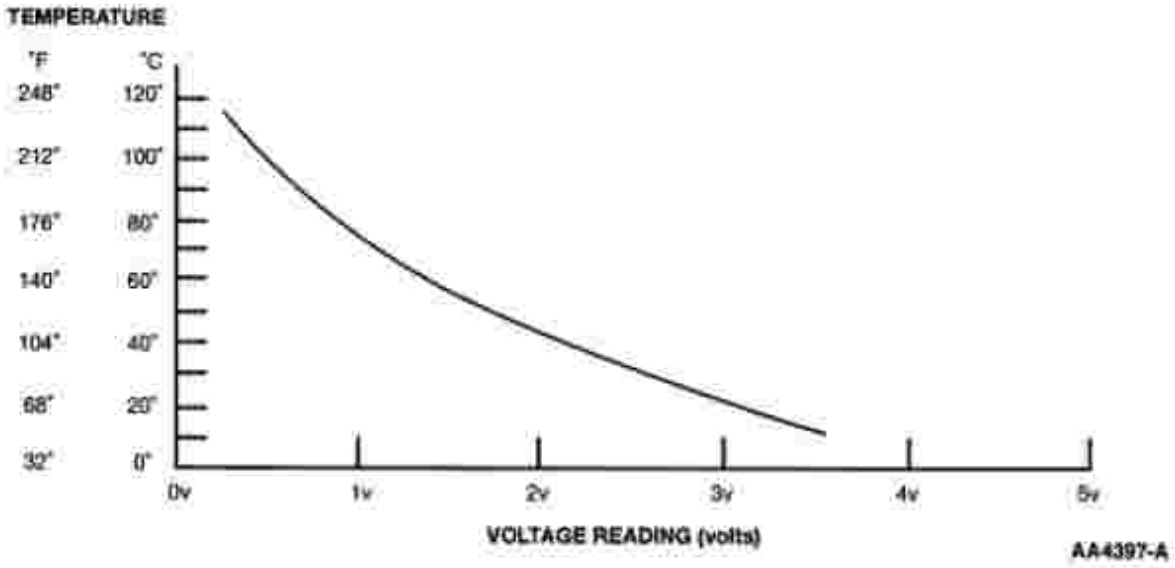

Fig. 180: Charge Air Cooler Voltage Graph
Courtesy of FORD MOTOR CO.

TEMPERATURE SENSOR VOLTAGE AND RESISTANCE SPECIFICATIONS

Temperature	Temperature Sensor Values	
Â°C	Â°F	Resistance (K ohms)
120	248	1.18
110	230	1.55
100	212	2.07
90	194	2.80
80	176	3.84
70	158	5.37
60	140	7.70
50	122	10.97
40	104	16.15
30	86	24.27
20	68	37.30
10	50	58.75
0	32	95.85
-10	14	160.31

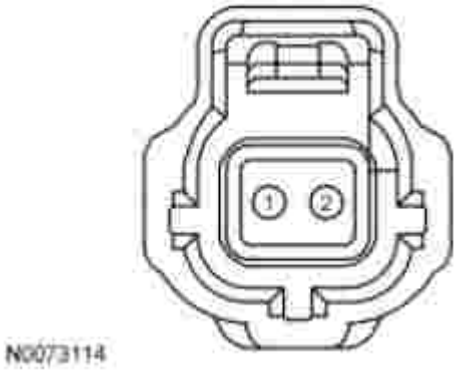

Fig. 181: Charge Air Cooler (CAC) Coolant Temperature Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)

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Pin	Circuit
1	CACCTS (Charge Air Cooler Coolant Temperature Signal)

N0073203

Fig. 182: Charge Air Cooler (CAC) Pump Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
3	CAC (Charge Air Cooler)
1	GND (Ground)
2	PUMPPWR (Pump Power)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Escape/Kuga	198 PIN	E2	CAC
Fusion	198 PIN	E13 B19 E23	CAC SIGRTN CACCTS

TEST PROCEDURE

KP1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

Are DTCs P00DF, P00E0, P00E1, P00E2, P023A, P023B, P023C or P026A present?

Yes	No
For DTC P00DF, P00E0, P00E1, P00E2, GO to KP2. For all others, GO to KP9.	For symptoms without DTCs, GO to KP2. For all others, RETURN to **SYMPTOM CHARTS** for further direction.

KP2 CHECK THE CAC 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. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

NOTE: **Verify cooling fan operation before proceeding with this test.**

- Check the CAC cooling system for any loss of coolant or overheating concerns.

Is the CAC cooling system OK?

Yes	No
GO to KP3.	REFER to the appropriate Engine Cooling article, Charge Air Cooling, to continue CAC cooling system diagnosis.

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KP3 CHECK THE RESISTANCE OF THE CAC COOLANT TEMPERATURE SENSOR

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

- Ignition OFF.
- Charge Air Cooler (CAC) Coolant Temperature Sensor connector disconnected.
- Measure the resistance between:

(+) Charge Air Cooler (CAC) Coolant Temperature Sensor Connector, Component Side	(-) Charge Air Cooler (CAC) Coolant Temperature Sensor Connector, Component Side
CACCTS - Pin 1	SIGRTN - Pin 2

Is the resistance within specification?

Yes	No
GO to KP4.	INSTALL a new Charge Air Cooler (CAC) Coolant Temperature sensor. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM), REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . Clear the PCM DTCs. REPEAT the self-test.

KP4 CHECK THE CAC COOLANT TEMPERATURE SENSOR CIRCUITS FOR AN OPEN

- PCM connector disconnected.
- Measure the resistance between:

(+) Charge Air Cooler (CAC) Coolant Temperature Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
CACCTS - Pin 1	CACCTS
SIGRTN - Pin 2	SIGRTN

Are the resistances less than 5 ohms?

Yes	No
GO to KP5.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KP5 CHECK THE CAC COOLANT TEMPERATURE SENSOR CIRCUITS FOR A SHORT TO GROUND

- Measure the resistance between:

(+) Charge Air Cooler (CAC) Coolant Temperature Sensor Connector, Harness Side	(-)
CACCTS - Pin 1	Ground
SIGRTN - Pin 2	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to KP6.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KP6 CHECK THE CAC COOLANT TEMPERATURE SENSOR CIRCUITS FOR A SHORT TO VOLTAGE

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

(+) Charge Air Cooler (CAC) Coolant Temperature Sensor Connector, Harness Side	(-)
CACCTS - Pin 1	Ground
SIGRTN - Pin 2	Ground

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Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to KP7.

KP7 CAC COOLANT TEMPERATURE SENSOR INTERMITTENT CHECK

- Charge Air Cooler (CAC) Coolant Temperature Sensor connector connected.
- PCM connector connected.
- Ignition ON, engine OFF.
- Access the PCM and monitor the CACCT_V (VOLT) PID.
- While observing the PID, wiggle, shake, and bend small sections of the wiring harness while working from the sensor to the PCM.
- Lightly tap on the CAC coolant temperature sensor and wiggle the harness and connector to simulate road shock.

Does the PID reading change?

Yes	No
REPAIR as necessary or INSTALL a new CAC coolant temperature sensor. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM), REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .	GO to KP8.

KP8 CHECK THE CHARGE AIR COOLER COOLANT TEMPERATURE AND THE ENGINE COOLANT TEMPERATURE CORRELATION

NOTE: **Check temperature values while engine is at ambient temperature, cold soak the engine for a minimum of 6 hours if necessary. Make sure the vehicle has not been in direct sun light.**

NOTE: **All PIDs may not be available on all vehicles.**

- Access the PCM and monitor the CACCT (TEMP), ECT (TEMP) and ECT1 (TEMP) PIDs.

Are the temperature readings within 16.6Â° C (30Â°F) of each other?

Yes	No
GO to KP14.	INSTALL a new Charge Air Cooler (CAC) Coolant Temperature sensor. REFER to the appropriate Electronic Engine Controls article. RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . Clear the PCM DTCs. REPEAT the self-test.

KP9 CHECK THE PUMPPWR CIRCUIT FOR AN OPEN

- Ignition OFF.
- Charge Air Cooler (CAC) Pump connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Charge Air Cooler (CAC) Pump Connector, Harness Side	(-)
PUMPPWR - Pin 2	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to KP10.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KP10 CHECK THE GND CIRCUIT FOR AN OPEN

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- Ignition OFF.
- Measure the resistance between:

(+) Charge Air Cooler (CAC) Pump Connector, Harness Side	(-)
GND - Pin 1	Ground

Is the resistance less than 5 ohms?

Yes	No
GO to KP11.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KP11 CHECK THE CAC CIRCUIT FOR AN OPEN

- PCM connector disconnected.
- Measure the resistance between:

(+) Charge Air Cooler (CAC) Pump Connector, Harness Side	(-) PCM Connector, Harness Side
CAC - Pin 3	CAC

Is the resistance less than 5 ohms?

Yes	No
GO to KP12.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

KP12 CHECK THE CAC CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

(+) Charge Air Cooler (CAC) Pump Connector, Harness Side	(-)
CAC - Pin 3	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to KP13.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

KP13 CHECK THE CAC CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) Charge Air Cooler (CAC) Pump Connector, Harness Side	(-)
CAC - Pin 3	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new Charge Air Cooler (CAC) Pump. REFER to the appropriate Engine Cooling article, Charge Air Cooling. Clear the PCM DTCs. REPEAT the self-test.

KP14 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.

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- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. GO to **PINPOINT TEST Z**.

