

G - TESTS W/CODES - TESTS (NON-TURBO)

1998 Toyota Supra

1998 ENGINE PERFORMANCE
Toyota - Self-Diagnostics - Non-Turbo
Supra

DIAGNOSTIC TESTS

* PLEASE READ FIRST *

NOTE: Before performing any diagnostic test, refer to SELF-DIAGNOSTICS INTRODUCTION article for diagnostic system functions and system diagnostic procedures. For component location, see appropriate illustration in E - THEORY/OPERATION article.

DTC P0100: MASS AIRFLOW (MAF) SENSOR CIRCUIT

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

MAF sensor uses a platinum hot wire maintained at a constant temperature. Airflow past sensor affects temperature and current flow through sensor. DTC is set when ECM detects an open or short MAF sensor circuit with engine speed of 4000 RPM or less. ECM will operate in fail-safe mode if DTC P0100 is set. Possible causes are:

- * MAF open or short circuit.
- * MAF sensor.
- * ECM.

Diagnosis & Repair

1) Connect scan tool to DLC No. 3 connector. See Fig. 1. Start engine and allow to idle. Using scan tool, monitor MAF flow rate. If scan tool reading is 0.0 gm/sec., go to next step. If reading is 271 gm/sec. or more once engine is at normal operating temperature, go to step 5).

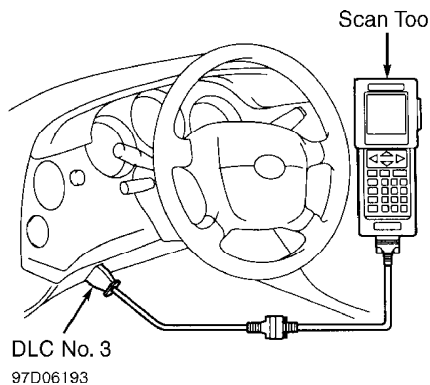


Fig. 1: Connecting Scan Tool To Data Link Connector (DLC) No. 3
Courtesy of Toyota Motor Sales, U.S.A., Inc.

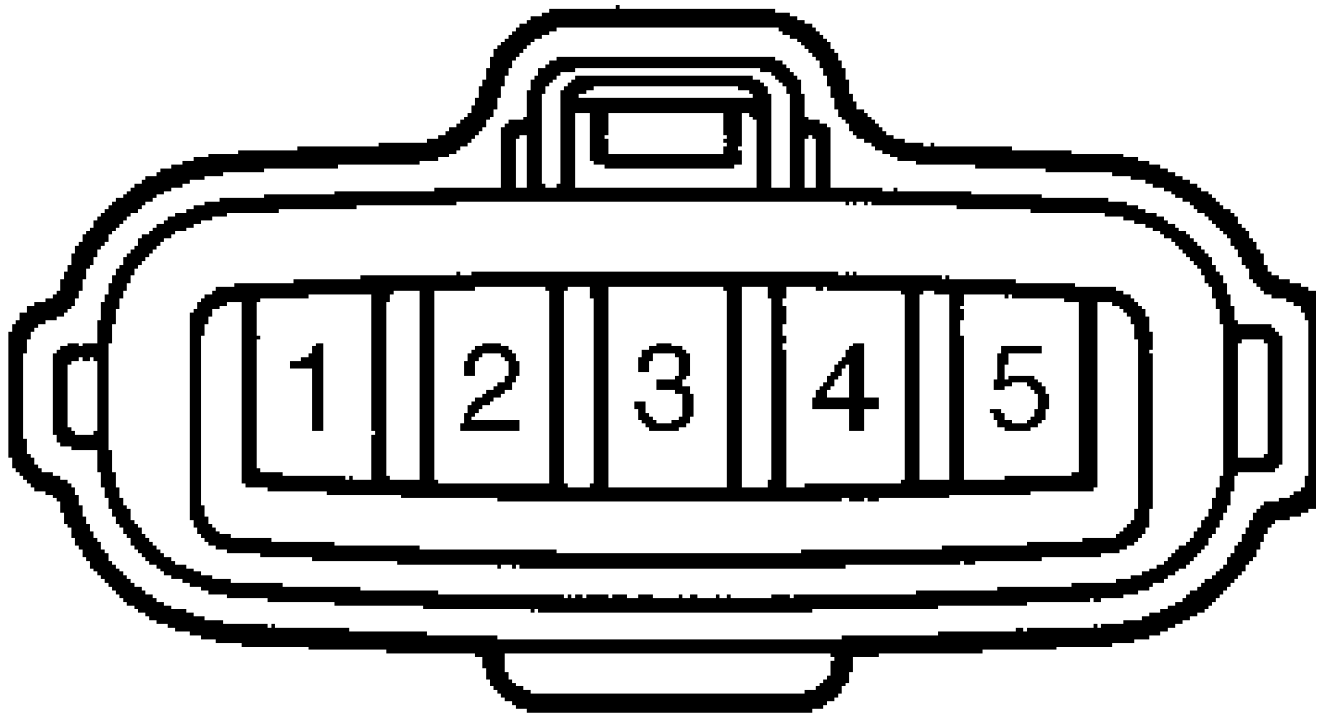
2) Disconnect MAF sensor connector. Ensure ignition is on. Using DVOM, measure voltage between terminal No. 4 (Black/Red wire)

and ground. See Fig. 2. If voltage is 9-14 volts, go to next step. If voltage is not 9-14 volts, check for an open circuit in wiring harness between EFI main relay and MAF sensor. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary.

3) Access ECM below passenger's side of instrument panel, underneath carpet. Start engine. Ensure A/C is off. Backprobing ECM connector, measure voltage between ground and terminal No. 10 (Yellow/Red wire) at ECM E10 connector. See Fig. 3. If voltage is 1.1-1.5 volts, replace ECM.

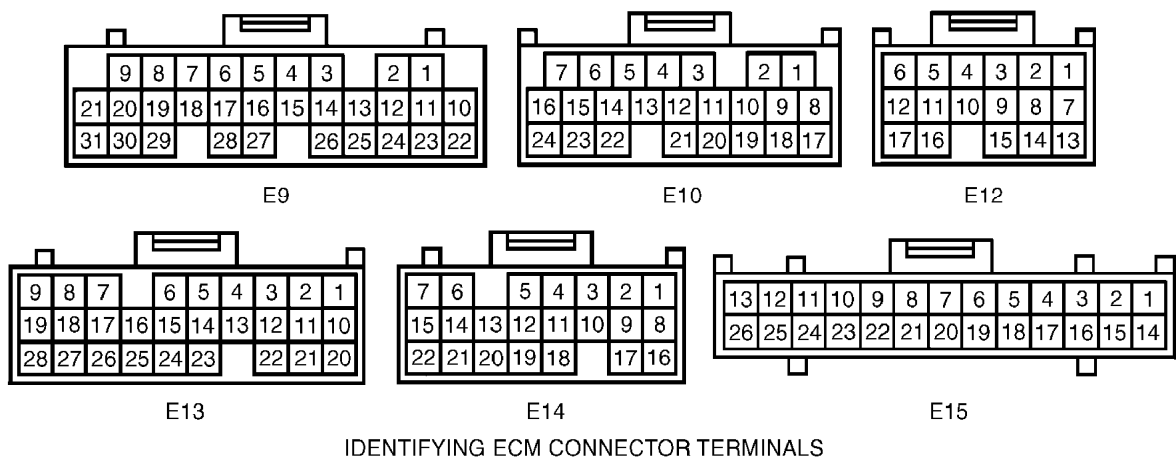
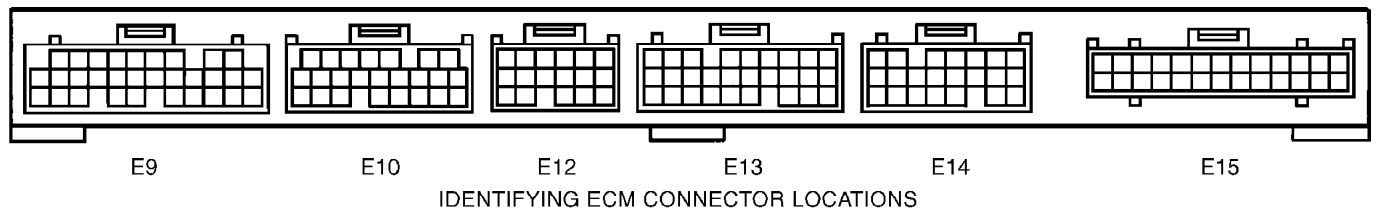
4) If voltage is not 1.1-1.5 volts, check for open or short circuit in wiring harness between MAF sensor and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring harness as necessary. If wiring harness is okay, replace MAF sensor.

5) Access ECM below passenger's side of instrument panel, underneath carpet. Turn ignition off. Using ohmmeter, backprobe ECM connector. Check continuity between ground and terminal No. 19 (Brown wire) at ECM E10 connector. See Fig. 3. If continuity does not exist, replace ECM. If continuity exists, check for open circuit in wiring harness between MAF sensor and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring harness as necessary. If wiring harness is okay, replace MAF sensor.



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Fig. 2: Identifying MAF Sensor Harness Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.



98B10208
Fig. 3: Identifying Engine Control Module (ECM) Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

DTC P0101: MASS AIRFLOW (MAF) SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM

Condition

Following conditions continue for more than 10 seconds with engine speed of 1000 RPM or less:

- * Throttle valve fully closed.
- * MAF sensor output is more than 2.2 volts.

Following conditions continue for more than 10 seconds with engine speed of 2000 RPM or more:

- * VTA circuit signal is .64 volt or more.
- * MAF sensor output is less than one volt.

Diagnosis & Repair Procedure

If only DTC P0101 is displayed, replace MAF sensor. If other codes are displayed, diagnose and repair those codes first and retest.

DTC P0110: INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

The IAT sensor is a thermistor built into the MAF sensor and is used to monitor temperature of air flowing through MAF sensor. DTC is set when ECM detects an open or short IAT circuit. ECM will operate in fail-safe mode if DTC P0110 is set. Possible causes are:

- * IAT sensor open or short circuit.
- * IAT sensor.
- * ECM.

NOTE: If DTCs P0110, P0115, P0120, P0450 and P1120 are output together, inspect ECM terminal E2 (ground) circuit. Repair as necessary. See appropriate wiring diagram in L - WIRING DIAGRAMS article.

Diagnosis & Repair

1) Connect scan tool to DLC No. 3 connector. See Fig. 1. Turn ignition on. Using scan tool, monitor IAT sensor temperature. If temperature displayed is same as outside temperature, check component and ECM connections. Problem is intermittent.

2) If temperature displayed is 284°F (140°C) or more, go to step 5). If temperature displayed is -40°F (-40°C), turn ignition off. Disconnect MAF sensor connector. Using jumper wire, connect terminals No. 1 (Green/White wire) and No. 2 (White/Black wire) at MAF sensor wiring harness connector. See Fig. 2. Turn ignition on. Using scan tool, monitor IAT sensor temperature.

3) If temperature displayed is 284°F (140°C) or more, replace MAF sensor. If temperature displayed is less than 284°F (140°C), turn ignition off. Remove jumper wire. Access ECM below passenger's side of instrument panel, underneath carpet. Connect a jumper wire between terminals No. 22 (Green/White wire) and No. 18 (White/Black wire) at ECM E10 connector. See Fig. 3.

4) If temperature displayed on scan tool is 284°F (140°C) or more, check and repair circuits between MAF sensor wiring harness connector and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. If temperature displayed on scan tool is less than 284°F (140°C), replace ECM.

5) Turn ignition off. Disconnect MAF sensor connector. Turn ignition on. If temperature displayed on scan tool is -40°F (-40°C), replace MAF sensor. If temperature displayed is not -40°F (-40°C), turn ignition off.

6) Access ECM below passenger's side of instrument panel, underneath carpet. Disconnect ECM E10 connector. See Fig. 3. Turn ignition on. If temperature displayed is -40°F (-40°C), locate and repair short circuit in wiring harness between MAF sensor and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. If temperature displayed by scan tool is not -40°F (-40°C), replace ECM.

DTC P0115: ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

The ECT sensor is a thermistor sensor that monitors water temperature. DTC is set when ECM detects an open or short in ECT sensor circuit. Possible causes are:

- * Open or short in ECT sensor circuit.
- * ECT sensor.
- * ECM.

NOTE: If DTCs P0110, P0115, P0120, P0450 and P1120 are output together, inspect ECM terminal E2 (ground) circuit. Repair as necessary. See appropriate wiring diagram in L - WIRING DIAGRAMS article.

Diagnosis & Repair

1) Connect scan tool to DLC No. 3 connector. See Fig. 1. Turn ignition on. Using scan tool, monitor ECT sensor temperature. If temperature displayed is same as actual coolant temperature, check ECT sensor and ECM connections. Problem is intermittent.

2) If temperature displayed is 284°F (140°C) or more, go to step 5). If temperature displayed is -40°F (-40°C), turn ignition off. Disconnect ECT sensor connector. ECT sensor is located on left side of cylinder head, below oil filler cap. Connect a jumper wire between ECT sensor wiring harness connector terminals. Turn ignition on. Using scan tool, monitor ECT sensor temperature.

3) If temperature displayed is 284°F (140°C) or more, replace ECT sensor. If temperature displayed is less than 284°F (140°C), turn ignition off. Remove jumper wire. Access ECM below passenger's side of instrument panel, underneath carpet. Connect a jumper wire between terminals No. 14 (Blue wire) and No. 18 (White/Black wire) at ECM E10 connector. See Fig. 3.

4) If temperature displayed on scan tool is 284°F (140°C) or more, locate and repair open circuit in wiring harness between ECT sensor and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. If temperature displayed on scan tool is less than 284°F (140°C), replace ECM.

5) Turn ignition off. Disconnect ECT sensor connector. Turn ignition on. If temperature displayed on scan tool is -40°F (-40°C), replace ECT sensor. If temperature displayed is not -40°F (-40°C), turn ignition off.

