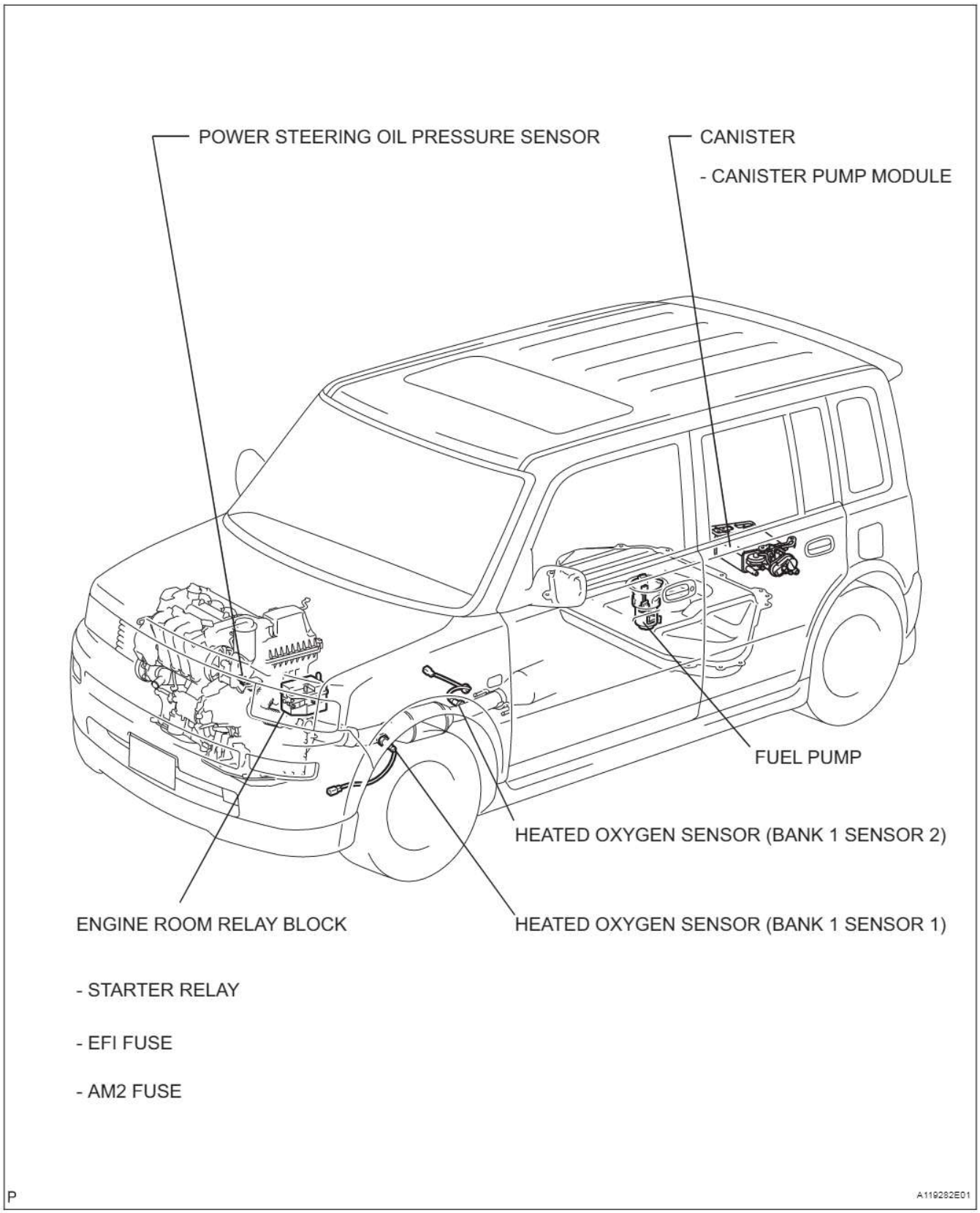
PART AND SYSTEM NAME LIST

This reference list indicates the part names used in this manual along with their definitions.