PINPOINT TESTS QA: UNABLE TO ACTIVATE SELF-TEST/NETWORK COMMUNICATION ERROR

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- unable to communicate with powertrain control module (PCM)
- unable to activate the PCM self-test
- incorrect self-test procedure
- harness circuits: ISP-R, PCMRC, PWRGND and VPWR

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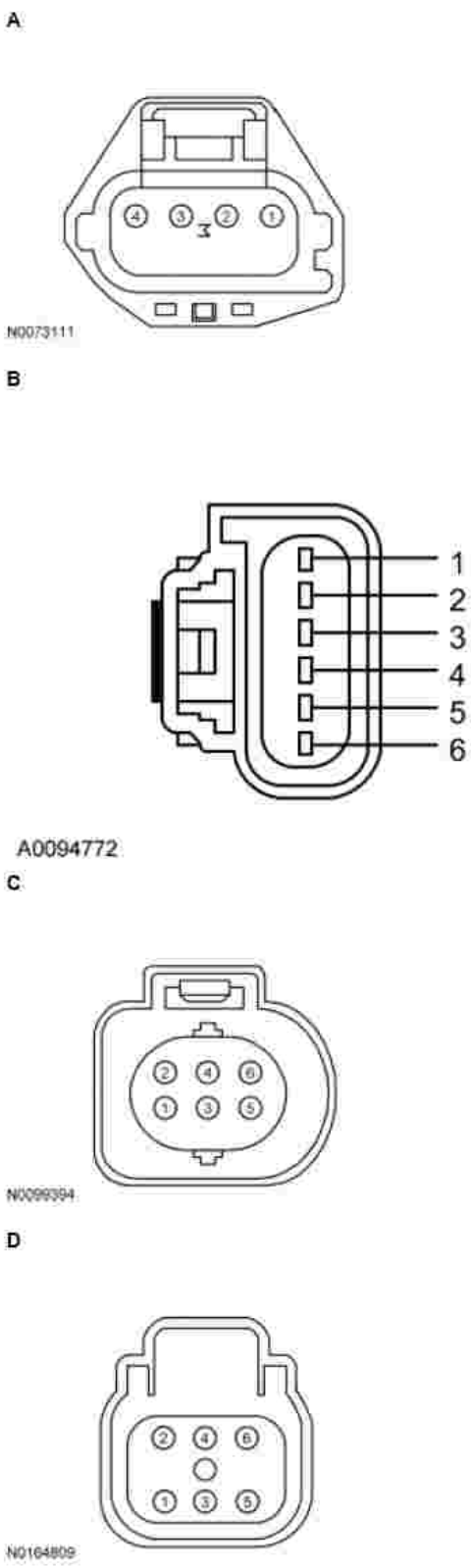

Fig. 183: Electronic Throttle Body Throttle Position Sensor (ETBTPS) Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
E-Series 6.8L, Explorer GTDI 3.5L, F-650/F-750, F-Series Super Duty 6.8L, Flex GTDI 3.5L, MKT 3.5L, Motorhome/Stripped Chassis/Step Van, Taurus GTDI 3.5L	A	3 2	ETCRTN ETCREF
EcoSport 2.0L	B	5 4	ETCRTN ETCREF

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Vehicle	Connector	Pin	Circuit
EcoSport 1.5L, EcoSport 1.0L, Escape/Kuga 1.5L, Fiesta 1.0L, Focus 1.0L, Fusion 1.5L, KA 1.0L	C	3 1	ETCRTN ETCREF
Fiesta 1.6L	D	2 6	ETCRTN ETCREF
KA 1.5L	C	2 6	ETCRTN ETCREF
All other vehicles	B	4 5	ETCRTN ETCREF

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Continental 3.7L, E-Series, Edge 3.5L, Explorer TiVCT 3.5L, Explorer 3.7L, F-650/F-750, F-Series Super Duty, Flex TiVCT 3.5L, MKT 3.7L, MKX 3.7L, Motorhome/Stripped Chassis/Step Van, Mustang 5.2L, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L	198 PIN	B100, B102, B103, B5 B97, B99 B20 B64	PWRGND VPWR PCMRC ISP-R
EcoSport 1.5L Automatic Transmission, Escape/Kuga 2.5L, Transit Connect	198 PIN	B100, B102, B103, B5 B97, B99 B20 B41	PWRGND VPWR PCMRC ISP-R
EcoSport 1.5L Manual Transmission	112 PIN	B49, B50, B51 B55, B56 B25 B43	PWRGND VPWR PCMRC ISP-R
Escape/Kuga 1.5L	198 PIN	B96, B97, B98, B99 B101, B102, B103 B37 B36	PWRGND VPWR PCMRC ISP-R
Expedition, Navigator	198 PIN	B96, B97, B98, B99 B101, B102, B103 B25 B48	PWRGND VPWR PCMRC ISP-R
F-150 2.7L, F-150 3.3L, F-150 5.0L, Mustang 5.0L	306 PIN	B46, B47, B61, B62, B76, B77 B1, B16, B2 B60 B13	PWRGND VPWR PCMRC ISP-R
F-150 3.5L	198 PIN	B96, B97, B98, B99 B101, B102, B103 B25 B83	PWRGND VPWR PCMRC ISP-R

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Vehicle	Connector	Pin	Circuit
Fiesta 1.0L, Fiesta GTDI 1.6L	198 PIN	B96, B97, B99 B101, B102, B103 B58 B48	PWRGND VPWR PCMRC ISP-R
Fiesta TiVCT 1.6L	128 PIN	B35, B36, B47, B48 B11, B12, E13, E37 B1 B8	PWRGND VPWR PCMRC ISP-R
Focus GDI 2.0L	154 PIN	B1, B2, B4 B5, B6 B27 B15	PWRGND VPWR PCMRC ISP-R
Fusion 2.5L	198 PIN	B50, B69, B70 B97, B99 B20 B41	PWRGND VPWR PCMRC ISP-R
KA	128 PIN	B48, E12, T23, T31, T32 B36, E24 B37 B45	PWRGND VPWR PCMRC ISP-R
Mustang 2.3L	198 PIN	B96, B97, B98, B99 B101, B102, B103 B25 B64	PWRGND VPWR PCMRC ISP-R
Ranger	128 PIN	B35, B36, B47, B48 B11, B12 B1 B8	PWRGND VPWR PCMRC ISP-R
All other vehicles	198 PIN	B96, B97, B98, B99 B101, B102, B103 B58 B48	PWRGND VPWR PCMRC ISP-R

TEST PROCEDURE

QA1 CARRY OUT A VEHICLE INSPECTION AND VERIFY THE SELF-TEST PROCEDURE

NOTE: **Check for BCM DTCs. Diagnose all PCM circuit DTCs retrieved from the BCM before entering this pinpoint test. Refer to the appropriate Service Information article for the BCM DTC diagnosis.**

NOTE: **If the self-test or communication concern occurred after a failed or an aborted reprogram, the module may be blank. Attempt to reprogram the module again before continuing with this pinpoint test.**

- Visually inspect the following for obvious signs of electrical damage:
  - harness wiring
  - electrical connections
- Verify the correct procedure was used to activate the self-test for the scan tool. Refer to **SCAN TOOL SETUP AND FUNCTIONALITY** .

Was the correct self-test procedure used?

Yes	No
GO to QA2.	REFER to **SCAN TOOL SETUP AND FUNCTIONALITY** .

QA2 CARRY OUT THE NETWORK TEST

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NOTE: **When using Integrated Diagnostic System (IDS), the scan tool attempts to communicate with the PCM first. After establishing communication with the PCM, the scan tool then attempts to communicate with all modules on the vehicle. If an IDS session cannot be established, IDS may state no communication can be established with the PCM:**

- choose No when the scan tool prompts whether or not to retry communication.
- enter a PCM part number, tear tag or calibration number to identify the vehicle and start a session. The PCM part number and 4-character tear tag are located on the PCM.
- Ignition ON, engine OFF.
- Carry out the network test.

Do all modules indicate pass?

Yes	No
For DTCs U0101, U0402, U1011 or U1013, GO to QA7. For DTC U0104, GO to QA12. For DTCs P1935, U0121, U0415, U1012 or U1039, GO to QA8. For DTC U0138, GO to QA13. For DTCs U0140 or U0422, GO to QA9. For DTCs U0155 or U0423, GO to QA10. For DTC U0212, GO to QA11. For DTC U0298, GO to QA14. For all others, REFER to Symptom Charts, GO to **PINPOINT TEST QT** .	If only PCM indicates fail, GO to QA3. For network test or all other modules indicates fail, REFER to the appropriate Module Communications Network article, to diagnose the PCM does not respond to the scan tool or no high speed controller area network (CAN) communication, all modules are not responding symptom.

QA3 CHECK FOR VREF VOLTAGE AT THE ETBTPS SENSOR

- Ignition ON, engine OFF.
- ETBTPS connector disconnected.
- Measure the voltage between:

(+) ETBTPS Connector, Harness Side	(-) ETBTPS Connector, Harness Side
ETCREF	ETCRTN

Is the voltage between 4.5 - 5.5 V?

Yes	No
REFER to the appropriate Module Communications Network article, to diagnose the PCM does not respond to the scan tool or no high speed controller area network (CAN) communication, all modules are not responding symptom.	GO to QA4.

QA4 CHECK THE ISP-R VOLTAGE AT THE PCM

- Ignition OFF.
- PCM connector disconnected.
- Ignition ON, engine OFF.

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- Measure the voltage between:

(+) PCM Connector, Harness Side	(-)
ISP-R	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to QA5.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

QA5 CHECK THE PCM VPWR CIRCUITS FOR VOLTAGE

- Ignition OFF.
- Disconnect the PCM.
- Connect a 5 amp fused jumper wire between the following:

Point A PCM Connector, Harness Side	Point B
PCMRC	Ground

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

(+) PCM Connector, Harness Side	(-)
VPWR	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to QA6.	GO to **PINPOINT TEST B**.

QA6 CHECK THE PCM GROUND CIRCUITS FOR AN OPEN

- Ignition OFF.
- Measure the resistance between:

(+) PCM Connector, Harness Side	(-)
PWRGND	Ground

Is the resistance less than 5 ohms?

Yes	No
GO to QA17.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

QA7 CHECK FOR A TRANSMISSION CONTROL MODULE (TCM) CONCERN

- Check for any TCM DTCs.
- Check for other TCM related symptoms.

Is a concern present?

Yes	No
REFER to the appropriate Automatic Transmission article, DTC Charts to continue diagnosis.	For DTCs U1011 or U1013, GO to QA15. For all others, GO to QA17.

QA8 CHECK FOR AN ANTI-LOCK BRAKE SYSTEM (ABS) MODULE CONCERN

- Check for any ABS module DTCs.
- Check for other ABS related symptoms.

Is a concern present?

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Yes	No
REFER to the appropriate Anti-Lock Brake System And Stability Control article, Vehicle Dynamic Systems, DTC Charts to continue diagnosis.	For DTC P1935, The test is complete. Clear the PCM DTCs. REPEAT the self-test. For DTC U1012, GO to QA15. For all others, GO to QA17.

QA9 CHECK FOR A BODY CONTROL MODULE (BCM) CONCERN

- Check for any BCM DTCs.
- Check for other BCM related symptoms.

Is a concern present?

Yes	No
REFER to the appropriate Multifunction Electronic Modules article, DTC Charts to continue diagnosis.	GO to QA17.

QA10 CHECK FOR AN INSTRUMENT PANEL CLUSTER (IPC) CONCERN

- Check for any IPC DTCs.
- Check for other IPC related symptoms.

Is a concern present?

Yes	No
REFER to the appropriate Instrumentation, Message Center, And Warning Chimes article, DTC Charts to continue diagnosis.	GO to QA17.

QA11 CHECK FOR A CRUISE CONTROL CONCERN

- Check for any other PCM DTCs.
- Check for other PCM related symptoms.

Is a concern present?

Yes	No
Refer to the appropriate Cruise Control article to continue diagnosis of the cruise control system.	GO to QA17.

QA12 CHECK FOR A STEERING ANGLE SENSOR MODULE (SASM) CONCERN

- Check for any SASM DTCs.
- Check for other SASM related symptoms.

Is a concern present?