6) Access ECM below passenger's side of instrument panel, underneath carpet. Disconnect ECM E10 connector. See Fig. 3. Turn ignition on. If temperature displayed is -40°F (-40°C), locate and repair short circuit in wiring harness between ECT sensor and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. If temperature displayed by scan tool is not -40°F (-40°C), replace ECM.

DTC P0116: ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM

Condition

DTC is set when ECT sensor value is out of range during engine. Possible causes are:

- * ECT sensor.
- * Cooling system.

Diagnosis & Repair

If any other codes are displayed, diagnose and repair those codes first and retest. If only DTC P0116 is displayed, remove and inspect cooling system thermostat. Replace thermostat as necessary. If thermostat is okay, replace ECT sensor.

DTC P0120: THROTTLE POSITION (TP) SENSOR CIRCUIT MALFUNCTION

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

The TP sensor is located on throttle body and has 2 variable resistors integral to sensor. TP sensor monitors throttle opening. The ECM determines vehicle driving condition and adjusts air/fuel mixture accordingly. DTC is set when ECM detects voltage is out of range on VTA or VTA2 circuits. Possible causes are:

- * Open or short in TP sensor circuit.
- * TP sensor.
- * ECM.

NOTE: If DTCs P0110, P0115, P0120, P0450 and P1120 are output together, inspect ECM terminal E2 (ground) circuit. Repair as necessary. See appropriate wiring diagram in L - WIRING DIAGRAMS article.

Diagnosis & Repair (With Toyota Scan Tool)

1) Connect scan tool to DLC No. 3 connector. See Fig. 1. Turn ignition on. Using scan tool, monitor throttle valve opening percentage for VTA circuit and read voltage for VTA2 circuit. Throttle opening percentage for VTA circuit should be 8-20 percent with fully closed throttle. Depress accelerator pedal to floor (WOT). Opening percentage should be 64-96 percent. Voltage reading for VTA2 circuit should be 2.0-2.9 volts with throttle fully closed and 4.7-5.1 volts with throttle fully open. If circuit values are as specified, replace ECM. If circuit values are not as specified, go to next step.

2) Access ECM below passenger's side of instrument panel, underneath carpet. Turn ignition on. Measure voltage between terminals No. 2 (Blue/Red wire) and No. 18 (White/Black wire) at ECM E10 connector. See Fig. 3. If voltage is 4.5-5.5 volts, go to next step. If voltage is not 4.5-5.5 volts, replace ECM.

3) Measure voltage between terminals No. 18 (White/Black wire) and No. 23 (Yellow wire) at ECM E10 connector. With throttle valve closed, voltage should be .4-1.0 volt. With throttle valve fully open, voltage should be 3.2-4.8 volts. Measure voltage between terminals No. 18 (White/Black wire) and No. 24 (Red/Black wire) at ECM E10 connector. With throttle valve closed, voltage should be 2.0-2.9 volts. With throttle valve fully open, voltage should be 4.7-5.1 volts. If voltage readings are as specified, replace ECM. If voltage readings are not as specified, go to next step.

4) Check Throttle Position (TP) sensor. See THROTTLE BODY under IDLE CONTROL SYSTEM in appropriate I - SYSTEM/COMPONENT TESTS article. Replace TP sensor as necessary. If TP sensor is okay, check for an open or short circuit in wiring harness between ECM and TP sensor. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring harness as necessary.

Diagnosis & Repair (With OBD-II Scan Tool)

1) Access ECM below passenger's side of instrument panel, underneath carpet. Turn ignition on. Measure voltage between terminals No. 2 (Blue/Red wire) and No. 18 (White/Black wire) at ECM E10 connector. See Fig. 3. If voltage is 4.5-5.5 volts, go to next step. If voltage is not 4.5-5.5 volts, replace ECM.

2) Measure voltage between terminals No. 18 (White/Black wire) and No. 23 (Yellow wire) at ECM E10 connector. With throttle valve closed, voltage should be .4-1.0 volt. With throttle valve fully open, voltage should be 3.2-4.8 volts. Measure voltage between terminals No. 18 (White/Black wire) and No. 24 (Red/Black wire) at ECM E10 connector. With throttle valve closed, voltage should be 2.0-2.9 volts. With throttle valve fully open, voltage should be 4.7-5.1 volts. If voltage readings are as specified, replace ECM. If voltage readings are not as specified, go to next step.

3) Check Throttle Position (TP) sensor. See THROTTLE BODY under IDLE CONTROL SYSTEM in appropriate I - SYSTEM/COMPONENT TESTS article. Replace TP sensor as necessary. If TP sensor is okay, check for an open or short circuit in wiring harness between ECM and TP sensor. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring harness as necessary.

DTC P0121: THROTTLE POSITION (TP) SENSOR CIRCUIT

RANGE/PERFORMANCE FAULT

Condition

DTC is set when ECM detects TP sensor output voltage is out of range during vehicle operation. Possible cause is:

- * Throttle Position (TP) sensor.

Diagnosis & Repair

If only DTC P0121 is displayed, replace TP sensor. If other codes are displayed, diagnose and repair those codes first and retest.

DTC P0125: INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP

FUEL CONTROL

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

NOTE: Bank No. 1 refers to bank that includes cylinder No. 1. Bank No. 2 refers to bank without cylinder No. 1. Oxygen sensor No. 1 refers to sensor closest to engine block. Oxygen sensor No. 2 refers to sensor furthest away from engine block.

Circuit Description

The oxygen sensor monitors exhaust gas oxygen content and delivers an input signal to ECM. The ECM uses input signal to determine fuel injection system operation. Sensors include heater. DTC is set when sensor does not output a rich condition once engine is at normal operating temperature, engine speed of 1500 RPM or more, and vehicle speed is 25-62 MPH for at least 2 minutes. Possible causes are:

- * Open or short in heated oxygen sensor circuit.
- * Fuel system.
- * Fuel injector.
- * Ignition system.
- * Heated oxygen sensor.
- * ECM.

Diagnosis & Repair

1) Connect scan tool to DLC No. 3 connector. See Fig. 1. Start vehicle and warm engine to normal operating temperature. Using scan tool, monitor each oxygen sensor in front of converter. Snap accelerate engine to about 4000 RPM 3 times. Both sensors should indicate a rich signal (.45 volt or more) at least once.

2) If a rich signal is indicated for both sensors at least once, replace ECM. If either sensor does not display a rich signal at least once, perform misfire diagnosis. See DTCS P0301-P0306: CYLINDERS NO. 1-6 MISFIRE DETECTED test. Repair as necessary. If no misfire is detected, go to next step.

3) Check wiring harness between ECM and suspect sensor. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary. If wiring harness is okay, check exhaust system for leaks. Repair exhaust system as necessary. If exhaust system is okay, replace oxygen sensor.

DTC P0130 OR P0150: HEATED OXYGEN CIRCUIT (SENSOR NO. 1)

CAUTION: If ECM replacement is instructed in following testing,

always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

NOTE: Bank No. 1 refers to bank that includes cylinder No. 1. Bank No. 2 refers to bank without cylinder No. 1. Oxygen sensor No. 1 refers to sensor closest to engine block.

Condition

DTC P0130 is set when bank No. 1, sensor No. 1 voltage remains at .4 volt or more, or .6 volt or less during idle, once engine is at normal operating temperature. DTC P0150 is set when bank No. 2, sensor No. 1 voltage remains at .4 volt or more, or .6 volt or less during idle, once engine is at normal operating temperature. Possible causes are:

- * Heated oxygen sensor.
- * Fuel trim.

Test Drive Confirmation

1) If using OBD-II scan tool, go to next step. If using Toyota scan tool, connect scan tool. See Fig. 1. Switch scan tool to CHECK mode. Start and warm engine to normal operating temperature. Drive vehicle at 31-40 MPH for 1-3 minutes. Stop vehicle and allow to idle for one minute. If malfunction exists, MIL will illuminate.

2) If using OBD-II scan tool, start and warm engine to normal operating temperature. Drive vehicle at 31-40 MPH for 1-3 minutes. Stop vehicle and allow to idle for one minute. Turn vehicle off. Repeat driving and idle part of test. If malfunction exists, MIL will illuminate.

Diagnosis & Repair Procedure

1) Check for open or short circuit between ECM and oxygen sensor. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary. If wiring harness is okay, connect scan tool. See Fig. 1.

2) Start engine and warm to normal operating temperature. Using scan tool, monitor heated oxygen sensor output voltage and short-term fuel trim. If scan tool indicates a lean condition (.6 volt or less, +20 trim) or rich condition (.4 volt or more, -20 trim), see DTC P0171: SYSTEM TOO LEAN (FUEL TRIM), DTC P0172: SYSTEM TOO RICH (FUEL TRIM) test.

3) If scan tool indicates other than reading in step 2), operate engine at 2500 RPM for 90 seconds. Monitor oxygen sensor voltage. If voltage constantly fluctuates from less than .4 volt to more than .6 volt, perform TEST DRIVE CONFIRMATION. If voltage does not fluctuate as specified, replace oxygen sensor.

DTC P0133 OR P0153: HEATED OXYGEN SENSOR CIRCUIT (SENSOR NO.

1) SLOW RESPONSE

NOTE: Bank No. 1 refers to bank that includes cylinder No. 1. Bank No. 2 refers to bank without cylinder No. 1. Oxygen sensor No. 1 refers to sensor closest to engine block.

Condition

DTC is set when ECM detects a response time of one second or more from sensor to change from rich to lean, or lean to rich. Possible cause is

- * Heated oxygen sensor.

Diagnosis & Repair

If only DTC P0133 or P0153 is displayed, replace oxygen sensor. DTC P0133 is for bank No. 1, sensor No. 1. DTC P0153 is for bank No. 2, sensor No. 1. If other codes are displayed, diagnose and repair those codes first and retest system.

DTC P0135 OR P0155: HEATED OXYGEN SENSOR HEATER CIRCUIT

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

NOTE: Bank No. 1 refers to bank that includes cylinder No. 1. Bank No. 2 refers to bank without cylinder No. 1. Oxygen sensor No. 1 refers to sensor closest to engine block.

Condition

DTC P0135 is for bank No. 1, sensor No. 1. DTC P0155 is for bank No. 2, sensor No. 1. DTC is set when either of the following conditions is present:

- * Sensor heater current draw exceeds 2 amps.
- * Sensor heater current draw is .25 amp or less.

Possible causes are:

- * Heated oxygen sensor open or short circuit.
- * Heated oxygen sensor heater.
- * ECM.

Diagnosis & Repair

1) Access ECM below passenger's side of instrument panel, underneath carpet. Turn ignition on. Using DVOM, backprobe ECM connector. If DTC P0135 is set, measure voltage between ground and terminal No. 4 (Green wire) at ECM E10 connector. If DTC P0155 is set, measure voltage between ground and terminal No. 3 (Black/Yellow wire) at ECM E10 connector. See Fig. 3. Voltage for each circuit should be 9-14 volts.

2) If voltage is as specified, replace ECM. If voltage is not as specified, turn ignition off. Disconnect appropriate oxygen sensor connector. Using ohmmeter, measure resistance between terminals No. 1 and 2 at oxygen sensor connector. See IDENTIFYING OXYGEN SENSOR HEATER TERMINALS table.

IDENTIFYING OXYGEN SENSOR HEATER TERMINALS TABLE

Application	Terminal No. 1	Terminal No. 2
Bank 1, Sensor 1	Green Wire	Black/Red Wire
Bank 2, Sensor 1	Black/Yellow Wire	Black/Red Wire

3) If resistance is 11-16 ohms at 68°F (20°C), check circuits between ECM and sensor. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary. If resistance is not 11-16 ohms at 68°F (20°C), replace oxygen sensor.

DTC P0136 OR P0156: HEATED OXYGEN SENSOR CIRCUIT (SENSOR NO.

2)

NOTE: Bank No. 1 refers to bank that includes cylinder No. 1. Bank No. 2 refers to bank without cylinder No. 1. Oxygen sensor No. 1 refers to sensor closest to engine block. Oxygen sensor No. 2 refers to sensor furthest away from engine

block.

Condition

DTC P0136 is set when bank No. 1, sensor No. 2 voltage remains at .4 volt or more, or .6 volt or less during vehicle operation of less than 62 MPH, once engine is at normal operating temperature. DTC P0156 is set when bank No. 2, sensor No. 2 voltage remains at .4 volt or more, or .6 volt or less during vehicle operation of less than 62 MPH, once engine is at normal operating temperature. Possible causes are:

- * Heated oxygen sensor.

Diagnosis & Repair

1) If only DTC P0136 or P0156 is displayed, go to next step. If other codes are displayed, diagnose and repair those codes first and retest system.

2) Check for open or short circuit in wiring harness between ECM and oxygen sensor. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary. If wiring harness is okay, go to next step.

3) Connect scan tool. See Fig. 1. Start and warm engine to normal operating temperature. Using scan tool, monitor bank No. 1, sensor No. 2 and bank No. 2, sensor No. 2 output voltage. Snap accelerate engine to about 4000 RPM 3 times. Each sensor voltage reading should fluctuate from less than .4 volt to more than .5 volt.

4) If voltage fluctuates as specified, check sensor wiring harness connector. Problem may be intermittent. If voltage does not fluctuate as specified, replace oxygen sensor.

DTC P0141 OR P0161: HEATED OXYGEN SENSOR HEATER CIRCUIT

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

NOTE: Bank No. 1 refers to bank that includes cylinder No. 1. Bank No. 2 refers to bank without cylinder No. 1. Oxygen sensor No. 1 refers to sensor closest to engine block. Oxygen sensor No. 2 refers to sensor furthest away from engine block.

Condition

DTC P0141 is for bank No. 1, sensor No. 2. DTC P0161 is for bank No. 2, sensor No. 2. DTC is set when either of the following conditions is present:

- * Sensor heater current draw exceeds 2 amps.
- * Sensor heater current draw is .25 amp or less.

Possible causes are:

- * Heated oxygen sensor open or short circuit.
- * Heated oxygen sensor heater.
- * ECM.

Diagnosis & Repair

1) Access ECM below passenger's side of instrument panel, underneath carpet. Turn ignition on. Using DVOM, backprobe ECM connector. If DTC P0141 is set, measure voltage between ground and terminal No. 26 (Blue/White wire) at ECM E15 connector. If DTC P0161 is set, measure voltage between ground and terminal No. 25 (Green/Yellow wire) at ECM E15 connector. See Fig. 3. Voltage for each

circuit should be 9-14 volts.