Yes	No
REFER to the appropriate Anti-Lock Brake System And Stability Control article, Vehicle Dynamic Systems to continue diagnosis of the SASM system.	GO to QA17.

QA13 CHECK FOR AN ALL TERRAIN CONTROL MODULE (ATCM) CONCERN

- Check for any ATCM DTCs.
- Check for other ATCM related symptoms.

Is a concern present?

Yes	No

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Yes	No
REFER to the appropriate Four Wheel Drive 4WD Systems article to continue diagnosis of the ATCM system.	GO to QA17.

QA14 CHECK FOR A DC TO DC CONVERTOR CONTROL MODULE CONCERN

- Check for any DC to DC convertor control module DTCs.
- Check for other DC to DC convertor control module related symptoms.

Is a concern present?

Yes	No
REFER to the appropriate Voltage Convertor/Invertor article to continue diagnosis of the DC to DC control module system.	GO to QA17.

QA15 CHECK FOR A POWERTRAIN CONTROL MODULE (PCM) CONCERN

- Check for any other PCM DTCs.

Is a concern 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 QA16.

QA16 REFLASH THE PCM

- Clear the PCM DTCs.
- Reprogram or update the PCM calibration. Refer to **FLASH ELECTRICALLY ERASABLE PROGRAMMABLE READ ONLY MEMORY (EEPROM)** , Programming the VID Block for a Replacement PCM.
- Road test the vehicle.
- Carry out the PCM self-test.
- Verify the concern is still present.

Is the concern still present?

Yes	No
For Fiesta and Focus with DTC U1013, INSTALL a new TCM. REFER to the appropriate Automatic Transmission article, Automatic Transmission. Clear the PCM DTCs. REPEAT the self-test. For DTC U1012, REPROGRAM or UPDATE the ABS Calibration. REFER to the appropriate Module Configuration article. Clear the PCM DTCs. REPEAT the self-test. For all others, REPROGRAM or UPDATE the TCM Calibration. REFER to the appropriate Module Configuration article. Clear the PCM DTCs. REPEAT the self-test.	The system is operating correctly at this time.

QA17 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 network test and verify the concern is still present.
- Carry out the PCM self-test.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS QB: KEEP ALIVE POWER (KAPWR)

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- battery terminal condition
- KAPWR wire routing
- harness circuit: KAPWR
- powertrain control module (PCM) (12A650)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
E-Series, Motorhome/Stripped Chassis/Step Van	198 PIN	B21	KAPWR
EcoSport	112 PIN	B10	KAPWR
Escape/Kuga 2.5L, Fusion 2.5L	198 PIN	B62	KAPWR
Fiesta, Ranger	128 PIN	B10	KAPWR
All other vehicles	198 PIN	B100	KAPWR

TEST PROCEDURE

QB1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: **The DTC P2610 may set after a PCM reprogramming. If this DTC is retrieved after a PCM reprogramming, disregard this DTC.**

- Carry out a visual inspection.
- Record the DTCs.
- Record the freeze frame data.
- Clear the PCM DTCs.
- Carry out the PCM self-test.

Are DTCs P0603, P1633 or P2610 present?

Yes	No
For DTC P2610, GO to QB6. For all others, GO to QB2.	Unable to duplicate the condition. CHECK for a loose connection, and damaged or corroded pins. WIGGLE the harness attempting to recreate the concern. REPAIR as necessary, GO to **PINPOINT TEST QT** , if a driveability concern exists. Clear the PCM DTCs. REPEAT the self-test.

QB2 CHECK THE 12-VOLT BATTERY TERMINALS

NOTE: **If the KAPWR is interrupted to the PCM, a DTC can be generated on the first power-up.**

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NOTE: **If DTC P0603 occurred right after or during an unsuccessful reprogramming of the PCM, clear the DTCs and repeat the PCM self-test. If DTC P0603 is retrieved again, continue with this pinpoint test.**

- Inspect the 12 volt battery cables for loose connections and for corrosion.

Are the 12 volt battery terminal connections in good condition?

Yes	No
GO to QB3.	REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.

QB3 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 incorrectly routed wiring. If necessary re-route and secure the wiring.
- Visually inspect the wiring and connectors.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	For E-Series, Fiesta 1.6L TiVCT, Ford GT, Motorhome/Stripped Chassis/Step Van, and Ranger, GO to QB4. For all others, GO to QB5.

QB4 CHECK KAPWR TO THE PCM

- Ignition OFF.
- PCM connector disconnected.
- Measure the voltage between:

(+) PCM Connector, Harness Side	(-) 12 Volt Vehicle Battery
KAPWR	Negative terminal

Is the voltage greater than 10.5 V?

Yes	No
GO to QB5.	ISOLATE the concern and REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.

QB5 CHECK FOR A REOCCURRENCE OF THE DTC

- PCM connector connected.
- Clear the PCM DTCs.
- Test drive the vehicle and allow the engine to reach normal operating temperature.
- Carry out the PCM self-test.

Is DTC P0603 or P1633 present?

Yes	No
GO to QB8.	Unable to duplicate or identify the concern at this time. GO to **PINPOINT TEST Z**.

QB6 CHECK THE ENGINE OFF TIMER

NOTE: **Turning the ignition ON then OFF without an engine start for the purpose of checking the engine coolant temperature does not affect the test results.**

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- Ignition ON, engine running.
- Allow the engine to stabilize at the correct operating temperature.
- Ignition OFF.
- Ignition ON, engine OFF.
- Clear the PCM DTCs.
- Ignition OFF.
- Allow the engine to cold soak long enough for the engine coolant temperature to drop at least 16.7Â°C (30Â°F).
- Ignition ON, engine OFF.
- Carry out the PCM self-test.

Is DTC P2610 present?

Yes	No
GO to QB7.	Unable to duplicate the condition. GO to **PINPOINT TEST QT** , to continue diagnosis.

QB7 CHECK FOR ANY BODY CONTROL MODULE (BDYCM) DTCS

- Carry out the BdyCM self-test.

Are any DTCs present?

Yes	No
REFER to the Multifunction Electronic Modules article, to continue diagnosis.	GO to QB8.

QB8 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.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS QC: ON BOARD DIAGNOSTIC (OBD) SYSTEMS READINESS

INTRODUCTION

NOTE: **The vehicle may not have completed an OBD drive cycle. This is indicated by the inspection maintenance (I/M) readiness status not complete. In some areas, the OBD drive cycle must be completed to pass an I/M test. Refer to ON BOARD DIAGNOSTIC (OBD) DRIVE CYCLE .**

TEST PROCEDURE

QC1 CHECK FOR PTO

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Is the vehicle equipped with PTO?

Yes	No
GO to QC2.	INFORM the customer the law in your area may require additional driving to complete an inspection/maintenance test.

QC2 CHECK THE PTO PID

- Ignition ON, engine running.
- Access the PCM and monitor the PTO_STATUS (MODE) PID.
- Cycle the PTO switch/actuator ON and OFF. (Follow the PTO aftermarket instructions).

Does the PTO PID cycle ON and OFF?

Yes	No
INFORM the customer the law in your area may require additional driving to complete an inspection/maintenance test.	GO to **PINPOINT TEST FB**.

PINPOINT TESTS QD: DTC P1260: PASSIVE ANTI-THEFT SYSTEM

INTRODUCTION

NOTE: **The passive anti-theft system (PATS) uses radio frequency identification technology to deter a drive away theft. Passive means that it does not require any activity from the user. The PATS uses a specially encoded ignition key. Each encoded ignition key contains a permanently installed electronic device called a transponder. Each transponder contains a unique electronic identification code. Each encoded ignition key must be programmed into the vehicle before it can be used to start the engine. DTC P1260 is stored any time the PCM disables the vehicle because of the PATS. This DTC can also be set when a new instrument panel cluster (IPC) or powertrain control module (PCM) is installed without correctly programming either module even if the vehicle is not equipped with PATS. If a new IPC or PCM is installed without correctly programming either module, the parameters must be reset in both modules. Refer to the appropriate Anti-Theft article, Parameter Reset, to continue diagnosis.**

TEST PROCEDURE

QD1 CHECK FOR PATS DTCS

- Repair all PATS DTCs before P1260. Refer to the appropriate Anti-Theft article for System Description, Operation and Self-Test.

Are all PATS DTCs diagnosed?

Yes	No
GO to QD2.	REFER to the appropriate Anti-Theft article, to diagnose any PATS-related DTCs.

QD2 CHECK FOR ANY OTHER POWERTRAIN DTCS

- Repair all powertrain DTCs other than P1260.

Are all other powertrain DTCs diagnosed?

Yes	No
GO to QD3.	DISREGARD DTC P1260. DIAGNOSE all other powertrain DTCs. REFER to **DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS** .

QD3 ATTEMPT TO START THE ENGINE

- Carry out a keep alive memory reset to clear DTC P1260. Refer to **RESETTING THE KEEP ALIVE MEMORY (KAM)** .
- Attempt to start the engine.

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Does the engine start?

Yes	No
No system concerns exist at the present time. For intermittent no start or start stalls, CHECK for intermittent PATS concerns (PATS cannot stall the engine after 1 second of operation). For intermittent stalls while driving, VERIFY scan tool to PCM communication during the concern. If a PCM communication error occurs, the possible causes are: loss of voltage or ground to the PCM, damaged PCM power relay, or a damaged EEC PWR diode. REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	DTC P1260 is not the cause of the No Start. REFER to **NO DIAGNOSTIC TROUBLE CODES (DTCS) PRESENT SYMPTOM CHART INDEX** .

PINPOINT TESTS QE: ELECTRONIC THROTTLE CONTROL (ETC) SYSTEM

INTRODUCTION

NOTE: **Diagnose and repair the following DTCs through DIAGNOSTIC TROUBLE CODE (DTC) CHARTS AND DESCRIPTIONS , and the Service Information article respectively before entering this pinpoint test:**

- C1165
- P0102-P0104
- P0106-P0108
- P0236-P0238
- P0321
- P0715
- P0720
- P0731-P0735
- P2227-P2229
- U1027

This pinpoint test is intended to diagnose the informational PCM DTCs.

The informational DTCs are the result of the failure mode effects management (FMEM) operating strategy that maintains limited vehicle function in the event of a PCM, harness or component concern.

Circuit DTCs can be accompanied by the informational DTCs and should be diagnosed first. Informational DTCs without circuit DTCs may or may not indicate the actual concern and should be diagnosed as a symptom.

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
Continental 3.7L, E-Series, EcoSport 1.5L Automatic Transmission, Edge 3.5L, Escape/Kuga 2.5L, Explorer TiVCT 3.5L, Explorer 3.7L, F-650/F-750, F-Series Super Duty, Flex TiVCT 3.5L, Fusion 2.5L, MKT 3.7L, MKX 3.7L, Motorhome/Stripped Chassis/Step Van, Mustang 5.2L, Taurus TiVCT 3.5L, Taurus 3.7L, Transit 3.7L, Transit Connect	198 PIN	B97, B99 B20	VPWR PCMRC
EcoSport 1.5L Manual Transmission	112 PIN	B55, B56 B25	VPWR PCMRC
Escape/Kuga 1.5L	198 PIN	B101, B102, B103 B37	VPWR PCMRC
Expedition, F-150 3.5L, Mustang 2.3L, Navigator	198 PIN	B101, B102, B103 B25	VPWR PCMRC
F-150 2.7L, F-150 3.3L, F-150 5.0L, Mustang 5.0L	306 PIN	B1, B16, B2 B60	VPWR PCMRC
Fiesta TiVCT 1.6L	128 PIN	B11, B12, E13, E37 B1	VPWR PCMRC
Focus GDI 2.0L	154 PIN	B5, B6 B27	VPWR PCMRC
KA	128 PIN	B36, E24 B37	VPWR PCMRC
Ranger	128 PIN	B11, B12 B1	VPWR PCMRC
All other vehicles	198 PIN	B101, B102, B103 B58	VPWR PCMRC

TEST PROCEDURE

QE1 CHECK FOR DTCS

NOTE: **For DTC P061A, P061B or P162D make sure the air cleaner and air inlet are correctly seated and correctly installed before continuing diagnosis.**

Are any DTCs present other than the following: P0600, P060A, P060B, P060C, P060D, P061A, P061B, P061C, P061D, P061F, P062B, P062C, P162D, P1674 or U0300?

Yes	No

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Yes	No
RETURN to **SYMPTOM CHARTS** for further direction.	For DTCs P0600, P060A or U0300, GO to QE2. For DTC P060B, GO to QE4. For DTCs P061A, P061B or P162D, GO to QE11. For DTC P061C, GO to QE6. For DTC P061F, GO to QE8. For DTC P062B, GO to QE5. For DTC P062C, GO to QE9. For all others, GO to QE3.

QE2 CHECK THE PCM VOLTAGE CIRCUITS FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Connect a 5 amp fused jumper wire between the following:

Point A PCM Connector, Harness Side	Point B
PCMRC	Ground

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

(+) PCM Connector, Harness Side	(-)
VPWR	Ground

Is the voltage greater than 10.5 V?

Yes	No
GO to QE3.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

QE3 CHECK THE PCM FOR THE LATEST CALIBRATION

- Ignition OFF.
- Remove the jumper wires.
- PCM connector connected.
- Program the PCM to the latest calibration.
- Ignition OFF.
- Ignition ON, engine OFF.
- Ignition OFF.
- Ignition ON, engine running.
- Use the customer information to recreate the concern.
- Carry out the PCM self-test.

Are DTCs P0600, P060A, P060C, P060D, P061D, P1674 or U0300 present?

Yes	No
GO to QE14.	The concern is not present at this time.

QE4 CHECK FOR REFERENCE VOLTAGE CONCERNS

- Inspect the PCM harness for damage.
- Verify the correct operation of the sensors using ETCREF, VREF and related circuits. GO to **PINPOINT TEST C** and follow the pinpoint test direction.

Is a concern present?

Yes	No

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Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to QE5.

QE5 CHECK FOR AN INTERMITTENT CONCERN

- Clear the PCM DTCs.
- Carry out the PCM KOER self-test.

Are DTCs P060B or P062B present?

Yes	No
GO to QE14.	The concern is not present at this time.

QE6 CHECK THE CRANKSHAFT POSITION (CKP) SENSOR FOR CORRECT OPERATION

- Verify correct operation of the CKP sensor and related circuits. GO to **PINPOINT TEST JD** and follow the pinpoint test direction.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to QE7.

QE7 CHECK THE CAMSHAFT POSITION (CMP) SENSOR FOR CORRECT OPERATION

- Verify correct operation of the CMP sensor and related circuits. GO to **PINPOINT TEST DR** and follow the pinpoint test direction.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to QE8.

QE8 VERIFY THE CUSTOMER CONCERN

- Clear the PCM DTCs.
- Use the customer information to recreate the concern.
- Carry out the PCM self-test.

Are DTCs P061C or P061F present?

Yes	No
GO to QE14.	The concern is not present at this time.

QE9 CHECK FOR DTCS IN OTHER VEHICLE MODULES

NOTE: **If DTC P062C is retrieved after a PCM reprogramming, turn the ignition OFF and allow the PCM to complete a normal power down sequence. Carry out the self-test before continuing with this pinpoint test.**

- Check for self-test DTCs in all of the vehicle modules.

Are any DTCs present?

Yes	No
REFER to the applicable Service Information article to DIAGNOSE the DTC.	GO to QE10.

QE10 CHECK FOR THE PRESENCE OF ANY MODULE COMMUNICATION CONCERNS

- Check for self-test DTCs in all of the vehicle modules.

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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 applicable Service Information article to DIAGNOSE the communication DTC.	GO to QE13.

QE11 CHECK FOR THE PRESENCE OF PCM DTCS

NOTE: **An intermittent CKP sensor or harness concern may cause DTC P061A, P061B or P162D to set. Check for intermittent CKP sensor and harness concerns.**

- Clear the PCM DTCs.
- Check for self-test DTCs.

Are any DTCs present other than P061A, P061B or P162D?

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 QE12.

QE12 CHECK FOR MASS AIRFLOW (MAF) AND THROTTLE POSITION (TP) SENSOR CORRELATION CONCERNS

NOTE: **For vehicles without a MAF sensor, follow the No answer.**

NOTE: **For a MAF and TP sensor correlation concern DTC P061A, P061B or P162D may set before DTC P0068 sets.**

- Check for a MAF and TP sensor correlation concern. GO to **PINPOINT TEST DV** and follow the pinpoint test direction for DTC P0068.

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	For DTC P0068, CHECK for an intermittent concern with an ETC related harness or sensor. GO to **PINPOINT TEST Z**. For all others, GO to QE13.

QE13 CHECK FOR ANTILOCK BRAKING SYSTEM (ABS) AND WHEEL SPEED SENSOR CONCERNS

- Ignition ON, engine running.
- Access the PCM and monitor the VSS (SPD) PID.
- Access the ABS and monitor the LF_WSPD (SPD), LR_WSPD (SPD), RF_WSPD (SPD) and RR_WSPD (SPD) PIDs.
- Road test the vehicle under various load conditions while comparing the PIDs. Check for signals that are intermittent or do not correspond.

Do the PID values correspond with the vehicle operating conditions?

Yes	No
CHECK for an intermittent concern with an ETC related harness or sensor. GO to **PINPOINT TEST Z**.	REFER to the appropriate Anti-Lock Brake System And Stability Control article, Vehicle Dynamic Systems, to DIAGNOSE any ABS concerns.

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QE14 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.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS RA: PARTICULATE FILTER SYSTEM

INTRODUCTION

WARNING: **MANUAL REGENERATION OF THE PARTICULATE FILTER CAUSES THE EXHAUST GAS TO QUICKLY GET VERY HOT. INITIATE A MANUAL REGENERATION ONLY WHEN THE VEHICLE IS ON THE GROUND WITH THE AREA AROUND THE TAILPIPE FREE OF PEOPLE, OBSTRUCTIONS, FOREIGN MATERIAL OR OTHER ITEMS. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN SERIOUS PERSONAL INJURY.**

NOTE: **Regeneration may occur during normal operation. During regeneration, diagnostic procedures may display biased values. If a regeneration occurs during diagnostic procedures, allow the process to complete before continuing diagnostics.**

This pinpoint test is intended to diagnose the following:

- particulate filter (5H270)

TEST PROCEDURE

RA1 PRELIMINARY DIAGNOSIS

Are DTCs P226D, P226E, P242F, P246C, P243A or P243B present?

Yes	No
GO to RA2.	For vehicles with regeneration concerns and no DTCs present, GO to RA4. For all others, GO to RA2.

RA2 CHECK THE DPF_LOAD_PCT PID STATE

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

Is the percentage 100% or greater?

Yes	No
GO to RA3.	No system concerns exist at the present time. CLEAR the DTCs. REPEAT the self-test.

RA3 CHECK FOR A DAMAGED PARTICULATE FILTER

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NOTE: **The presence of soot in the tailpipe may indicate cracks or leaks in the particulate filter substrate.**

- Ignition OFF.
- Visually inspect the exhaust system for the following:
  - aftermarket accessories and performance modifications
  - damaged particulate filter
  - leaks, cracks, or punctures
  - leaks in the particulate filter pressure bank 1, sensor 1 connecting hose
  - leaks in the particulate filter pressure bank 2, sensor 1 connecting hose
  - tailpipe modifications that increase or decrease the exhaust restriction
- Remove the particulate filter pressure bank 1, sensor 1.
- Remove the particulate filter pressure bank 2, sensor 1.
- Use a suitable method to temporarily plug the exhaust pipe outlet, particulate filter pressure bank 1, sensor 1, and particulate filter pressure bank 2, sensor 1 openings.
- Connect the Evaporative Emission Leak Detector with On Board Nitrogen Generator 218-522C or equivalent to the exhaust system.
- Fill the exhaust system with smoke.
- Check the exhaust system for leaks and restrictions.

Are any concerns present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to RA4.

RA4 CHECK FOR ANY OTHER DTC

- Check for self-test DTCs.

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** .	GO to RA5.

RA5 IDENTIFY THE CUSTOMER'S DRIVING HABITS

NOTE: **Some vehicle operating conditions may cause excessive soot load at the particulate filter. The conditions that cause this DTC to set are cumulative.**

- Check with the customer for the following conditions:
- excessive idle time
- excessive low speed operation
- multiple short trips
- stopping the engine during regeneration

Is the vehicle consistently operated at extended idle or low speeds, on multiple short trips, or with multiple interrupted regenerations?

Yes	No

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Yes	No
ADVISE the customer of the conditions that may cause the DTC. ADVISE the customer to follow all DRIVE TO CLEAN EXHAUST messages on the message center. CARRY OUT the particulate filter manual regeneration with the scan tool. REFER to **SCAN TOOL SETUP AND FUNCTIONALITY** . Clear the PCM DTCs. REPEAT the self-test.	The test is complete and no concerns are present. Clear the PCM DTCs. REPEAT the self-test.