2) If voltage is as specified, replace ECM. If voltage is not as specified, turn ignition off. Disconnect appropriate oxygen sensor connector. Using ohmmeter, measure resistance between terminals No. 1 and 2 at oxygen sensor connector. See IDENTIFYING OXYGEN SENSOR HEATER TERMINALS table.

IDENTIFYING OXYGEN SENSOR HEATER TERMINALS TABLE

Application	Terminal No. 1	Terminal No. 2
Bank 1, Sensor 2	Blue/White Wire	Black/Red Wire
Bank 2, Sensor 2	Green/Yellow Wire	Black/Red Wire

3) If resistance is 11-16 ohms at 68°F (20°C), check circuits between ECM and sensor. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary. If resistance is not 11-16 ohms at 68°F (20°C), replace oxygen sensor.

DTC P0171: SYSTEM TOO LEAN (FUEL TRIM) DTC P0172: SYSTEM TOO RICH (FUEL TRIM)

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

NOTE: Bank No. 1 refers to bank that includes cylinder No. 1. Bank No. 2 refers to bank without cylinder No. 1. Oxygen sensor No. 1 refers to sensor closest to engine block. Oxygen sensor No. 2 refers to sensor furthest away from engine block.

Circuit Description

Fuel trim refers to feedback compensation value compared against basic injection time. Fuel trim includes short-term and long-term fuel trim.

DTC P0171 is set when fuel trim is rich beyond a certain value. Possible causes are:

- * Air intake hose loose.
- * Fuel line pressure.
- * Injector blockage.
- * Heated oxygen sensor.
- * Mass Airflow (MAF) sensor.
- * Engine Coolant Temperature (ECT) sensor.

DTC P0172 is set when fuel trim is lean beyond a certain value. Possible causes are:

- * Fuel line pressure.
- * Injector blockage or leak.
- * Heated oxygen sensor.
- * Mass Airflow (MAF) sensor.
- * Engine Coolant Temperature (ECT) sensor.

Diagnosis & Repair

1) Check all air induction components. Repair as necessary. If air induction components are okay, connect scan tool. See Fig. 1. Start engine and warm to normal operating temperature. Monitor bank No. 1, sensor No. 1 and bank No. 2, sensor No. 1 output voltage and short-term fuel trim.

2) If scan tool indicates a lean condition (.6 volt or less, +20 trim) or rich condition (.4 volt or more, -20 trim) for both sensors, go to next step. If results are other than specified, see DTC P0130 OR P0150: HEATED OXYGEN SENSOR CIRCUIT (SENSOR NO. 1) test.

3) Check fuel pressure. See appropriate F - BASIC TESTING article. Repair fuel pressure as necessary. If fuel pressure is okay, check fuel injectors. See appropriate I - SYSTEM/COMPONENT TESTS article. Replace injectors as necessary.

4) If all injectors are okay, check Mass Airflow (MAF) sensor and Engine Coolant Temperature (ECT) sensor. See appropriate I - SYSTEM/COMPONENT TESTS article. Replace MAF sensor and/or ECT sensor as necessary. If both components are okay, check ignition system. See IGNITION CHECKS in appropriate F - BASIC TESTING article. Repair ignition system as necessary. If ignition system is okay, replace ECM.

DTC P0300: RANDOM MISFIRE DETECTED

Circuit Description

A misfire is determined by the ECM. The ECM uses signals provided by the crankshaft and camshaft position sensors. If the engine speed rate has changed enough to equal a preset number, a misfire is detected and the MIL is illuminated. If the misfire rate is high enough, and driving conditions will cause catalytic converter damage or overheating, the MIL blinks when a misfire is occurring.

DTC is set when misfiring of random cylinders is detected during any particular 200 or 1000 revolutions. Possible causes are:

- * Ignition system.
- * Injector(s).
- * Fuel pressure.
- * EGR system.
- * Engine compression.
- * Valve clearance.
- * Valve timing.
- * Mass Airflow (MAF) sensor.
- * Engine Coolant Temperature (ECT) sensor.

Test Drive Confirmation

1) Connect Toyota or OBD-II scan tool. See Fig. 1. Record any DTCs and freeze frame data. Switch scan tool to CHECK mode (Toyota scan tool only). Drive vehicle several times with engine speed, load and its surrounding range shown with ENGINE SPD, CALC LOAD in freeze frame data or MISFIRE RPM and MISFIRE LOAD in scan tool data list.

2) Drive vehicle at specified engine speeds. See DRIVING PATTERN table. If using OBD-II scan tool, turn ignition off after symptom is simulated the first time, then repeat test drive again. If a misfire is detected, a DTC will set and misfire will be indicated in freeze frame data. Turn ignition off and wait a minimum of 5 seconds.

DRIVING PATTERN TABLE

RPM	(1) Minutes
Idling	3 1/2
1000	3
2000	1 1/2
3000	1

(1) - Minimum specification given.

1) Check vacuum hoses for leaks, blockage and proper routing. Also, check wiring harness and wiring harness connectors for damage or poor connections. Repair as necessary and perform TEST DRIVE CONFIRMATION. If vacuum hoses and wiring harness connectors are okay, go to next step.

2) Inspect spark plug and check for spark at misfiring cylinder. See appropriate F - BASIC TESTING article. Repair as necessary. If spark plug is okay and spark is present, go to next step.

3) Access ECM below passenger's side of instrument panel, underneath carpet. Turn ignition on. Using DVOM, backprobe ECM connector. Measure voltage between ground and injector terminals at ECM E9 or E10 connector. See IDENTIFYING INJECTOR TERMINALS table. See Fig. 3. If voltage is 9-14 volts for each circuit, go to step 5). If voltage is not 9-14 volts, go to next step.

IDENTIFYING INJECTOR TERMINALS TABLE

Injector No.	(1) Terminal No.	Wire Color
1	(2) 5	Red/Blue
2	(2) 6	Blue/Red
3	1	Blue
4	2	Red/White
5	3	Red
6	4	Red/Black

(1) - Terminals are located in ECM E9 connector.

(2) - Terminal is located in ECM E10 connector.

4) Disconnect injector of misfiring cylinder. Using ohmmeter, measure resistance between injector terminals. If resistance is 13.4-14.2 ohms, check for open or short circuit in wiring harness between ECM and injector. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary. If resistance is not 13.4-14.2 ohms, replace injector.

5) Check fuel pressure. See appropriate F - BASIC TESTING article. Repair fuel pressure as necessary. If fuel pressure is okay, check fuel injector performance. See appropriate I - SYSTEM/COMPONENT TESTS article. Replace injectors as necessary.

6) If all injectors are okay, check MAF sensor and ECT sensor. See appropriate I - SYSTEM/COMPONENT TESTS article. Replace MAF sensor and/or ECT sensor as necessary. If both components are okay, also check engine compression, valve clearance and valve timing. See appropriate F - BASIC TESTING article.

DTCS P0301-P0306: CYLINDERS NO. 1-6 MISFIRE DETECTED

NOTE: When 2 or more codes for a misfiring cylinder are recorded repeatedly, but DTC P0300 is not recorded, it indicates that misfires were detected and stored into ECM memory at different times.

Circuit Description

See DTC P0300: RANDOM MISFIRE DETECTED test.

Condition

Two conditions can cause code to set. These are:

- * During any particular 200 revolutions of engine, misfiring is detected which can cause catalytic converter overheating and/or damage.
- * During any particular 1000 revolutions of engine, misfiring

is detected which can cause a deterioration in emission levels.

For possible causes, see DTC P0300: RANDOM MISFIRE DETECTED test.

Diagnosis & Repair
See DTC P0300: RANDOM MISFIRE DETECTED test.

DTC P0325: KNOCK SENSOR NO. 1 CIRCUIT DTC P0330: KNOCK SENSOR NO. 2 CIRCUIT

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

Knock sensors are located on left side of cylinder block. Sensor generates voltage when engine block vibrates due to knocking. DTC P0325 is for front knock sensor. DTC P0330 is for rear knock sensor. DTC is set when there is no knock sensor signal to ECM with engine speed of 1600–5200 RPM. Possible causes are:

- * Open or short in knock sensor circuit.
- * Knock sensor (loose).
- * ECM.

Diagnosis & Repair

1) Access ECM below passenger's side of instrument panel, underneath carpet. If DTC P0325 is present, measure resistance between ground and terminal No. 28 (White wire) at ECM E9 connector. See Fig. 3. If DTC P0330 is present, measure resistance between ground and terminal No. 27 (White wire) at ECM E9 connector. On all models, if resistance is less than one megohm, go to next step. If resistance is one megohm or more, go to step 3).

2) Remove knock sensor. If remove rear knock sensor, starter must be removed. Check for continuity between knock sensor terminal and knock sensor body. If continuity does not exist, go to next step. If continuity exists, replace knock sensor.

3) Check for open or short circuit in wiring harness between ECM and knock sensor. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary. If circuits are okay, go to next step.

4) Substitute suspect knock sensor with a known-good knock sensor. Clear DTCs and retest. If DTC P0325 or P0330 is not present, replace knock sensor. If DTC P0325 or P0330 is present, replace ECM.

DTC P0335 OR P1335: CRANKSHAFT POSITION (CKP) SENSOR "A" CIRCUIT

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

The CKP sensor is a pick-up coil mounted next to crankshaft pulley. A 34-tooth signal plate is mounted to crankshaft. DTC P0335 is set if no cranking signal is received by ECM from sensor. DTC P1335 is set if no engine running signal is received by ECM from sensor. Possible causes are:

- * CKP sensor open or short circuit.
- * CKP sensor.
- * Starter.
- * ECM.

Diagnosis & Repair

1) Disconnect CKP sensor connector. Using ohmmeter, measure resistance between CKP sensor terminals. Resistance should be 1630-2740 ohms (cold sensor) or 2065-3225 ohms (hot sensor).

2) Replace CKP sensor as necessary. If CKP sensor is okay, check for open or short circuit in wiring harness between ECM and CKP sensor. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring harness as necessary. If wiring harness is okay, remove and inspect CKP sensor. Also inspect signal plate. Replace CKP sensor and/or signal plate as necessary. If both components are okay, replace ECM.

DTC P0340: CAMSHAFT POSITION (CMP) SENSOR CIRCUIT

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

Camshaft position sensor is located on left rear side of cylinder head. A 1-tooth signal plate is mounted on camshaft. DTC is set when either no cranking or engine running signal is received by ECM from sensor. Possible causes are:

- * Open or short in CMP sensor circuit.
- * CMP sensor.
- * Starter.
- * ECM.

Diagnosis & Repair

1) Disconnect CMP sensor connector. Using ohmmeter, measure resistance between CMP sensor terminals. Resistance should be 835-1400 ohms (cold sensor) or 1060-1645 ohms (hot sensor). If resistance is not as specified, replace CMP sensor. If resistance is as specified, go to next step.

2) Check for open or short circuit in wiring harness between ECM and CMP sensor. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring harness as necessary. If wiring harness is okay, remove and inspect CMP sensor. Replace CMP sensor as necessary. If CMP sensor is okay, replace ECM.

DTC P0420 OR P0430: CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD

NOTE: Bank No. 1 refers to bank that includes cylinder No. 1. Bank No. 2 refers to bank without cylinder No. 1. Oxygen sensor No. 1 refers to sensor closest to engine block. Oxygen sensor No. 2 refers to sensor furthest away from engine block.

Circuit Description

The ECM compares waveform of oxygen sensor located before catalytic converter with waveform of oxygen sensor located after converter to determine if converter performance has deteriorated. If both waveforms change at similar rate, catalyst performance has deteriorated. DTC is set when both oxygen sensors have same amplitude after vehicle is driven for 6 minutes at 20-50 MPH. DTC P0420 is for

bank No. 1. DTC P0430 is for bank No. 2. Possible causes are:

- * Catalytic converter.
- * Oxygen sensor open or short circuit.
- * Oxygen sensor.
- * Exhaust leak.

Diagnosis & Repair

1) Connect scan tool. See Fig. 1. Start and warm engine to normal operating temperature. Raise engine speed 2500–3000 RPM for about 3 minutes. Retrieve codes. See SELF-DIAGNOSTIC SYSTEM in SELF-DIAGNOSTICS – INTRODUCTION article.

2) If codes other than P0420 or P0430 are present, diagnose and repair those codes first. If DTC P0420 is only displayed, check bank No. 1, sensor No. 1 and bank No. 2, sensor No. 1. See DTC P0130 OR P0150: HEATED OXYGEN CIRCUIT (SENSOR NO. 1) test. Repair as necessary. If oxygen sensors are okay, go to next step.

3) Check bank No. 1, sensor No. 2 and bank No. 2, sensor No. 2. See DTC P0136 OR P0156: HEATED OXYGEN SENSOR CIRCUIT (SENSOR NO. 2) test. Repair as necessary. If oxygen sensors are okay, replace catalytic converter(s).

DTC P0440: EVAPORATIVE EMISSION CONTROL SYSTEM MALFUNCTION

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

Vapor pressure sensor and Vacuum Switching Valve (VSV) for vapor pressure sensor are used to detect faults in EVAP system.

DTC is set if EVAP system leak is detected or vapor pressure sensor malfunctions. Possible causes are:

- * Fuel pressure sensor.
- * Fuel tank cap installed incorrectly.
- * Fuel tank cap defective.
- * Damaged, disconnected or blocked vacuum hose.
- * Fuel tank damaged.
- * Charcoal canister.

NOTE: If DTC P0441, P0446, P0450 or P0451 is output after DTC P0440, perform appropriate test first before performing DTC P0440 test.

Diagnosis & Repair

1) Check with vehicle driver if fuel tank cap was loose when refueling. If fuel tank cap was loose prior to refueling, it probably was cause of DTC to set. If fuel tank cap was not loose, check for cracks, deformations or loose connections in the following:

- * Fuel tank.
- * Charcoal canister.
- * Fuel tank filler pipe.
- * Hose and tubes around fuel tank and charcoal canister.