PINPOINT TESTS RB: EXHAUST GAS TEMPERATURE (EGT) SENSOR

INTRODUCTION

WARNING: **MANUAL REGENERATION OF THE PARTICULATE FILTER CAUSES THE EXHAUST GAS TO QUICKLY GET VERY HOT. INITIATE A MANUAL REGENERATION ONLY WHEN THE VEHICLE IS ON THE GROUND WITH THE AREA AROUND THE TAILPIPE FREE OF PEOPLE, OBSTRUCTIONS, FOREIGN MATERIAL OR OTHER ITEMS. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN SERIOUS PERSONAL INJURY.**

NOTE: **Regeneration may occur during normal operation. During regeneration, diagnostic procedures may display biased values. If a regeneration occurs during diagnostic procedures, allow the process to complete before continuing diagnostics.**

This pinpoint test is intended to diagnose the following:

- EGT sensor (5J213)
- harness circuits: EGT11, EGT21 and SIGRTN
- PCM (12A650)

EGT Sensor Temperature And Resistance Specifications

Temperature		Temperature Sensor Value	EGT PID
Â°C	Â°F	Resistance (K ohms)	(Volts)
900	1652	0.09	0.41
850	1562	0.11	0.48
800	1472	0.13	0.58
750	1382	0.16	0.70
700	1292	0.21	0.86
650	1202	0.27	1.06
600	1112	0.36	1.26
550	1022	0.5	1.67
500	932	0.73	2.1
450	842	1.1	2.62
400	752	1.77	3.2
350	662	3.09	3.78
300	572	5.92	4.28
250	482	12.39	4.63
200	392	30.28	4.84

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Fig. 184: Exhaust Gas Temperature Bank 1, Sensor 1 (EGT11) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
1	EGT11 (Exhaust Gas Temperature Bank 1, Sensor 1)

Fig. 185: Exhaust Gas Temperature Bank 2, Sensor 1 (EGT21) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	SIGRTN (Signal Return)
1	EGT21 (Exhaust Gas Temperature Bank 2, Sensor 1)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Expedition, Navigator	198 PIN	B30 E24 B30 B31	SIGRTN EGT21 SIGRTN EGT11
Mustang 2.3L	198 PIN	B17 B29	SIGRTN EGT11
Mustang 5.0L	306 PIN	T28 B43 T12	EGT21 SIGRTN EGT11
All other vehicles	198 PIN	B18 B32	SIGRTN EGT11

TEST PROCEDURE

RB1 PRELIMINARY DIAGNOSIS

Are DTCs P0544, P0545, P0546, P0547, P0548 or P0549 present?

Yes	No

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Yes	No
GO to RB2.	RETURN to **SYMPTOM CHARTS** for further direction.

RB2 CHECK FOR LEAKS IN THE EXHAUST SYSTEM

- Ignition OFF.
- Visually inspect the exhaust system for the following:
- exhaust leaks at flanges and gaskets
- punctures or cracks in the catalyst
- punctures or cracks in the particulate filter
- engine coolant or oil contamination

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to RB3.

RB3 CHECK THE EGT SIGNAL AND SIGRTN CIRCUITS FOR AN OPEN

- Ignition OFF.
- For the EGT11 sensor,
- EGT11 Sensor connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) EGT11 Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
EGT11 - Pin 1	EGT11
SIGRTN - Pin 2	SIGRTN

- For the EGT21 sensor,
- EGT21 Sensor connector disconnected.
- PCM connector disconnected.
- Measure the resistance between:

(+) EGT21 Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
EGT21 - Pin 1	EGT21
SIGRTN - Pin 2	SIGRTN

Are the resistances less than 5 ohms?

Yes	No
GO to RB4.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

RB4 CHECK THE EGT SIGNAL CIRCUIT FOR A SHORT TO GROUND OR SIGRTN

- For the EGT11 sensor,
- Measure the resistance between:

(+) EGT11 Sensor Connector, Harness Side	(-)
EGT11 - Pin 1	Ground

- Measure the resistance between:

(+) EGT11 Sensor Connector, Harness Side	(-) EGT11 Sensor Connector, Harness Side
EGT11 - Pin 1	SIGRTN - Pin 2

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- For the EGT21 sensor,
- Measure the resistance between:

(+) EGT21 Sensor Connector, Harness Side	(-)
EGT21 - Pin 1	Ground

- Measure the resistance between:

(+) EGT21 Sensor Connector, Harness Side	(-) EGT21 Sensor Connector, Harness Side
EGT21 - Pin 1	SIGRTN - Pin 2

Is the resistance greater than 10K ohms?

Yes	No
GO to RB5.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

RB5 CHECK THE EGT SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For the EGT11 sensor,
- Measure the voltage between:

(+) EGT11 Sensor Connector, Harness Side	(-)
EGT11 - Pin 1	Ground
SIGRTN - Pin 2	Ground

- For the EGT21 sensor,
- Measure the voltage between:

(+) EGT21 Sensor Connector, Harness Side	(-)
EGT21 - Pin 1	Ground
SIGRTN - Pin 2	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to RB6.

RB6 CHECK THE EGT SENSOR AND CIRCUITS FOR AN INTERMITTENT SHORT OR OPEN

NOTE: **If any EGT sensor connector has been disconnected during testing, with the ignition ON and the engine OFF, connect the EGT sensor. Turn the ignition OFF for 30 seconds before attempting to start the vehicle. Do not crank or start the engine until the ignition has been turned OFF for a minimum of 30 seconds. Failure to do so may result in a 60 minute no crank, no start condition and a failure mode effects management (FMEM) condition.**

- Ignition OFF.
- For the EGT11 sensor,
- EGT11 Sensor connector connected.
- PCM connector connected.
- Ignition ON, engine running.
- Allow the engine to reach normal operating temperature.
- Access the PCM and monitor the EGT11 (TEMP) PID.

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- Record the EGT11 (TEMP) PID.
- Set the scan tool EGT11 (TEMP) PID limit as follows:
  - set the lower limit to 30Â°C (54Â°F) below the EGT11 (TEMP) PID.
  - set the upper limit to 20Â°C (36Â°F) above the EGT11 (TEMP) PID.
- Carry out a thorough wiggle test on the EGT11 harness from the PCM connector to the EGT11 sensor connector.
- Tap lightly around the sensor to simulate road shock.
- For the EGT21 sensor,
- EGT21 Sensor connector connected.
- PCM connector connected.
- Ignition ON, engine running.
- Allow the engine to reach normal operating temperature.
- Access the PCM and monitor the EGT21 (TEMP) PID.
- Record the EGT21 (TEMP) PID.
- Set the scan tool EGT21 (TEMP) PID limit as follows:
  - set the lower limit to 30Â°C (54Â°F) below the EGT21 (TEMP) PID.
  - set the upper limit to 20Â°C (36Â°F) above the EGT21 (TEMP) PID.
- Carry out a thorough wiggle test on the EGT21 harness from the PCM connector to the EGT21 sensor connector.
- Tap lightly around the sensor to simulate road shock.

Does the EGT11 (TEMP) PID value or the EGT21 (TEMP) PID exceed the set limits range?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to RB7.

RB7 CHECK THE EGT SENSOR PERFORMANCE

NOTE: **An EGT sensor may exceed its operating range only while in regeneration mode, which may result in performance DTCs being set.**

- Access the PCM and monitor the EGT11 (TEMP) PID and the EGT21 (TEMP) PID.
- Drive the vehicle at several steady state speeds above and below 50 km/h (30 mph). Monitor the EGT11 and EGT21 PID while driving to verify the concern.

Does the EGT11 or the EGT21 temperature ever exceed 950Â°C (1740Â°F)?

Yes	No
CHECK the circuits for corrosion or loose wires. WIGGLE the harness attempting to recreate the concern. REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	GO to RB8.

RB8 CHECK THE EGT SENSOR FOR CORRECT RESISTANCE

- Ignition OFF.
- For the EGT11 sensor,
- EGT11 Sensor connector disconnected.
- Measure the resistance between:

(+) EGT11 Sensor Connector, Component Side	(-) EGT11 Sensor Connector, Component Side
EGT11 - Pin 1	SIGRTN - Pin 2

- For the EGT21 sensor,
- EGT21 Sensor connector disconnected.

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- Measure the resistance between:

(+) EGT21 Sensor Connector, Component Side	(-) EGT21 Sensor Connector, Component Side
EGT21 - Pin 1	SIGRTN - Pin 2

Is the resistance greater than 80 ohms?

Yes	No
GO to RB9.	INSTALL a new EGT sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

RB9 CHECK FOR CORRECT EGT SENSOR OPERATION

- Ignition ON, engine OFF.
- For the EGT11 sensor,
- Access the PCM and monitor the EGT11_V (VOLT) PID.
- For the EGT21 sensor,
- Access the PCM and monitor the EGT21_V (VOLT) PID.

Is the EGT11 sensor or the EGT21 PID value greater than 4.7 V when disconnected?

Yes	No
The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.	CHECK for a loose connection, and damaged or corroded terminals. WIGGLE the harness attempting to recreate the concern. REPAIR as necessary. If no concerns were found during the visual inspection, INSTALL a new EGT sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

PINPOINT TESTS RC: PARTICULATE PRESSURE SENSOR

INTRODUCTION

WARNING: **MANUAL REGENERATION OF THE PARTICULATE FILTER CAUSES THE EXHAUST GAS TO QUICKLY GET VERY HOT. INITIATE A MANUAL REGENERATION ONLY WHEN THE VEHICLE IS ON THE GROUND WITH THE AREA AROUND THE TAILPIPE FREE OF PEOPLE, OBSTRUCTIONS, FOREIGN MATERIAL OR OTHER ITEMS. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN SERIOUS PERSONAL INJURY.**

NOTE: **Regeneration may occur during normal operation. During regeneration, diagnostic procedures may display biased values. If a regeneration occurs during diagnostic procedures, allow the process to complete before continuing diagnostics.**

This pinpoint test is intended to diagnose the following:

- particulate filter pressure bank 1, sensor 1 (9G824)
- particulate filter pressure bank 2, sensor 1 (9G824)
- harness circuits: PFP11, PFP21, SIGRTN and VREF
- PCM (12A650)

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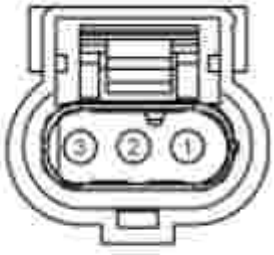

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Fig. 186: Particulate Filter Pressure Bank 1, Sensor 1 Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
1	PFP11 (Particulate Filter Pressure Bank 1, Sensor 1)
2	SIGRTN (Signal Return)
3	VREF (Reference Voltage)

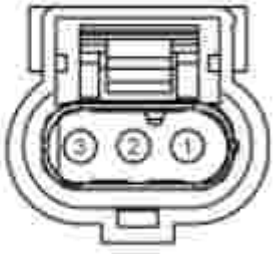

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Fig. 187: Particulate Filter Pressure Bank 2, Sensor 1 Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
3	VREF (Reference Voltage)
2	SIGRTN (Signal Return)
1	PFP21 (Particulate Filter Pressure Bank 2, Sensor 1)

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit
Expedition, Navigator	198 PIN	B93 B32	PFP21 PFP11
Mustang 2.3L	198 PIN	B57	PFP11
Mustang 5.0L	306 PIN	T13 T58	PFP21 PFP11
All other vehicles	198 PIN	B76	PFP11

TEST PROCEDURE

RC1 PRELIMINARY DIAGNOSIS

NOTE: **If the PCM was reflashed, reprogrammed or replaced prior to entering this pinpoint test, drive the vehicle for 8 km (5 miles) to update the PF PID data.**

Are DTCs P2452, P2453, P2454, P2455, P2456, P245E, P245F, P2460, P2461, P2462, U0601 or U0602 present?

Yes	No

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Yes	No
For DTCs P2452, P2453, P245E or P245F, GO to RC2. For all others, GO to RC3.	RETURN to **SYMPTOM CHARTS** for further direction.

RC2 CHECK THE PARTICULATE FILTER PRESSURE SENSOR CONNECTOR AND HOSE FOR DAMAGE

- For particulate filter pressure bank 1, sensor 1,
- Particulate Filter Pressure Bank 1, Sensor 1 connector disconnected.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Visually inspect the exhaust system for the following:
  - Leaks in the particulate filter pressure bank 1, sensor 1 connecting hose
  - Restrictions in the particulate filter pressure bank 1, sensor 1 port
- For particulate filter pressure bank 2, sensor 1,
- Particulate Filter Pressure Bank 2, Sensor 1 connector disconnected.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Visually inspect the exhaust system for the following:
- Leaks in the particulate filter pressure bank 2, sensor 1 connecting hose
- Restrictions in the particulate filter pressure bank 2, sensor 1 port

Is a concern present?

Yes	No
REPAIR as necessary. Clear the PCM DTCs. REPEAT the self-test.	Clear the PCM DTCs. REPEAT the self-test.

RC3 CHECK THE VREF AND SIGRTN CIRCUITS FOR AN OPEN

- Ignition OFF.
- For particulate filter pressure bank 1, sensor 1,
- Particulate Filter Pressure Bank 1, Sensor 1 connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Particulate Filter Pressure Bank 1, Sensor 1 Connector, Harness Side	(-) Particulate Filter Pressure Bank 1, Sensor 1 Connector, Harness Side
VREF - Pin 3	SIGRTN - Pin 2

- For particulate filter pressure bank 2, sensor 1,
- Particulate Filter Pressure Bank 2, Sensor 1 connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

(+) Particulate Filter Pressure Bank 2, Sensor 1 Connector, Harness Side	(-) Particulate Filter Pressure Bank 2, Sensor 1 Connector, Harness Side
PFP21 - Pin 1	SIGRTN - Pin 2

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to RC4.	GO to **PINPOINT TEST C**.

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RC4 CHECK THE SIGNAL CIRCUIT FOR AN OPEN

- Ignition OFF.
- For particulate filter pressure bank 1, sensor 1,
- PCM connector disconnected.
- Measure the resistance between:

(+) Particulate Filter Pressure Bank 1, Sensor 1 Connector, Harness Side	(-) PCM Connector, Harness Side
PFP11 - Pin 1	PFP11

- For particulate filter pressure bank 2, sensor 1,
- PCM connector disconnected.
- Measure the resistance between:

(+) Particulate Filter Pressure Bank 2, Sensor 1 Connector, Harness Side	(-) PCM Connector, Harness Side
PFP21 - Pin 1	PFP21

Is the resistance less than 5 ohms?

Yes	No
GO to RC5.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

RC5 CHECK THE SIGNAL CIRCUIT FOR A SHORT TO SIGRTN OR GND

- Ignition OFF.
- For particulate filter pressure bank 1, sensor 1,
- Particulate Filter Pressure Bank 1, Sensor 1 connector disconnected.
- Measure the resistance between:

(+) Particulate Filter Pressure Bank 1, Sensor 1 Connector, Harness Side	(-) Particulate Filter Pressure Bank 1, Sensor 1 Connector, Harness Side
PFP11 - Pin 1	SIGRTN - Pin 2

- Measure the resistance between:

(+) Particulate Filter Pressure Bank 1, Sensor 1 Connector, Harness Side	(-)
PFP11 - Pin 1	Ground

- For particulate filter pressure bank 2, sensor 1,
- Particulate Filter Pressure Bank 2, Sensor 1 connector disconnected.
- Measure the resistance between:

(+) Particulate Filter Pressure Bank 2, Sensor 1 Connector, Harness Side	(-) Particulate Filter Pressure Bank 2, Sensor 1 Connector, Harness Side
PFP21 - Pin 1	SIGRTN - Pin 2

- Measure the resistance between:

(+) Particulate Filter Pressure Bank 2, Sensor 1 Connector, Harness Side	(-)
PFP21 - Pin 1	Ground

Are the resistances greater than 10K ohms?

Yes	No
GO to RC6.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

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RC6 CHECK THE SIGNAL CIRCUIT FOR A SHORT TO VREF

- For particulate filter pressure bank 1, sensor 1,
- Measure the resistance between:

(+) Particulate Filter Pressure Bank 1, Sensor 1 Connector, Harness Side	(-) Particulate Filter Pressure Bank 1, Sensor 1 Connector, Harness Side
PFP11 - Pin 1	VREF - Pin 3

- For particulate filter pressure bank 2, sensor 1,
- Measure the resistance between:

(+) Particulate Filter Pressure Bank 2, Sensor 1 Connector, Harness Side	(-) Particulate Filter Pressure Bank 2, Sensor 1 Connector, Harness Side
PFP21 - Pin 1	VREF - Pin 3

Is the resistance greater than 10K ohms?

Yes	No
GO to RC7.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

RC7 CHECK THE SIGNAL CIRCUIT FOR A SHORT TO VOLTAGE

- Ignition ON, engine OFF.
- For particulate filter pressure bank 1, sensor 1,
- Measure the voltage between:

(+) Particulate Filter Pressure Bank 1, Sensor 1 Connector, Harness Side	(-)
PFP11 - Pin 1	Ground

- For particulate filter pressure bank 2, sensor 1,
- Measure the voltage between:

(+) Particulate Filter Pressure Bank 2, Sensor 1 Connector, Harness Side	(-)
PFP21 - Pin 1	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to RC8.

RC8 CHECK FOR CORRECT OPERATION

- Disconnect all the PCM connectors.
- For particulate filter pressure bank 1, sensor 1,
- Particulate Filter Pressure Bank 1, Sensor 1 connector disconnected.
- Visually inspect for:
  - pushed out pins
  - corrosion
- Connect all the PCM connectors, and the particulate filter pressure bank 1, sensor 1 connector, and make sure they seat correctly.
- Carry out the PCM self-test.
- Verify the concern is still present.
- For particulate filter pressure bank 2, sensor 1,
- Particulate Filter Pressure Bank 2, Sensor 1 connector disconnected.
- Visually inspect for:
  - pushed out pins

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- corrosion
- Connect all the PCM connectors, and the particulate filter pressure bank 2, sensor 1 connector, and make sure they seat correctly.
- Carry out the PCM self-test.
- Verify the concern is still present.

Is the concern still present?

Yes	No
Clear the PCM DTCs. REPEAT the self-test.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS TA: CLUTCH PEDAL POSITION (CPP) SWITCH

INTRODUCTION

This pinpoint test is intended to diagnose the following:

- CPP sensor
- CPP switch (11A152/7C534)
- harness circuits: CPP, CPP-BT, GND, SIGRTN, and VREF
- PCM (12A650)

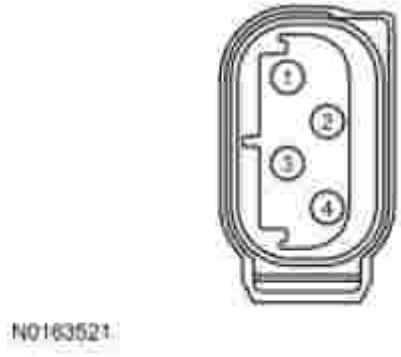

Fig. 188: Clutch Pedal Position (CPP) Sensor Connector
Courtesy of FORD MOTOR CO.

Pin	Circuit
2	CPP (Clutch Pedal Position)
1	SIGRTN (Signal Return)
3	VREF (Reference Voltage)

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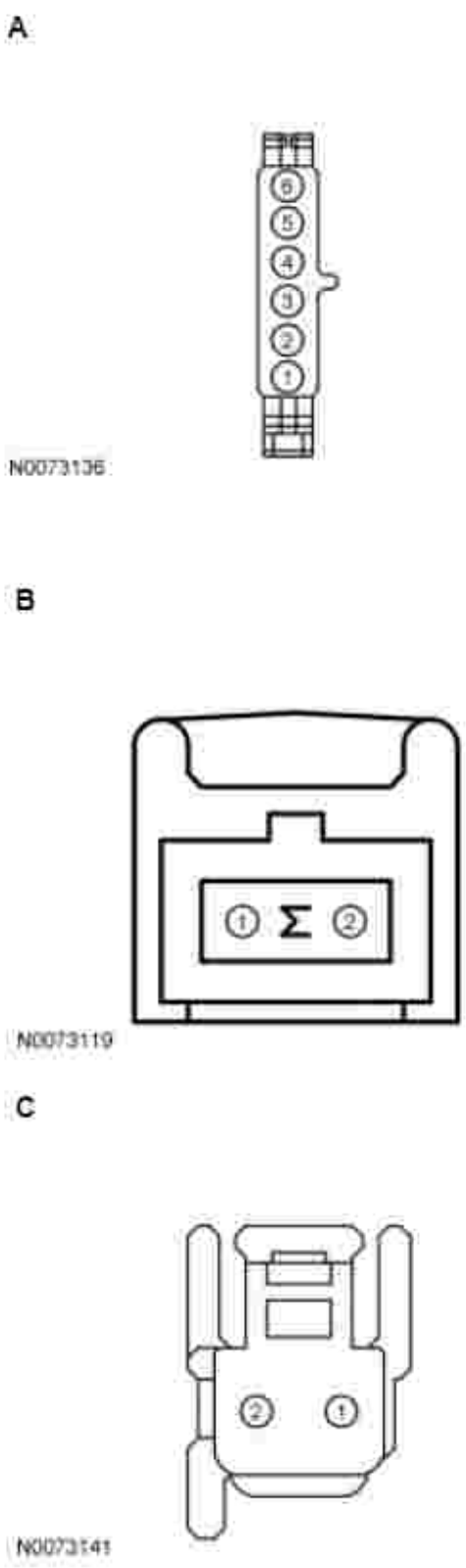

Fig. 189: Clutch Pedal Position (CPP) Switch Connector
Courtesy of FORD MOTOR CO.

Vehicle	Connector	Pin	Circuit
F-Series Super Duty	A	2 1	GND CPP-BT
Mustang	B	2 1	GND CPP-BT
All other vehicles	C	2 1	GND CPP-BT

Powertrain Control Module (PCM) Connector

For PCM connector views or reference values, refer to **REFERENCE VALUES** .