Repair as necessary. If components are okay, go to next step.

2) Check if fuel tank cap is an original manufacturer's cap. If fuel tank cap is an original manufacturer's cap, go to next step. If fuel tank cap is not an original manufacturer's cap, replace cap with a manufacturer's cap.

3) Check if fuel cap is installed properly. Reinstall cap as

necessary. If fuel cap is installed properly, go to next step.

4) Check for damaged fuel tank cap and gasket. Replace fuel cap as necessary. If fuel tank cap and gasket are okay, go to next step.

5) Remove fuel tank cap. Visually inspect fuel tank filler neck for damage. Replace filler neck as necessary. If filler neck is okay, go to next step.

6) Check vacuum hoses between vapor pressure sensor and VSV for vapor pressure sensor and between vapor pressure sensor and charcoal canister. Check hoses for correct installation, looseness and damage. Replace vacuum hoses as necessary. If vacuum hoses are okay, go to next step.

7) Check hose and tube between fuel tank and charcoal canister for correct installation and damage. Repair as necessary. If hose and tube are okay, go to next step.

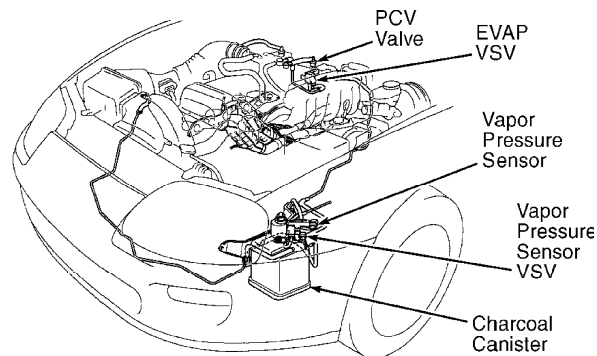
8) Check canister for cracks or damage. See appropriate I - SYSTEM/COMPONENT TESTS article. Replace charcoal canister as necessary. If charcoal canister is okay, go to next step.

9) Access ECM below passenger's side of instrument panel, underneath carpet. Turn ignition on. Backprobing ECM connector, measure voltage between terminals No. 2 (Blue/Red wire) and No. 18 (White/Black wire) at ECM E10 connector. See Fig. 3. If voltage is 4.5-5.5 volts, go to next step. If voltage is not 4.5-5.5 volts, replace ECM.

10) Backprobing ECM connector, measure voltage between terminal No. 18 (White/Black wire) at ECM E10 connector and terminal No. 18 (Brown/Yellow wire) at ECM E13 connector. Disconnect vacuum hose from vapor pressure sensor. Sensor is located on charcoal canister in left front side of engine compartment. See Fig. 4. Connect a vacuum pump to sensor. If voltage is 3.0-3.6 volts without vacuum applied and 1.3-2.1 volts with .59 in. Hg (2 kPa) vacuum applied, go to step 12). If voltage is not as specified, go to next step.

11) Check for open or short circuit in wiring harness between vapor pressure sensor and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary. If wiring harness is okay, replace vapor pressure sensor.

12) Disconnect EVAP vacuum hose from charcoal canister (vacuum hose from fuel tank-to-charcoal canister). Ensure fuel tank cap is installed properly. Using compressed air, apply .71 psi (.05 kg/cm²) to disconnected vacuum hose. If tank does not hold pressure for a minimum of one minute, replace fuel tank. If tank holds pressure, no fault is indicated at this time. Probable cause of DTC to set was an incorrectly installed fuel tank cap.



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Fig. 4: Locating Vapor Pressure Sensor & Vapor Pressure Sensor Vacuum Switching Valve (VSV)

Courtesy of Toyota Motor Sales, U.S.A., Inc.

DTC P0441: INCORRECT EVAP PURGE FLOW DTC P0446: VENT

CONTROL MALFUNCTION

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

Vapor pressure sensor and Vacuum Switching Valve (VSV) for vapor pressure sensor are used to detect faults in EVAP system.

DTC is set if EVAP system leak is detected or if there is a malfunction in EVAP VSV, vapor pressure sensor VSV or in vapor pressure sensor. Possible causes are:

- * Open or short in VSV circuit for vapor pressure sensor.
- * Open or short circuit in vapor pressure sensor circuit.
- * VSV for vapor pressure sensor.
- * Vapor pressure sensor.
- * VSV for EVAP.
- * Open or short in VSV circuit for EVAP.
- * Disconnected or blocked vacuum hose.
- * Charcoal canister.

NOTE: If DTC P0441, P0446, P0450 or P0451 is output after DTC P0440, perform appropriate test first before performing DTC P0440 test.

Diagnosis & Repair (Using Toyota Scan Tool)

1) Check EVAP VSV, vapor pressure sensor VSV and vapor pressure sensor wiring harness connectors for damaged pins, corrosion and loose wires. EVAP VSV is located on rear of air intake chamber. Vapor pressure sensor VSV and vapor pressure sensor are located on charcoal canister in left front side of engine compartment. See Fig. 4 . Repair connectors as necessary. If connectors are okay, go to next step.

2) Check all EVAP related vacuum hoses for cracks, looseness and correct routing. For proper vacuum hose routing, see appropriate illustration in M - VACUUM DIAGRAMS article. Replace vacuum hoses as necessary. If vacuum hoses are okay, go to next step.

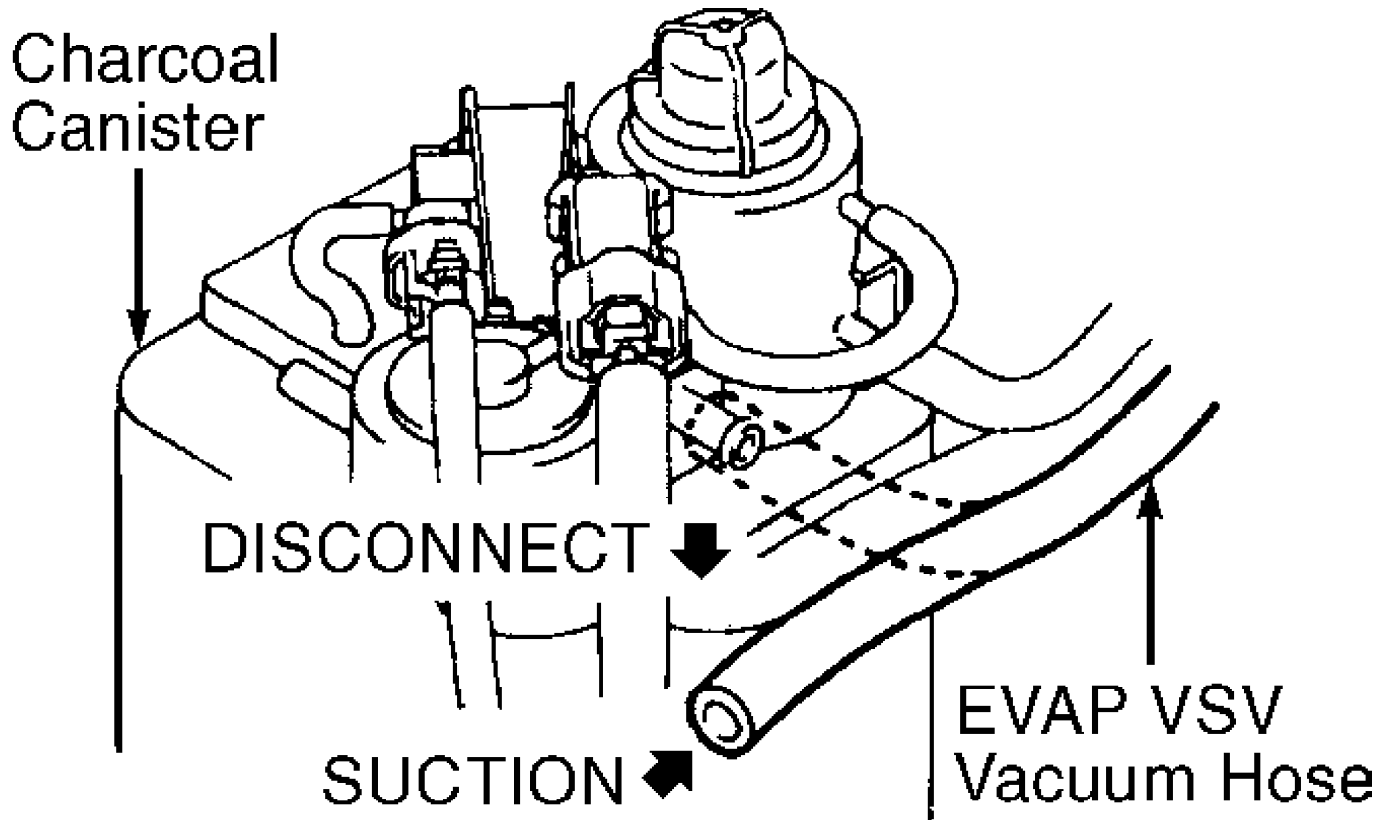
3) Access ECM below passenger's side of instrument panel, underneath carpet. Turn ignition on. Backprobing ECM connector, measure voltage between terminals No. 2 (Blue/Red wire) and No. 18 (White/Black wire) at ECM E10 connector. See Fig. 3. If voltage is 4.5-5.5 volts, go to next step. If voltage is not 4.5-5.5 volts, replace ECM.

4) Backprobing ECM connector, measure voltage between terminal No. 18 (White/Black wire) at ECM E10 connector and terminal No. 18 (Brown/Yellow wire) at ECM E13 connector. Disconnect vacuum hose from vapor pressure sensor. Sensor is located on top of charcoal canister in left front side of engine compartment. See Fig. 4. Connect a vacuum pump to sensor. If voltage is 3.0-3.6 volts without vacuum applied and 1.3-2.1 volts with .59 in. Hg (2 kPa) vacuum applied, go to step 6). If voltage is not as specified, go to next step.

5) Check for open or short circuit in wiring harness between vapor pressure sensor and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary. If wiring harness is okay, replace vapor pressure sensor.

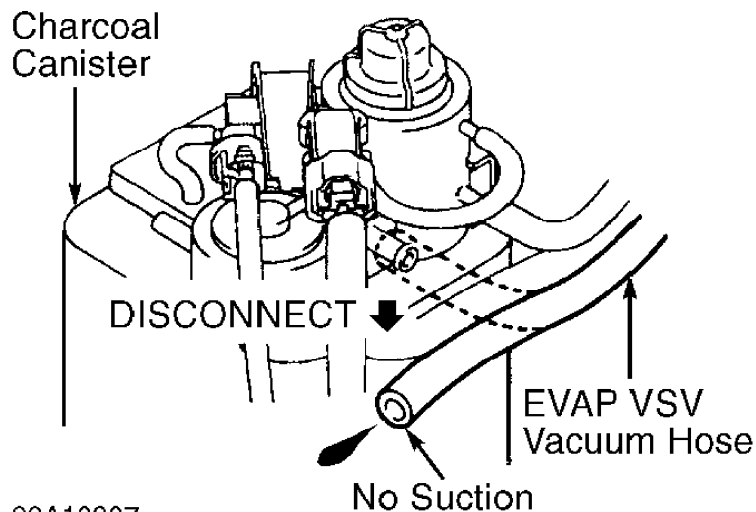
6) Connect scan tool to DLC No. 3. Turn ignition. Using scan tool, select ACTIVE TEST mode. Disconnect EVAP VSV vacuum hose from charcoal canister. See Figs. 5-6. Start engine. Connect a vacuum gauge to disconnected vacuum hose. When EVAP VSV is activated by scan tool, vacuum should be present. When EVAP VSV is not activated, no vacuum should be present. If vacuum is as specified, go to step 10). If

vacuum is not as specified, go to next step.



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Fig. 5: Testing EVAP Vacuum Switching Valve (VSV) VSV On
Courtesy of Toyota Motor Sales, U.S.A., Inc.



98A10207

Fig. 6: Testing EVAP Vacuum Switching Valve (VSV) VSV Off
Courtesy of Toyota Motor Sales, U.S.A., Inc.

7) Check vacuum hose between throttle body and EVAP VSV, and between EVAP VSV and charcoal canister. Check for correct routing,

damage, blockage and for proper connections. Replace vacuum hoses as necessary. If vacuum hoses are okay, go to next step.

8) Check EVAP VSV. See EMISSION SYSTEMS & SUB-SYSTEMS in appropriate I - SYSTEM/COMPONENT TESTS article. Replace VSV as necessary. If VSV is okay, go to next step.

9) Check for open or short circuit in wiring harness between EFI main relay, EVAP VSV and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary. If wiring harness is okay, replace ECM.

10) Disconnect vapor pressure sensor VSV vacuum hoses. Apply air pressure to VSV port "E". See Fig. 7. Air from port "E" should flow from port "G" only. Using scan tool, select ACTIVE TEST mode. With VSV on, air from port "E" should flow from port "F". If VSV operates as specified, go to step 13). If VSV does not operate as specified, go to next step.

11) Check vapor pressure sensor VSV operation. See EMISSION SYSTEMS & SUB-SYSTEMS in appropriate I - SYSTEM/COMPONENT TESTS article. Replace VSV as necessary. If VSV is okay, go to next step.

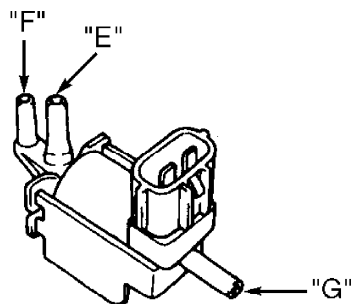
12) Check for open or short circuit in wiring harness between EFI main relay, vapor pressure sensor VSV and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary. If wiring harness is okay, replace ECM.

13) Turn ignition on. Disconnect vapor pressure sensor VSV connector. Start and run engine. Using scan tool, select ACTIVE TEST mode. Measure voltage between terminal No. 18 (White/Black wire) at ECM E10 connector and terminal No. 18 (Brown/Yellow wire) at ECM E13 connector. With EVAP VSV activated, voltage should be 2 volts or less. If voltage is as specified, go to step 15). If voltage is not as specified, go to next step.