Vehicle	Connector	Pin	Circuit

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Vehicle	Connector	Pin	Circuit
EcoSport 1.5L	112 PIN	B47	CPP-BT
F-Series Super Duty	198 PIN	B8	CPP-BT
Fiesta TiVCT 1.6L	128 PIN	B14	CPP-BT
Focus 1.0L	198 PIN	B33 B30	CPP CPP-BT
Focus GDI 2.0L	154 PIN	B30	CPP-BT
Focus GTDI 2.0L, Focus 2.3L	198 PIN	B76 B30	CPP CPP-BT
KA	128 PIN	B15	CPP-BT
Mustang 5.0L	306 PIN	B53	CPP-BT
Mustang 5.2L	198 PIN	B9	CPP-BT
Ranger	128 PIN	E14	CPP-BT
All other vehicles	198 PIN	B30	CPP-BT

TEST PROCEDURE

TA1 CHECK FOR DIAGNOSTIC TROUBLE CODES (DTCS)

NOTE: **Diagnose DTCs P0830, P0833 and P170A before entering this pinpoint test. Refer to the appropriate Electronic Engine Controls article, to continue diagnosis.**

NOTE: **Diagnose and repair all circuit DTCs before diagnosing range and performance DTCs.**

Are DTCs P08A9, P08AA, P08B6, P08B7, P08B9, or P26C4 present?

Yes	No
For DTCs P08B9 or P26C4, GO to TA2. For all others, GO to TA10.	GO to TA4.

TA2 CHECK THE CPP PID CORRELATION

WARNING: **BLOCK ALL WHEELS, SET THE PARKING BRAKE AND FIRMLY APPLY THE SERVICE BRAKE TO REDUCE THE RISK OF VEHICLE MOVEMENT DURING THIS PROCEDURE. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN SERIOUS PERSONAL INJURY.**

NOTE: **All PIDs may not be available on all vehicles.**

- Ignition ON, engine OFF.
- Access the PCM and monitor the CPP_BOT (MODE) and CPP_TOP (MODE) PIDs.
- Access the PCM and monitor the CPP_PERCENT (PER) PID.
- Apply and release the clutch pedal.

Do all the PID values change when the clutch pedal is applied and released?

Yes	No
For Focus, GO to TA3. For all others, The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.	For the CPP_TOP PID value did not change, REFER to the appropriate Cruise Control article, to DIAGNOSE the cruise control does not disengage when the clutch pedal is applied symptom. Clear the PCM DTCs. REPEAT the self-test. For the CPP_BOT PID value did not change, GO to TA5. For all others, GO to TA10.

TA3 CHECK CPP SWITCH OPERATION

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NOTE: **The CPP switches should change states when the CPP percentage PID is between 11% to 63% and 67% to 95% while applying the clutch pedal.**

- Access the PCM and monitor the CPP_BOT (MODE) and CPP_TOP (MODE) PIDs.
- Access the PCM and monitor the CPP_PERCENT (PER) PID.
- Apply and release the clutch pedal.

Does the CPP_TOP PID value change when the CPP PERCENT PID value is between 11% to 63%, and does the CPP_BOT PID value change when the CPP PERCENT PID value is between 67% to 95%?

Yes	No
For DTC P26C4, GO to TA15. For all others, The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new CPP switch. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

TA4 CHECK THE CPP SWITCH

WARNING: **BLOCK ALL WHEELS, SET THE PARKING BRAKE AND FIRMLY APPLY THE SERVICE BRAKE TO REDUCE THE RISK OF VEHICLE MOVEMENT DURING THIS PROCEDURE. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN SERIOUS PERSONAL INJURY.**

- Ignition ON, engine OFF.
- Access the PCM and monitor the CPP_BOT (MODE) PID.
- Apply and release the clutch pedal.

Does the PID value change when the clutch pedal is applied and released?

Yes	No
GO to **PINPOINT TEST Z**.	GO to TA5.

TA5 CHECK THE SWITCH CIRCUIT RESISTANCE

NOTE: **The CPP switch is located near the clutch pedal.**

NOTE: **Measure the CPP switch resistance with the clutch pedal pressed down.**

- Ignition OFF.
- Inspect the switches and brackets for damage. Repair as necessary.
- CPP Switch connector disconnected.
- Measure the resistance between:

(+) CPP Switch Connector, Component Side	(-) CPP Switch Connector, Component Side
CPP-BT	GND

Is the resistance less than 5 ohms?

Yes	No
GO to TA6.	INSTALL a new CPP switch. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

TA6 CHECK THE CPP FOR INTERNAL SHORTS

NOTE: **Measure the CPP switch resistance with the clutch pedal released.**

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- Measure the resistance between:

(+) CPP Switch Connector, Component Side	(-) CPP Switch Connector, Component Side
CPP-BT	GND

Is the resistance greater than 10K ohms?

Yes	No
GO to TA7.	INSTALL a new CPP switch. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

TA7 CHECK THE CPP AND GROUND CIRCUITS FOR AN OPEN

- PCM connector disconnected.
- Measure the resistance between:

(+) CPP Switch Connector, Harness Side	(-) PCM Connector, Harness Side
CPP-BT	CPP-BT

- Measure the resistance between:

(+) CPP Switch Connector, Harness Side	(-)
GND	Ground

Are the resistances less than 5 ohms?

Yes	No
GO to TA8.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

TA8 CHECK THE CPP CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) CPP Switch Connector, Harness Side	(-)
CPP-BT	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	GO to TA9.

TA9 CHECK THE CPP CIRCUIT FOR A SHORT TO GROUND

- Ignition OFF.
- Measure the resistance between:

(+) CPP Switch Connector, Harness Side	(-)
CPP-BT	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to TA15.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

TA10 CHECK THE VREF VOLTAGE TO THE CPP SENSOR

- CPP Sensor connector disconnected.
- Ignition ON, engine OFF.
- Measure the voltage between:

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(+) CPP Sensor Connector, Harness Side	(-) CPP Sensor Connector, Harness Side
VREF - Pin 3	SIGRTN - Pin 1

Is the voltage between 4.5 - 5.5 V?

Yes	No
GO to TA11.	GO to **PINPOINT TEST C**.

TA11 CHECK THE CPP CIRCUIT FOR AN OPEN

- Ignition OFF.
- PCM connector disconnected.
- Measure the resistance between:

(+) CPP Sensor Connector, Harness Side	(-) PCM Connector, Harness Side
CPP - Pin 2	CPP

Is the resistance less than 5 ohms?

Yes	No
GO to TA12.	REPAIR the open circuit. Clear the PCM DTCs. REPEAT the self-test.

TA12 CHECK THE CPP CIRCUIT FOR A SHORT TO GROUND

- Measure the resistance between:

(+) CPP Sensor Connector, Harness Side	(-)
CPP - Pin 2	Ground

Is the resistance greater than 10K ohms?

Yes	No
GO to TA13.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

TA13 CHECK THE CPP SENSOR CIRCUITS FOR A SHORT

- Measure the resistance between:

(+) CPP Sensor Connector, Harness Side	(-) CPP Sensor Connector, Harness Side
CPP - Pin 2	VREF - Pin 3
CPP - Pin 2	SIGRTN - Pin 1

Are the resistances greater than 10K ohms?

Yes	No
GO to TA14.	REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.

TA14 CHECK THE CPP CIRCUIT FOR A SHORT TO VOLTAGE

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

(+) CPP Sensor Connector, Harness Side	(-)
CPP - Pin 2	Ground

Is any voltage present?

Yes	No
REPAIR the short circuit. Clear the PCM DTCs. REPEAT the self-test.	INSTALL a new CPP sensor. REFER to the appropriate Electronic Engine Controls article. Clear the PCM DTCs. REPEAT the self-test.

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TA15 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.
- 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)** , Programming the VID Block for a Replacement PCM.	The system is operating correctly at this time. The concern may have been caused by a loose or corroded connector.

PINPOINT TESTS Z: INTERMITTENT

INTRODUCTION

This pinpoint test is intended to diagnose and isolate intermittent concerns for all electronic engine control (EEC) subsystems.

This chart is used to determine which test to run for the suspect circuit. Parameter identifiers (PIDs) corresponding 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 (DMM). More specific information on the PID can be found in **REFERENCE VALUES** .

PCM PIDS/SIGNALS

PCM/PIDS/SIGNALS	Associated Circuit	Test Type
AAT	AAT	Input
APP1	APP1	Input
APP2	APP2	Input
BOO1	BPP	Input
BOO2	BPS	Input
Use DMM	CD A-J (primary)	Output
CAC_T	CACT	Input
CAC_V	CACT	Input
CACCT	CACCTS	Input
CACCT_V	CACCTS	Input
CHT	CHT	Input
CKP	CKP	Input
CMP	CMP	Input
CPP/PNP	CPP	Input
DPFE	DPFE	Input
EBP	EP	Input
ECT1, ECTS	ECT	Input
EGRMC1	EGRMC1	Output
EGRMC2	EGRMC2	Output
EGRMC3	EGRMC3	Output
EGRMC4	EGRMC4	Output
EGRMDSD	EGRMC	Output
EGRT12	EGRT12	Input
EGRVR	EGRVR	Output

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PCM/PIDS/SIGNALS	Associated Circuit	Test Type
EGT11	EGT11	Input
EGT21	EGT21	Input
EVAPCV	CANV	Output
FANDC	VDF	Output
FANSS	FANSS	Input
FANVAR	FCV	Input
FLI	FLI	Input
FLP	FLP	Input
FP	FP	Output
FP	M FPM	Input
FRP	FRP	Input
FRT	FRT	Input
FTP	FTP	Input
HFC	HFC	Output
IAT, IATS	IAT	Input
IAT12, IAT2	IAT2	Input
IMRC	IMRC	Output
IMRC1M	IMRC1	Input
IMRC2M	IMRC2	Input
IMTV	IMTV1	Output
KNOCK_1	KS11, KS12	Input
KNOCK_2	KS12, KS22	Input
LFC	LFC	Output
MAF, MAF	V MAF	Input
MAP	V MAP	Input
MFC	MFC	Output
O2S12	HO2S12	Input
O2S22	HO2S22	Input
OSS	OSS	Input
PFP11	PFP11	Input
PFP21	PFP21	Input
PTO	PTO	Input
SCIP, SCIP V	TCIP	Input
TACM (+)	TACM (+)	Output
TACM (-)	TACM (-)	Output
TCBP	TCBP	Input
TCBP_V	TCBP	Input
TP	TP	Input
TP1	TP1	Input
Â	TP2	Input
TURBO_BP1_STAT	TCBY	Output
TURBO_BP2_STAT	TCBY2	Output
TURBO_WGATE	TCWRVS	Output
TWGATE_STAT	TCWRVS	Output
VCTADV, VCT_INT_ACT1	VCT11	Input
VCTADV2, VCT_INT_ACT2	VCT21	Input
VCT_EXH_ACT1	VCT12	Input
VCT_EXH_ACT2	VCT22	Input
VPWR	VPWR	Input
Use	DMM VREF	Output
Use	DMM VSO	Output

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PCM/PIDS/SIGNALS	Associated Circuit	Test Type
VSS	VSS+	Input
WGATE_PRES	WVS	Input
WGATE_V	WVS	Input

TEST PROCEDURE

Z1 DIRECTION FOR INTERMITTENT DIAGNOSTIC PATH

NOTE: **Proceed with this step only if the PCM DTCs and the freeze frame data have not been cleared. Record freeze frame data prior to clearing the PCM DTCs. Clearing the DTCs clears any freeze frame data and eliminates FMEM. This helps to recreate the original conditions that set the DTCs or caused the symptom.**

- Ignition ON, engine OFF.
- Clear the PCM DTCs.

Are the PCM DTCs cleared?

Yes	No
GO to Z2.	RESET the keep alive memory (KAM). REFER to **RESETTING THE KEEP ALIVE MEMORY (KAM)** . REPEAT the self-test.

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 scan tool to monitor the suspect areas. Obtain the customer symptom description. Use the Reference Value Symptom chart and proceed to the Reference Value PID/Signal Measurement chart located at the beginning of **REFERENCE VALUES** .
- Highlight each available PID/signal recommended by the charts under the PID/signal selection menu on the scan tool.

Are all available PIDs/signals related to the symptom selected?

Yes	No
GO to Z3.	REPEAT the test step. GO to Z2.

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 back for a repeat repair, or there is no DTC present.**

Is a concern or symptom present?

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 scan tool instruction manual to retrieve the freeze frame information.**

- Prepare the freeze frame data for use with information from the, **SYMPTOM CHARTS** .
- Check for continuous memory DTCs that should have been recorded from an earlier pinpoint test.
- Access the information from the customer information worksheet and the customer if available. Access any other symptom related data available, such as TSBs and OASIS reports.

Is all available data recorded?

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Yes	No
GO to Z5.	GATHER as much data as possible to aid in isolating the intermittent concern area. REPEAT the test step. GO to Z4.

Z5 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.

- With the scan tool, select and monitor the same PIDs as displayed in freeze frame along with any previously selected PIDs/signals from step Z2. Using the 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 scan tool instruction manual for information on the recorder function.

Can the symptom be recreated?

Yes	No
GO to Z10.	GO to Z6.

Z6 RECREATE THE SYMPTOM

NOTE: PIDs for output in the Reference Value Charts represent command values only. Circuit measurements with a DMM indicate the actual output status. Therefore, in the case of a concern, the PID and circuit reading on the vehicle may not correspond with each other. PIDs for PCM circuits with a mismatch in the DMM measurement indicate a possible PCM 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 scan tool and circuit measurements with a DMM. This is done under 4 different conditions - ignition on and engine off, hot idle, 48 km/h (30 mph) and 88 km/h (55 mph). Use the typical diagnostic reference values from **REFERENCE VALUES** to compare with the actual vehicle.
- Locate the correct reference value chart in **REFERENCE VALUES** .
- Setup the vehicle to measure the circuits with a DMM and a scan tool.
- Connect a scan tool to the DLC.
- Ignition ON, engine OFF.
- With the scan tool, select and monitor PIDs and measure the circuits shown in the reference value chart in **REFERENCE VALUES** .
- Compare the scan tool PIDs and DMM 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

NOTE: The engine temperature should be at least 87Â°C (189Â°F).

- Ignition ON, engine running.
- Continue to monitor the PIDs and circuits as in the previous step.

Are any values out of range?

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Yes	No
GO to Z10.	GO to Z8.

Z8 RECREATE THE SYMPTOM DURING AN 48 KM/H (30 MPH) ROAD TEST

- 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 DURING AN 88 KM/H (55 MPH) ROAD TEST

- 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.	It is now necessary to physically disturb the selected vehicle circuits in an attempt to recreate the intermittent concern. GO to Z10.

Z10 SELECT THE CIRCUITS FROM THE PCM PIDS/SIGNALS CHART

NOTE: **From the same chart, be sure to select and proceed with the appropriate test type.**

NOTE: **The Input Test step should be used on sensing inputs such as temperature, position or oxygen.**

NOTE: **The Output Test step should be used on output devices such as relays, coils or solenoids.**

- Remain in the PID/Signal selection menu with the scan tool.
- Highlight only the PIDs/signals from step Z2.
- Proceed to the PCM PIDS/SIGNALS chart located at the beginning of this 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 scan tool, it may be helpful to replay it at this time. Refer to the scan tool instruction manual for additional information.

Has a test been chosen?

Yes	No
For the input test step, GO to Z11. For the output test step, GO to Z15.	RETURN to **SYMPTOM CHARTS** for further direction.

Z11 KOEO INPUT TEST PROCEDURE FOR THE PCM SENSORS

WARNING: **WHEN CARRYING OUT ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS, BELTS OR HOT SURFACES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

- Using the circuits chosen from the **REFERENCE VALUES** , PCM PIDS/SIGNALS Chart, select only the recommended PIDs/signals to monitor with the scan tool. If a PID is not available for the circuit, use a DMM to check the value.
- Proceed to the area of the suspect wiring or component concern.

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- Ignition ON, engine OFF.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or DMM and wiggle the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the reference values in **REFERENCE VALUES** .

Are there abrupt changes in the PID values that do not compare with the TYPICAL REFERENCE VALUES ?

Yes	No
REPAIR as necessary. VERIFY the repair. Clear the PCM DTCs. REPEAT the self-test.	GO to Z12.

Z12 KOER INPUT TEST PROCEDURE FOR THE PCM SENSORS

WARNING: **WHEN CARRYING OUT ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS, BELTS OR HOT SURFACES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

- Ignition 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 concern.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or DMM and wiggle the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the reference values in **REFERENCE VALUES** .

Are any values fluctuating in and out of range?

Yes	No
REPAIR as necessary. VERIFY the repair. Clear the PCM DTCs. REPEAT the self-test.	GO to Z13.

Z13 KOEO WATER SOAK TEST PROCEDURE FOR THE PCM 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. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

- Ignition 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 concern.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Monitor while spraying the sensor harness wire from the component to the PCM.
- 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. VERIFY the repair. Clear the PCM DTCs. REPEAT the self-test.	GO to Z14.

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Z14 KOER WATER SOAK TEST PROCEDURE FOR THE PCM 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. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

- Ignition 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 concern.
- If the input is a switch type-component, turn it on manually.
- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Monitor while spraying the sensor harness wire from the component to the PCM.
- 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. VERIFY the repair. Clear the PCM DTCs. REPEAT the self-test.	GO to Z15.

Z15 KOER WIGGLE TEST PROCEDURE FOR THE PCM SENSORS

WARNING: **WHEN CARRYING OUT ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS, BELTS OR HOT SURFACES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

NOTE: **Remember that PIDs selected from the PCM PIDS/SIGNALS Chart display commanded values only. A DMM 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 PCM PIDS/SIGNALS Chart, select only the recommended PIDs/signals to monitor with the scan tool. If a PID is not available for the circuit, use a DMM to check the value.
- Ignition ON, engine OFF.
- With the scan tool, turn on selected outputs using output state control. Refer to the scan tool instruction manual.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PID or DMM and wiggle the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the reference values in **REFERENCE VALUES** .

Is there a mismatch between command and actual or are any values fluctuating in and out of range when compared to the reference value charts in REFERENCE VALUES ?

Yes	No
REPAIR as necessary. VERIFY the repair. Clear the PCM DTCs. REPEAT the self-test.	GO to Z16.

Z16 KOER OUTPUT TEST PROCEDURE FOR THE PCM ACTUATORS

WARNING: **WHEN CARRYING OUT ANY TEST STEPS, ALWAYS BE AWARE OF HANDS,**

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CLOTHING OR TOOLS NEAR COOLING FANS, BELTS OR HOT SURFACES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.

NOTE: **Remember that PIDs selected from the PCM PIDS/SIGNALS Chart display commanded values only. A DMM 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.**

- Ignition ON, engine running.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PIDs with the scan tool and note the values. Compare the scan tool values with values from a DMM with the engine at idle.
- If a coil for a coil on plug application is suspect, turn off the ignition. 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 PID and wiggle the sensor harness wire from the component to the PCM.
- Look for abrupt changes in the values. Compare these actual values to the reference values in **REFERENCE VALUES** .

Is there a scan tool to DMM value mismatch or an idle fluctuation?

Yes	No
REPAIR as necessary. VERIFY the repair. Clear the PCM DTCs. REPEAT the self-test.	GO to Z17.

Z17 KOEO WATER SOAK TEST PROCEDURE FOR THE PCM 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. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

NOTE: **Remember that PIDs selected from the PCM PIDS/SIGNALS Chart display commanded values only. A DMM 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.**

- Ignition ON, engine OFF.
- With the scan tool, turn on selected outputs using output state control. Refer to the scan tool instruction manual.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- Look for abrupt changes in the values. Compare these actual values to the reference values in, **REFERENCE VALUES** .

Is there a mismatch between command and actual or are any values fluctuating in and out of range when compared to the reference value charts in , REFERENCE VALUES ?

Yes	No
REPAIR as necessary. VERIFY the repair. Clear the PCM DTCs. REPEAT the self-test.	GO to Z18.

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Z18 KOER WATER SOAK TEST PROCEDURE FOR THE PCM ACTUATORS

WARNING: **WHEN CARRYING OUT ANY TEST STEPS, ALWAYS BE AWARE OF HANDS, CLOTHING OR TOOLS NEAR COOLING FANS, BELTS OR HOT SURFACES. FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN PERSONAL INJURY.**

- Ignition ON, engine running.
- Using the circuits chosen from the PCM PIDS/SIGNALS Chart, select only the recommended PIDs/signals to monitor with the scan tool. If a PID is not available for the circuit, use a DMM to check the value.
- Proceed to the area of the suspect wiring or component concern.
- Monitor the PID or DMM values while lightly spraying a water mist on the component.
- 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 Reference Value Charts in REFERENCE VALUES ?

Yes	No
REPAIR as necessary. VERIFY the repair. Clear the PCM DTCs. REPEAT the self-test.	GO to Z19.

Z19 INSPECT FOR INTERMITTENT MECHANICAL CONCERNS

NOTE: **It is possible for an intermittent mechanical concern to cause a good PCM system to react abnormally.**

- An inspection of DTC related mechanical systems should have been carried out in an earlier action. If not, visually inspect at this time.
- 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. VERIFY the repair. Clear the PCM DTCs. REPEAT the self-test.	It is necessary to seek additional help. REFER to the Service Repair And Technical Assistance Process. A vehicle data recorder (VDR) or similar recorder may also be useful.

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