14) Check vacuum hose between charcoal canister and vapor pressure sensor VSV. Also, check vacuum hose between vapor pressure sensor and vapor pressure sensor VSV. Check for correct routing, damage, blockage and for proper connections. Replace vacuum hose as necessary. If vacuum hose is okay, go to next step.

15) Remove fuel tank cap. Disconnect vapor pressure sensor VSV connector. Using scan tool, select ACTIVE TEST mode. Start engine. Using scan tool, switch EVAP VSV on. Backprobing ECM connector, measure voltage between terminal No. 18 (White/Black wire) at ECM E10 connector and terminal No. 18 (Brown/Yellow wire) at ECM E13 connector 5 seconds after switching EVAP VSV from on to off. If voltage is 2.5 volts or less, replace charcoal canister. If voltage is more than 2.5 volts, go to next step.

16) Check charcoal canister. See appropriate I - SYSTEM/COMPONENT TESTS article. Replace charcoal canister as necessary. If charcoal canister is okay, replace ECM.



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Fig. 7: Identifying Vapor Pressure Sensor Vacuum Switching Valve (VSV)

Courtesy of Toyota Motor Sales, U.S.A., Inc.

1) Check EVAP VSV, vapor pressure sensor VSV and vapor pressure sensor wiring harness connectors for damaged pins, corrosion and loose wires. EVAP VSV is located on rear of air intake chamber. Vapor pressure sensor VSV and vapor pressure sensor are located on charcoal canister in left front side of engine compartment. See Fig. 4. Repair connectors as necessary. If connectors are okay, go to next step.

2) Check all EVAP related vacuum hoses for cracks, looseness and correct routing. For proper vacuum hose routing, see appropriate illustration in M - VACUUM DIAGRAMS article. Replace vacuum hoses as necessary. If vacuum hoses are okay, go to next step.

3) Access ECM below passenger's side of instrument panel, underneath carpet. Turn ignition on. Backprobing ECM connector, measure voltage between terminals No. 2 (Blue/Red wire) and No. 18 (White/Black wire) at ECM E10 connector. See Fig. 3. If voltage is 4.5-5.5 volts, go to next step. If voltage is not 4.5-5.5 volts, replace ECM.

4) Backprobing ECM connector, measure voltage between terminal No. 18 (White/Black wire) at ECM E10 connector and terminal No. 18 (Brown/Yellow wire) at ECM E13 connector. Disconnect vacuum hose from vapor pressure sensor. Sensor is located on top of charcoal canister in left front side of engine compartment. See Fig. 4. Connect a vacuum pump to sensor. If voltage is 3.0-3.6 volts without vacuum applied and 1.3-2.1 volts with .59 in. Hg (2 kPa) vacuum applied, go to step 6). If voltage is not as specified, go to next step.

5) Check for open or short circuit in wiring harness between vapor pressure sensor and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary. If wiring harness is okay, replace vapor pressure sensor.

6) Access ECM below passenger's side of instrument panel, underneath carpet. Turn ignition on. Connect a jumper wire between ground and terminal No. 7 (Yellow wire) at ECM E10 connector. With jumper wire connected EVAP Vacuum Switching Valve (VSV) is on. Apply air pressure to VSV port "E". See Fig. 8. Air from port "E" should flow from port "F". Disconnect jumper wire. Air from port "E" should not flow from port "F". If VSV operates as specified, go to step 10). If VSV does not operate as specified, go to next step.

7) Remove EVAP VSV. Using ohmmeter, measure resistance between VSV terminals. Resistance should be 27-33 ohms at 68°F (20°C). Measure resistance between each terminal and body of VSV. Resistance should be infinite. If resistance is not as specified, replace VSV. If resistance is as specified, go to next step.

8) Check VSV operation. Apply battery voltage to VSV terminals. Apply air pressure to VSV port "E". See Fig. 8. Air from port "E" should flow from port "F". Remove battery voltage from VSV terminals. Air from port "E" should not flow from port "F". Replace VSV as necessary. If VSV operates as specified, go to next step.

9) Check for open or short circuit in wiring harness between EFI relay, EVAP VSV and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary. If wiring harness is okay, replace ECM.

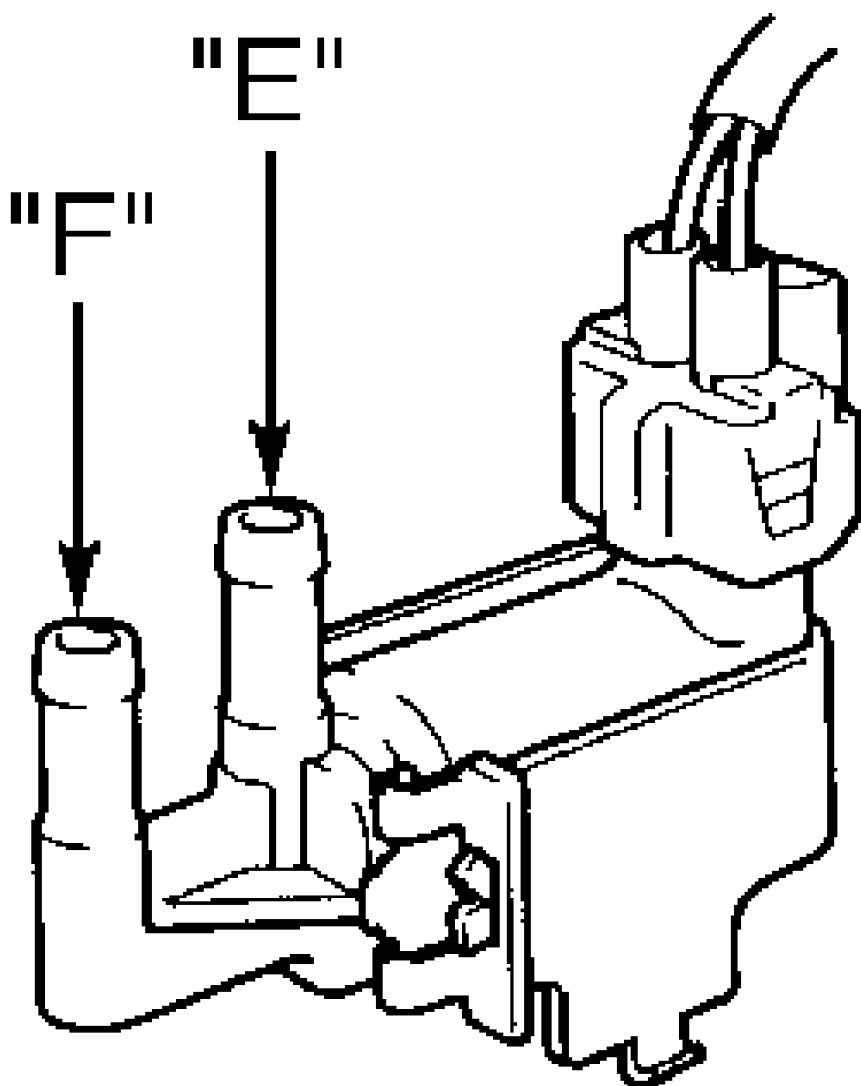
10) Access ECM below passenger's side of instrument panel, underneath carpet. Turn ignition on. Connect a jumper wire between ground and terminal No. 13 (Red/Blue wire) at ECM E15 connector. With jumper wire connected vapor pressure sensor Vacuum Switching Valve (VSV) is on. Apply air pressure to VSV port "E". See Fig. 7. Air from port "E" should flow from port "F". Disconnect jumper wire. Air from port "E" should flow from port "G". If VSV operates as specified, check charcoal canister. See appropriate I - SYSTEM/COMPONENT TESTS article. Replace charcoal canister as necessary. If VSV does not operate as specified, go to next step.

11) Disconnect vapor pressure sensor VSV vacuum hoses. Using ohmmeter, measure resistance between VSV terminals. If resistance is

37-44 ohms at 68°F (20°C), go to next step. If resistance is not 37-44 ohms, replace VSV.

12) Check for continuity between each terminal and VSV body. If continuity exists, replace VSV. If continuity does not exist, apply air pressure to VSV port "E". See Fig. 7. Air from port "E" should flow from port "G". Apply battery voltage to VSV terminals. Air from port "E" should flow from port "F". If VSV operates as specified, go to next step. If VSV does not operate as specified, replace VSV.

13) Check for open or short circuit in wiring harness between EFI main relay, vapor pressure sensor VSV and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring harness as necessary. If wiring harness is okay, replace ECM.



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Fig. 8: Identifying EVAP Vacuum Switching Valve (VSV)
Courtesy of Toyota Motor Sales, U.S.A., Inc.

DTC P0450: EVAP PRESSURE SENSOR FAULT DTC P0451: EVAP
PRESSURE SENSOR RANGE/PERFORMANCE

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

Vapor pressure sensor and Vacuum Switching Valve (VSV) for vapor pressure sensor are used to detect faults in EVAP system. DTC is set if vapor pressure sensor malfunctions. Possible causes are:

- * Short or open in vapor pressure sensor circuit.
- * Vapor pressure sensor.
- * ECM.

Diagnosis & Repair

1) Access ECM below passenger's side of instrument panel, underneath carpet. Turn ignition on. Backprobing ECM connector, measure voltage between terminals No. 2 (Blue/Red wire) and No. 18 (White/Black wire) at ECM E10 connector. See Fig. 3. If voltage is 4.5-5.5 volts, go to next step. If voltage is not 4.5-5.5 volts, replace ECM.

2) Backprobing ECM connector, measure voltage between terminal No. 18 (White/Black wire) at ECM E10 connector and terminal No. 18 (Brown/Yellow wire) at ECM E13 connector. Disconnect vacuum hose from vapor pressure sensor. Sensor is located on top of charcoal canister in left front side of engine compartment. See Fig. 4. Connect a vacuum pump to sensor. If voltage is 3.0-3.6 volts without vacuum applied and 1.3-2.1 volts with .59 in. Hg (2 kPa) vacuum applied, replace ECM. If voltage is not as specified, go to next step.

3) Check for open or short circuit in wiring harness between vapor pressure sensor and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary. If wiring harness is okay, replace vapor pressure sensor.

DTC P0500: VEHICLE SPEED SENSOR FAULT

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

Vehicle Speed Sensor (VSS) detects transmission output shaft rotation speed and sends signals to ECM. Signal is used by ECM to determine vehicle speed. DTC is set if there is no VSS signal to ECM while vehicle is being driven and park/neutral switch is off. Possible causes are:

- * Vehicle speed sensor.
- * Open or short circuit in VSS circuit.
- * ECM.

Diagnosis & Repair

1) Test drive vehicle and check speedometer operation. If speedometer is not functioning correctly, see appropriate INSTRUMENT PANEL article in ACCESSORIES/SAFETY EQUIPMENT section. If speedometer is functioning correctly, go to next step.

2) Turn ignition off. Access ECM below passenger's side of instrument panel, underneath carpet. Disconnect ECM E12 connector. See Fig. 3. Measure resistance between terminals No. 5 (Blue/Yellow wire) and No. 11 (Red/Yellow wire) at ECM E12 connector. If resistance is 560-680 ohms, replace ECM. If resistance is not 560-680 ohms, go to

next step.

3) Remove VSS from transmission. Connect DVOM between VSS terminals. Observe DVOM and slowly pass a magnet over end of VSS. As magnet is passed over VSS a low voltage signal should be generated. Voltage signal is extremely low. If VSS does not operate as specified, replace VSS. If VSS operates as specified, check for open or short circuit in wiring harness between ECM and VSS. See appropriate wiring diagram in L – WIRING DIAGRAMS article. Repair wiring harness as necessary.

DTC P0505: IDLE AIR CONTROL (IAC) SYSTEM MALFUNCTION

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

Idle speed is controlled by the Electronic Throttle Control System (ETCS). Description of ETCS components are as follows:

- * Throttle motor is used to operate throttle valve.
- * Magnetic clutch is used to connect throttle motor with the throttle valve.
- * Throttle position sensor is used to detect opening angle of throttle valve.
- * Accelerator pedal position sensor is used to detect accelerator pedal position.
- * Engine Control Module (ECM) controls the ETCS.

DTC is set when idle speed continues to vary greatly from target speed. Possible causes are:

- * ETCS.
- * Air intake leak.

Repair & Diagnosis

1) If codes other than DTC P0505 are present, diagnose and repair those codes first. If DTC P0505 is only displayed, check air induction system for leaks. Repair as necessary. If air induction system is okay, go to next step.

2) Check Electronic Throttle Control System (ETCS). See IDLE CONTROL SYSTEM in appropriate I – SYSTEM/COMPONENT TESTS article. Replace components as necessary.

DTC P1120: ACCELERATOR PEDAL POSITION (APP) SENSOR CIRCUIT FAULT

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

The APP sensor is located on throttle body and has 2 variable resistors integral to sensor. APP sensor monitors accelerator position and is connected with the accelerator pedal by the accelerator wire. APP sensor signal voltage (0-5 volts) to ECM changes in proportion to accelerator pedal opening angle. ECM controls throttle motor based on APP sensor voltage signals. If DTC P1120 is present, ECM turns off power to throttle motor and magnetic clutch and throttle valve is fully closed by the return spring. When this occurs, opening angle of

throttle valve can be controlled by accelerator pedal by means of the throttle cable. DTC is set when ECM detects voltage is out of range on VPA or VPA2 circuits. Possible causes are:

- * Open or short in APP sensor circuit.
- * APP sensor.
- * ECM.

NOTE: If DTCs P0110, P0115, P0120, P0450 and P1120 are output together, inspect ECM terminal E2 (ground) circuit. Repair as necessary. See appropriate wiring diagram in WIRING DIAGRAMS article.

Diagnosis & Repair (With Toyota Scan Tool)

1) Connect scan tool to DLC No. 3 connector. See Fig. 1. Turn ignition on. Using scan tool, monitor APP sensor voltage for VPA and VPA2 circuits. See ACCELERATOR PEDAL POSITION SENSOR VOLTAGE table. If voltage is as specified, replace ECM. If voltage is not as specified, go to next step.

ACCELERATOR PEDAL POSITION SENSOR VOLTAGE TABLE

Accelerator Pedal	Volts
Depressed	
VPA Circuit	3.2-4.8
VPA2 Circuit	4.7-5.1
Released	
VPA Circuit	0.3-0.9
VPA2 Circuit	1.8-2.7

2) Access ECM below passenger's side of instrument panel, underneath carpet. Turn ignition on. Measure voltage between terminals No. 2 (Blue/Red wire) and No. 18 (White/Black wire) at ECM E10 connector. See Fig. 3. If voltage is 4.5-5.5 volts, go to next step. If voltage is not 4.5-5.5 volts, replace ECM.

3) Measure voltage between terminals No. 18 (White/Black wire) and No. 15 (Green wire) at ECM E10 connector. With throttle valve closed, voltage should be .3-.9 volt. With throttle valve fully open, voltage should be 3.2-4.8 volts. Measure voltage between terminals No. 18 (White/Black wire) and No. 16 (White wire) at ECM E10 connector. With throttle valve closed, voltage should be 1.8-2.7 volts. With throttle valve fully open, voltage should be 4.7-5.1 volts. If voltage readings are as specified, replace ECM. If voltage readings are not as specified, go to next step.

4) Check APP sensor. See THROTTLE BODY under IDLE CONTROL SYSTEM in appropriate I - SYSTEM/COMPONENT TESTS article. Replace APP sensor as necessary. If APP sensor is okay, check for an open or short circuit in wiring harness between ECM and APP sensor. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring harness as necessary.

Diagnosis & Repair (With OBD-II Scan Tool)

1) Access ECM below passenger's side of instrument panel, underneath carpet. Turn ignition on. Measure voltage between terminals No. 2 (Blue/Red wire) and No. 18 (White/Black wire) at ECM E10 connector. See Fig. 3. If voltage is 4.5-5.5 volts, go to next step. If voltage is not 4.5-5.5 volts, replace ECM.

2) Measure voltage between terminals No. 18 (White/Black wire) and No. 15 (Green wire) at ECM E10 connector. With throttle valve closed, voltage should be .3-.9 volt. With throttle valve fully open, voltage should be 3.2-4.8 volts. Measure voltage between

terminals No. 18 (White/Black wire) and No. 16 (White wire) at ECM E10 connector. With throttle valve closed, voltage should be 1.8–2.7 volts. With throttle valve fully open, voltage should be 4.7–5.1 volts. If voltage readings are as specified, replace ECM. If voltage readings are not as specified, go to next step.

3) Check APP sensor. See THROTTLE BODY under IDLE CONTROL SYSTEM in appropriate I – SYSTEM/COMPONENT TESTS article. Replace APP sensor as necessary. If APP sensor is okay, check for an open or short circuit in wiring harness between ECM and APP sensor. See appropriate wiring diagram in L – WIRING DIAGRAMS article. Repair wiring harness as necessary.

DTC P1121: ACCELERATOR PEDAL POSITION (APP) SENSOR

RANGE/PERFORMANCE FAULT

Circuit Description

The APP sensor is located on throttle body and has 2 variable resistors integral to sensor. APP sensor monitors accelerator position and is connected with the accelerator pedal by the accelerator wire. APP sensor signal voltage (0–5 volts) to ECM changes in proportion to accelerator pedal opening angle. ECM turns off power to the throttle motor based on APP sensor voltage signals. DTC is set when ECM detects voltage is out of range on VPA circuit or VPA2 circuit. Possible causes are:

- * APP sensor.

Diagnosis & Repair

If DTC P1121 is present, replace APP sensor.

DTC P1125: THROTTLE CONTROL MOTOR CIRCUIT MALFUNCTION

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

Throttle valve opening angle is detected by the Throttle Position (TP) sensor and sends a signal to the ECM. The ECM then uses this signal to control the throttle control motor which opens and closes throttle valve in response to driving conditions. If DTC P1125 is present, ECM turns off power to the throttle motor and magnetic clutch and throttle valve is fully closed by the return spring. When this occurs, opening angle of throttle valve can be controlled by accelerator pedal by means of the throttle cable. DTC is set when ECM detects out of range throttle control motor current. Possible causes are:

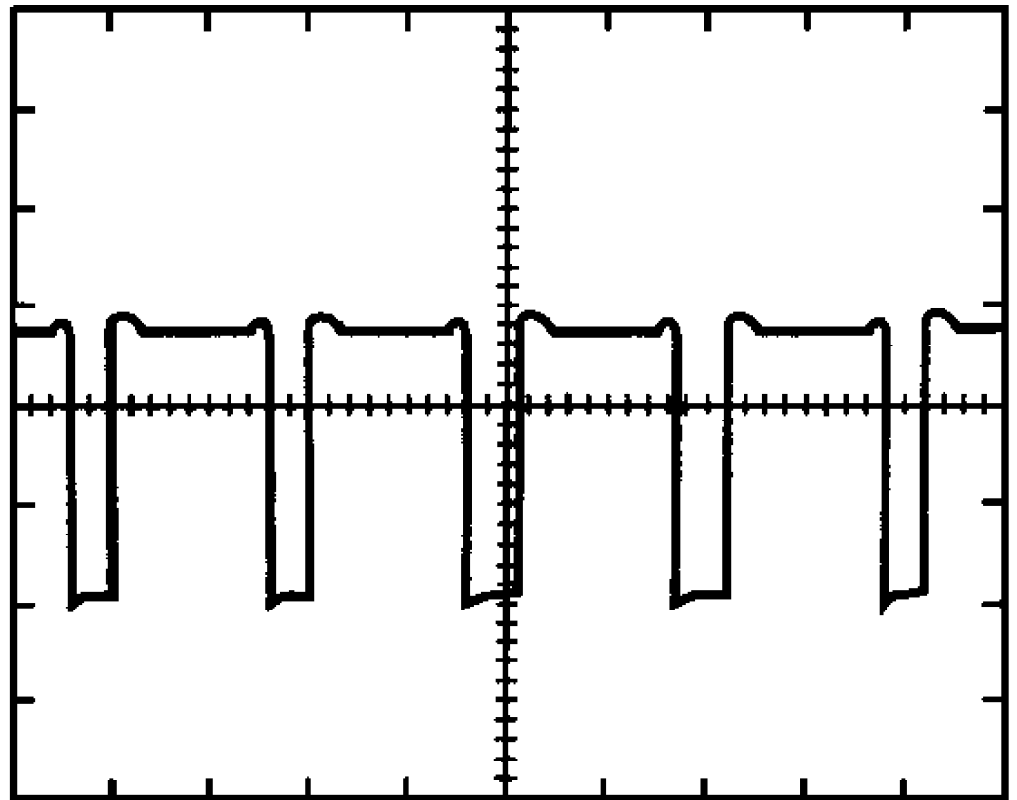
- * Open or short in throttle control motor circuit.
- * Throttle control motor.
- * ECM.

Diagnosis & Repair

1) Turn ignition off. Access ECM below passenger's side of instrument panel, underneath carpet. Connect an oscilloscope between terminal No. 17 (Brown wire) at ECM E10 connector and terminal No. 8 (White wire; circuit M+) or No. 7 (Black wire; circuit M-) at ECM E9. See Fig. 3. Start engine and allow it to idle. Observe waveform. See Figs. 9–10. If waveform is okay, replace ECM. If waveform is not okay, go to next step.

5 VOLT/
DIVISION

GROUND



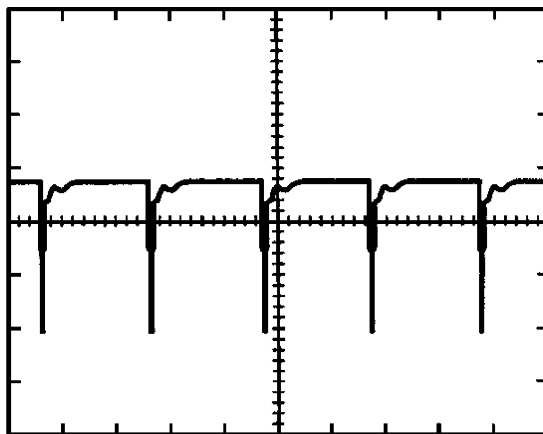
1 MILLISECOND/DIVISION

G98F10202

Fig. 9: Identifying Correct Throttle Control Motor Waveforms M+
Signal Waveform
Courtesy of Toyota Motor Sales, U.S.A., Inc.

5 VOLT/
DIVISION

GROUND



1 MILLISECOND/DIVISION

G98G10203

Fig. 10: Identifying Correct Throttle Control Motor Waveforms M-
Signal Waveform
Courtesy of Toyota Motor Sales, U.S.A., Inc.

- 2) Disconnect throttle control motor Gray 4-pin connector.

Measure resistance between terminals No. 1 (terminal for Black wire) and No. 2 (terminal for White wire) at throttle control motor. If resistance is .3-100.0 ohms at 68°F (20°C), go to next step. If resistance is not .3-100.0 ohms, replace throttle control motor.

3) Check for open or short circuit in wiring harness between throttle control motor and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring harness as necessary. If wiring harness is okay, replace ECM.

DTC P1126: MAGNETIC CLUTCH CIRCUIT MALFUNCTION

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

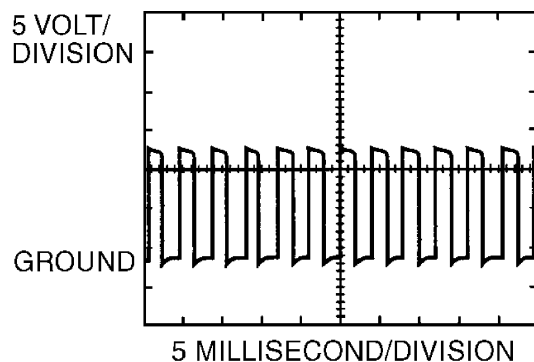
The magnetic clutch is mounted between throttle control motor and throttle body. The throttle motor opens and closes the throttle valve through the magnetic clutch. If the magnetic clutch is defective, the throttle control motor must be replaced. If DTC P1126 is present, ECM turns off power to throttle motor and magnetic clutch, and throttle valve is fully closed by the return spring. When this occurs, opening angle of throttle valve can be controlled by the accelerator pedal by means of the throttle cable. DTC is set when ECM detects out of range throttle control motor current. Possible causes are:

- * Open or short in magnetic clutch circuit.
- * Magnetic clutch.
- * ECM.

Diagnosis & Repair

1) If not using Toyota scan tool, go to next step. If using Toyota scan tool, turn ignition on. Using scan tool, read magnetic clutch current value. If reading is .8-1.0 amp, go to step 3). If reading is not .8-1.0 amp, go to step 5).

2) Turn ignition off. Access ECM below passenger's side of instrument panel, underneath carpet. Connect an oscilloscope between terminals No. 19 (Yellow wire; circuit C-) and No. 20 (Blue wire; circuit C+) at ECM E9. See Fig. 3. Start engine and allow it to idle. Observe waveform. See Fig. 11. If waveform is okay, go to next step. If waveform is not okay, go to step 5).



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Fig. 11: Identifying Correct Magnetic Clutch Waveform
Courtesy of Toyota Motor Sales, U.S.A., Inc.

3) Disconnect throttle control motor Gray 4-pin connector. Measure resistance between terminals No. 3 (terminal for Blue wire)

and No. 4 (terminal for Yellow wire) at throttle control motor. If resistance is 4.2-5.2 ohms at 68°F (20°C), go to next step. If resistance is not 4.2-5.2 ohms, replace throttle control motor.

4) Check for open or short circuit in wiring harness between throttle control motor and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring harness as necessary. If wiring harness is okay, go to next step.

5) Clear DTC. Start engine. Turn ignition off and wait 3 seconds. Turn ignition on and check for DTCs. If DTC P1126 is not present, replace ECM. If DTC P1126 is present, replace throttle control motor.

DTC P1127: ELECTRONIC THROTTLE CONTROL SYSTEM ACTUATOR POWER

SOURCE CIRCUIT FAULT

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

Battery voltage is supplied to circuit +BM at ECM E14 connector at all times. If DTC P1127 is present, ECM turns off power to throttle motor and magnetic clutch and throttle valve is fully closed by the return spring. When this occurs, opening angle of throttle valve can be controlled by the accelerator pedal by means of the throttle cable. DTC is set when ECM detects an open ETCS power source circuit. Possible causes are:

- * Open ETCS power source circuit.
- * ECM.

Diagnosis & Repair

1) Remove and inspect ETCS fuse (15-amp) from left side engine compartment fuse block. If fuse is okay, go to next step. If fuse is blown, check for cause of fuse to blow. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair as necessary and retest.

2) Access ECM below passenger's side of instrument panel, underneath carpet. Measure voltage between ground and terminal No. 7 (Blue/Red wire) at ECM E14 connector. See Fig. 3. If voltage is 9-14 volts, replace ECM. If voltage is not 9-14 volts, repair open in power source circuit.

DTC P1128: THROTTLE CONTROL MOTOR LOCK MALFUNCTION

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

Throttle valve opening angle is detected by the Throttle Position (TP) sensor and sends a signal to the ECM. The ECM then uses this signal to control the throttle control motor which opens and closes the throttle valve in response to driving conditions. If DTC P1128 is present, ECM turns off power to the throttle motor and magnetic clutch and the throttle valve is fully closed by the return spring. When this occurs, opening angle of throttle valve can be controlled by accelerator pedal by means of the throttle cable. DTC is set when ECM detects a locked throttle control motor. Possible causes are:

- * Throttle body assembly.
- * Throttle control motor.
- * ECM.

Diagnosis & Repair

1) Turn ignition off. Disconnect throttle control motor Gray 4-pin connector. Measure resistance between terminals No. 1 (terminal for Black wire) and No. 2 (terminal for White wire) at throttle control motor. If resistance is .3-100.0 ohms at 68°F (20°C), go to next step. If resistance is not .3-100.0 ohms, replace throttle control motor.

2) Remove air inlet hose from throttle body. Visually inspect throttle body for carbon build-up or foreign material holding throttle valve open. Repair as necessary and retest. If no problem is detected, replace throttle body.

DTC P1129: ELECTRONIC THROTTLE CONTROL SYSTEM FAULT

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

Throttle valve opening angle is detected by the Throttle Position (TP) sensor and sends a signal to the ECM. The ECM then uses this signal to control the throttle control motor which opens and closes throttle valve in response to driving conditions. If DTC P1129 is present, ECM turns off power to the throttle motor and magnetic clutch and throttle valve is fully closed by the return spring. When this occurs, opening angle of throttle valve can be controlled by accelerator pedal by means of the throttle cable. DTC is set when throttle opening angle varies greatly from target throttle opening angle. Possible causes are:

- * Open or short in throttle control motor circuit.
- * Throttle body.
- * ECM.

Diagnosis & Repair

Replace ECM. Clear DTCs and retest. Retrieve DTCs. If DTC P1129 is present, replace throttle body and retest.

DTC P1300: IGNITOR CIRCUIT MALFUNCTION

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

The ECM determines ignition timing and outputs ignition signals (IGT) for each cylinder. Based on IGT signals, the ignitor controls the primary ignition signals (IGC) for all ignition coils. The ignitor also sends an ignition confirmation signal (IGF) as a fail-safe measure to the ECM. DTC is set when there is no IGF signal to ECM for 6 consecutive IGT signals during engine operation. Possible causes are:

- * IGF or IGT open or short circuit from ignitor to ECM.
- * Ignitor.
- * ECM.

Diagnosis & Repair

1) Check for spark at misfiring cylinder. See IGNITION CHECKS in appropriate F - BASIC TESTING article. If spark is present, go to next step. If spark is not present, go to step 4).

2) Check for open or short in IGF circuit (Red/Yellow wire) between ECM and ignitor. Ignitor is located near left shock tower. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary. If circuit is okay, go to next step.

3) Disconnect Black 10-pin ignitor connector. Access ECM below passenger's side of instrument panel, underneath carpet. Turn ignition on. Measure voltage between ground and terminal No. 25 (Red/Yellow wire) at ECM E9 connector. See Fig. 3. If voltage is 4.5-5.5 volts, replace ignitor. If voltage is not 4.5-5.5 volts, replace ECM.

4) Check for open or short in IGT1, IGT2 and IGT3 circuits between ECM and ignitor. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary. If circuits are okay, go to next step.

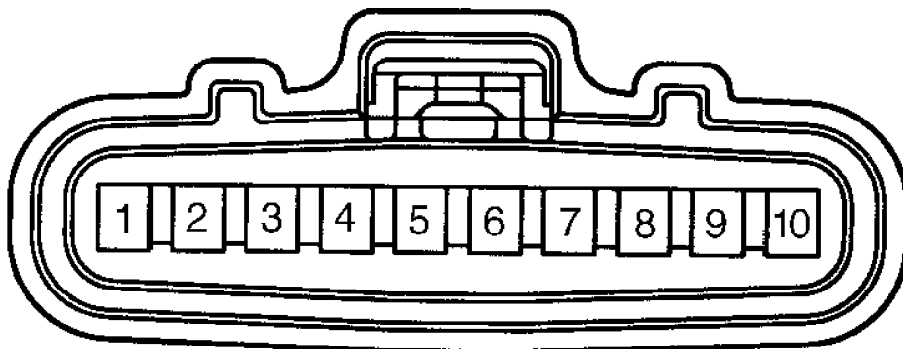
5) Access ECM below passenger's side of instrument panel, underneath carpet. Measure voltage between ground and terminals No. 11 (Red/White wire), No. 12 (Light Green wire) and No. 13 (Green/Red wire) at ECM E9 connector while cranking engine. See Fig. 3. If voltage is .1-4.5 volts, go to next step. If voltage is not .1-4.5 volts, replace ECM.

6) Disconnect Black 10-pin ignitor connector. Backprobing ECM connector, measure voltage between ground and terminals No. 11 (Red/White wire), No. 12 (Light Green wire) and No. 13 (Green/Red wire) at ECM E9 connector while cranking engine. See Fig. 3. If voltage is .1-4.5 volts, go to next step. If voltage is not .1-4.5 volts, replace ECM.

7) Turn ignition on. Measure voltage between ground and terminal No. 9 (Black/White wire) at ignitor wiring harness connector. See Fig. 12. If voltage is 9-14 volts, go to next step. If voltage is not 9-14 volts, check and repair ignitor power source circuit. See appropriate wiring diagram in L - WIRING DIAGRAMS article.

8) Check for open or short in wiring harness between ignition switch and ignition coil, and between ignition coil and ignitor. Repair wiring as necessary. If wiring harness is okay, go to next step.

9) Check EFI main relay. See appropriate I - SYSTEM/COMPONENT TESTS article. Replace relay as necessary. If relay is okay, check ignition coil. See IGNITION CHECKS in appropriate F - BASIC TESTING article. Replace coil as necessary. If coil is okay, replace ignitor.



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Fig. 12: Identifying Ignitor Connector Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

DTC P1335: CRANKSHAFT POSITION (CKP) SENSOR CIRCUIT

See DTC P0335 OR P1335: CRANKSHAFT POSITION (CKP) SENSOR CIRCUIT test.

DTC P1349: VARIABLE VALVE TIMING (VVT) SYSTEM FAULT

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM harness connector and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

NOTE: For information on VVT system, see VARIABLE VALVE TIMING (VVT) SYSTEM under COMPUTERIZED ENGINE CONTROLS in E - THEORY/OPERATION article.

Circuit Description

The VVT system controls intake valve timing in response to driving condition. DTC is set if valve timing does not change after engine is at normal operating temperature and engine speed is 400-4000 RPM. Possible causes are:

- * Valve timing.
- * Oil control valve.
- * VVT controller assembly.
- * ECM.

Diagnosis & Repair (Using Toyota Scan Tool)

1) Ensure valve timing is correct. See appropriate article in ENGINE MECHANICAL section. Adjust valve timing as necessary. If valve timing is okay, go to next step.

2) Start engine. Ensure engine is at normal operating temperature. Connect scan tool to DLC No. 3. See Fig. 1. Using scan tool, select ACTIVE TEST mode. Select VVT. Observe engine speed with Oil Control Valve (OCV) on and off. With OCV off, engine should idle normally. With OCV on, engine should idle rough or stall. If OCV operation is not as specified, go to next step. If OCV operation is as specified, no problem is detected at this time.

NOTE: If no problem is detected, reason for DTC P1349 to set may have been a foreign object that was caught in some part of VVT system in the engine oil for a short time. System returned to normal when the object was ejected and picked up by the engine oil filter.

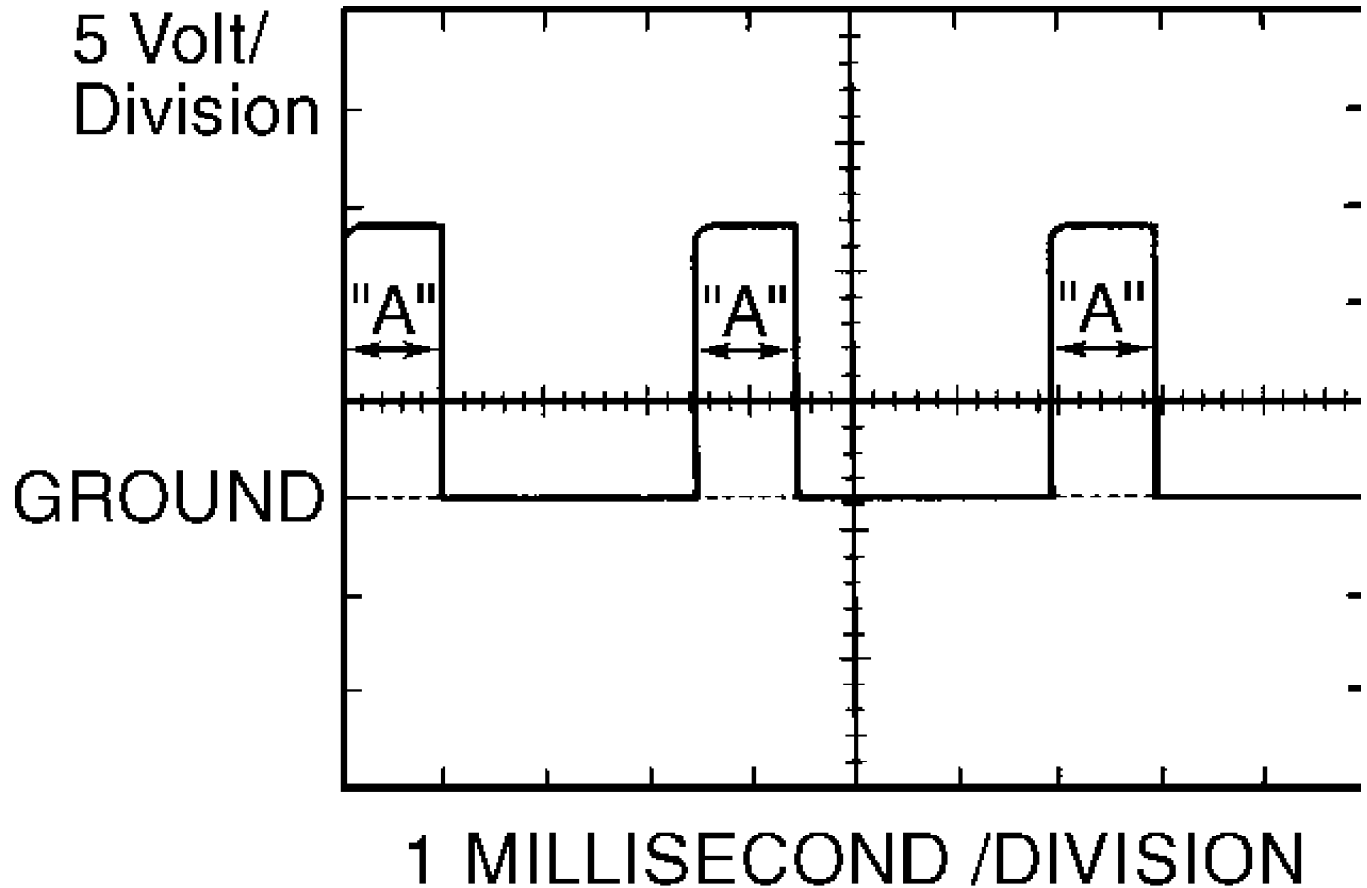
3) Connect an oscilloscope between terminals No. 17 (Yellow/Black wire) and No. 18 (White/Red wire) at ECM E9 connector. See Fig. 3. Start engine and observe waveform pattern. See Fig. 13. Waveform frequency ("A") will lengthened as engine speed increases. If waveform pattern is okay, go to next step. If waveform pattern is not okay, replace ECM.

4) Turn ignition off. Remove timing belt cover, timing belt cover and OCV. See appropriate article in ENGINE MECHANICAL section. Place a rag under OCV mounting hole. Rotate VVT intake camshaft timing pulley back-and-forth 30 degrees. If oil drains from VVT controller assembly, go to next step. If oil does not drain, replace VVT controller assembly and go to next step.

5) Check OCV. See appropriate I - SYSTEM/COMPONENT TESTS article. Replace OCV as necessary. If OCV is okay, check for oil blockage to OCV. Inspect oil check valve and OCV oil pipe. Check valve is integral to oil pipe banjo bolt. If any oil blockage is indicated, repair as necessary and retest. If no oil blockage is indicated, go to next step.

6) Clear DTCs. Start engine and check for DTCs. If DTC P1349 is not present, no problem is indicated at this time. If DTC P1349 is

present, replace ECM.



98C10209

Fig. 13: Identifying Correct VVT System Waveform
Courtesy of Toyota Motor Sales, U.S.A., Inc.

Diagnosis & Repair (Using OBD-II Scan Tool)

1) Ensure valve timing is correct. See appropriate article in ENGINE MECHANICAL section. Adjust valve timing as necessary. If valve timing is okay, go to next step.

2) Start engine. Ensure engine is at normal operating temperature. Disconnect Oil Control Valve (OCV) connector. OCV is located on top left front of cylinder head. See Fig. 14. With OCV disconnected, engine should idle normally. Apply battery voltage to OCV terminals. See Fig. 14. Engine should idle rough or stall. If OCV operation is not as specified, go to step 4). If OCV operation is as specified, go to next step.

3) Connect an oscilloscope between terminals No. 17 (Yellow/Black wire) and No. 18 (White/Red wire) at ECM E9 connector. See Fig. 3. Start engine and observe waveform pattern. See Fig. 13. Waveform frequency ("A") will lengthened as engine speed increases. If waveform pattern is okay, no problem is indicated at this time. If waveform pattern is not okay, replace ECM.

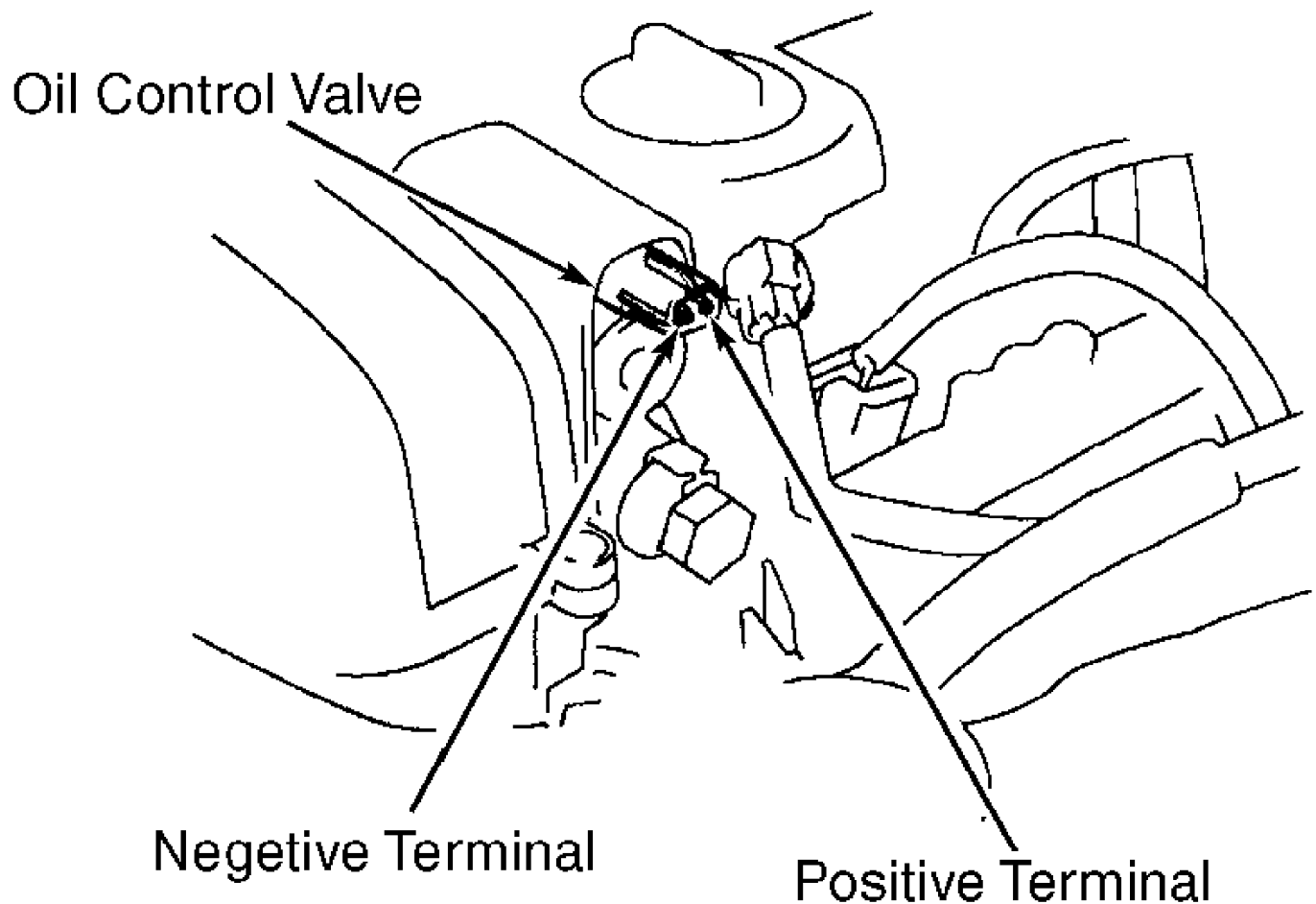
NOTE: If no problem is detected, reason for DTC P1349 to set may have been a foreign object that was caught in some part of VVT system in the engine oil for a short time. System returned to normal when the object was ejected and picked up

by the engine oil filter.

4) Turn ignition off. Remove timing belt cover, timing belt cover and OCV. See appropriate article in ENGINE MECHANICAL section. Place a rag under OCV mounting hole. Rotate VVT intake camshaft timing pulley back-and-forth 30 degrees. If oil drains from VVT controller assembly, go to next step. If oil does not drain, replace VVT controller assembly and go to next step.

5) Check OCV. See appropriate I - SYSTEM/COMPONENT TESTS article. Replace OCV as necessary. If OCV is okay, check for oil blockage to OCV. Check oil check valve and OCV oil pipe. Check valve is integral to oil pipe banjo bolt. If any oil blockage is indicated, repair as necessary. If no oil blockage is indicated, go to next step.

6) Clear DTCs. Start engine and check for DTCs. If DTC P1349 is not present, no problem is indicated at this time. If DTC P1349 is present, replace ECM.



98F10210

Fig. 14: Testing Oil Control Valve
Courtesy of Toyota Motor Sales, U.S.A., Inc.

DTC P1520: STOPLIGHT SWITCH SIGNAL MALFUNCTION (A/T ONLY)

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM harness connector and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

The stoplight signal is used to detect when brakes have been applied. ECM uses this signal to control fuel cut-off engine speed. DTC is set if stoplight switch does not turn off when vehicle is being driven. Possible causes are:

- * Short in stoplight switch signal circuit.
- * Stoplight switch.
- * ECM.

Diagnosis & Repair

1) Check stoplights. If stoplights do not function properly, repair as necessary and retest system. If stoplights function properly, go to next step.

2) Access ECM below passenger's side of instrument panel, underneath carpet. Turn ignition on. Backprobing ECM connector, measure voltage between ground and terminal No. 6 (Green/White wire) at ECM E6 connector. With brake pedal depressed, voltage should be 7.5-14.0 volts. With brake pedal released, voltage should be less than 1.5 volt. If voltage is not as specified, go to next step. If voltage is as specified, check wiring harness and connectors. Problem is intermittent.

3) Check for short in wiring harness between ECM and stoplight switch. Repair wiring harness as necessary. If wiring harness is okay, replace ECM. Retest system.

DTC P1600: ECM BATT MALFUNCTION

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

Battery voltage is supplied to ECM BATT terminal (constant). DTC is set when open in back-up power source is detected. Possible causes are:

- * Back-up power source open circuit.
- * ECM.

Diagnosis & Repair

1) Turn ignition off. Access ECM below passenger's side of instrument panel, underneath carpet. Using DVOM, measure voltage between ground and terminal No. 1 (Black/White wire) at ECM E14 connector. See Fig. 3. If voltage is 9-14 volts, replace ECM. If voltage is not 9-14 volts, go to next step.

2) Remove and inspect EFI fuse in engine compartment fuse block. Replace fuse as necessary. If fuse is okay, check circuit between EFI fuse and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary.

DTC P1656: OIL CONTROL VALVE (OCV) FAULT

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

Throttle valve opening angle is detected by the Throttle Position (TP) sensor and sends a signal to the ECM. The ECM then uses

this signal to control the throttle control motor which opens and closes throttle valve in response to driving conditions. DTC is set when ECU detects an open or short in OCV circuit. Possible cause is:

- * Open or short in OCV circuit.
- * OCV.
- * ECM.

Diagnosis & Repair (Using Toyota Scan Tool)

1) Start engine. Ensure engine is at normal operating temperature. Connect scan tool to DLC No. 3. Using scan tool, select ACTIVE TEST mode. Select VVT. Observe engine speed with Oil Control Valve (OCV) on and off. With OCV off, engine should idle normally. With OCV on, engine should idle rough or stall. If OCV operation is not as specified, go to next step. If OCV operation is as specified, no problem is detected at this time. Fault may be intermittent

2) Start engine. Ensure engine is at normal operating temperature. Disconnect OCV connector. OCV is located on top left front of cylinder head. See Fig. 14. With OCV disconnected, engine should idle normally. Apply battery voltage to OCV terminals. See Fig. 14. Engine should idle rough or stall. If OCV operation is not as specified, replace OCV. If OCV operation is as specified, go to next step.

3) Connect an oscilloscope between terminals No. 17 (Yellow/Black wire) and No. 18 (White/Red wire) at ECM E9 connector. See Fig. 3. Start engine and observe waveform pattern. See Fig. 13. Waveform frequency ("A") will lengthened as engine speed increases. If waveform pattern is okay, go to next step. If waveform pattern is not okay, replace ECM.

4) Check for an open or short circuit between OCV and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary. If wiring harness is okay, no problem is detected at this time. Fault maybe intermittent.

Diagnosis & Repair (Using OBD-II Scan Tool)

1) Start engine. Ensure engine is at normal operating temperature. Disconnect Oil Control Valve (OCV) connector. OCV is located on top left front of cylinder head. See Fig. 14. With OCV disconnected, engine should idle normally. Apply battery voltage to OCV terminals. See Fig. 14. Engine should idle rough or stall. If OCV operation is not as specified, replace OCV. If OCV operation is as specified, go to next step.

2) Connect an oscilloscope between terminals No. 17 (Yellow/Black wire) and No. 18 (White/Red wire) at ECM E9 connector. See Fig. 3. Start engine and observe waveform pattern. See Fig. 13. Waveform frequency ("A") will lengthened as engine speed increases. If waveform pattern is okay, go to next step. If waveform pattern is not okay, replace ECM.

3) Check for an open or short circuit between OCV and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring as necessary. If wiring harness is okay, no problem is detected at this time. Fault may be intermittent.

DTC P1780: PARK/NEUTRAL POSITION (PNP) SWITCH

CAUTION: If ECM replacement is instructed in following testing, always ensure ECM connectors and ground circuit are okay. If either are suspect, repair and repeat testing to confirm ECM malfunction.

Circuit Description

The PNP switch sends a signal to ECM when transmission is in Neutral or Park. This signal is used for air/fuel correction and for idle speed control. DTC is set under 2 conditions:

- * When 2 or more switches are on simultaneously for "R", "N", "2" and "L" position.
- * ECM is receiving an ON signal from PNP switch when vehicle is being operated for more than 30 seconds at 44 MPH or more (1500-2500 RPM).

Possible causes are:

- * PNP switch short circuit.
- * PNP switch.
- * ECM.

NOTE: Toyota scan tool can be used to confirm PNP switch from CURRENT DATA.

Diagnosis & Repair

1) Access ECM below passenger's side of instrument panel, underneath carpet. Turn ignition on. Backprobing ECM connector, measure voltage between ground and specified terminal at ECM connector. See PARK/NEUTRAL POSITION SWITCH VOLTAGE table. See Fig. 3. If voltage is as specified, replace ECM. If voltage is not as specified, go to next step.

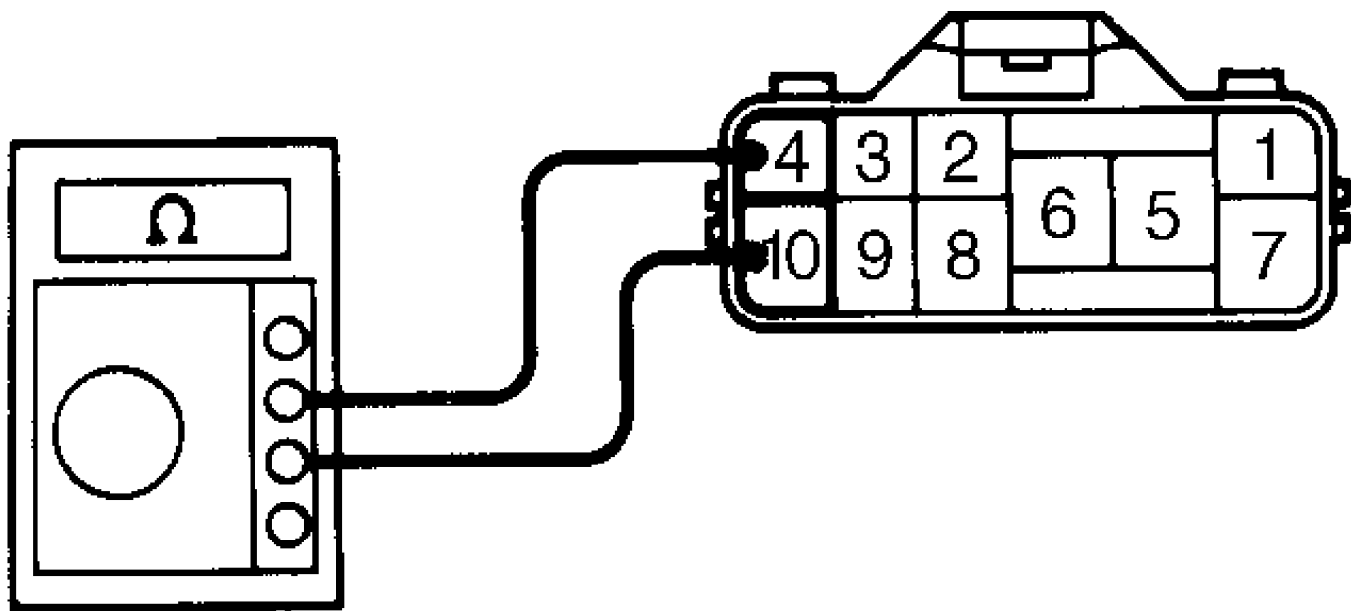
PARK/NEUTRAL POSITION SWITCH VOLTAGE TABLE

Shifter Position	Terminal No.		Volts
Park & Neutral	(1) 16	.....	Zero
	(1) 17	.....	Zero
	(3) 20	.....	Zero
	(3) 21	.....	Zero
	(4) 24	.....	9-14
Reverse	(1) 16	..... (2)	9-14
	(1) 17	.....	Zero
	(3) 20	.....	Zero
	(3) 21	.....	Zero
	(4) 24	.....	9-14
Drive	(1) 16	.....	Zero
	(1) 17	.....	9-14
	(3) 20	.....	Zero
	(3) 21	.....	Zero
	(4) 24	.....	9-14
2	(1) 16	.....	Zero
	(1) 17	.....	Zero
	(3) 20	.....	9-14
	(3) 21	.....	Zero
	(4) 24	.....	9-14
Low	(1) 16	.....	Zero
	(1) 17	.....	Zero
	(3) 20	.....	9-14
	(3) 21	.....	Zero
	(4) 24	.....	9-14

- (1) - Measure voltage between ground and terminal listed at ECM E13 connector. See Fig. 3.
- (2) - Voltage may slightly be less due to lighting of reverse lights.
- (3) - Measure voltage between ground and terminal listed at ECM E10 connector.
- (4) - Measure voltage between ground and terminal listed at ECM E9 connector.

2) Disconnect PNP switch connector. Using ohmmeter, check continuity of switch terminals with shift lever in specified positions. See Figs. 15 and 16. Replace PNP switch as necessary. If PNP switch is okay, go to next step.

3) Check wiring harness between battery and PNP switch and between PNP switch and ECM. See appropriate wiring diagram in L - WIRING DIAGRAMS article. Repair wiring harness as necessary. If wiring harness is okay, replace ECM.



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Fig. 15: Identifying PNP Switch Terminals
Courtesy of Toyota Motor Sales, U.S.A., Inc.

○—○ Continuity

Terminal Shift Position	6	5	4	7	8	10	9	2	3
P	○—○		○—○						
R			○—○		○				
N	○—○		○			○			
D			○				○		
2			○					○	
L			○						○

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Fig. 16: PNP Switch Continuity Chart
Courtesy of Toyota Motor Sales, U.S.A., Inc.