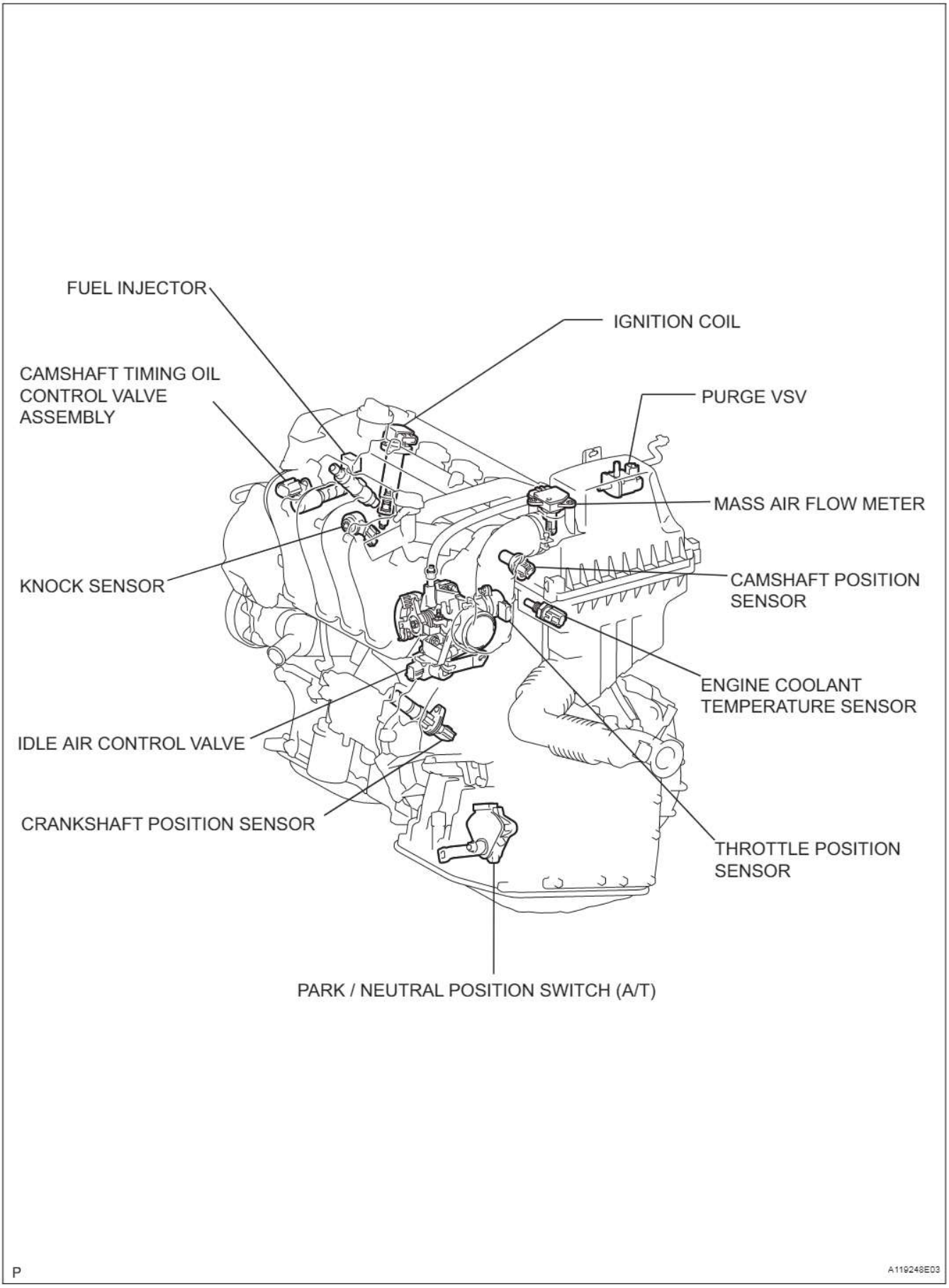
TOYOTA/LEXUS name	Definition
Toyota HCAC system, Hydro-carbon Adsorptive Catalyst (HCAC) system, HC adsorptive three-way catalyst	HC adsorptive three-way catalytic converter
Variable valve timing sensor, VVT sensor	Camshaft position sensor
Variable valve timing system, VVT system	Camshaft timing control system
Camshaft timing oil control valve, Oil control valve, OCV, VVT, VSV	Camshaft timing oil control valve
Variable timing and lift	Camshaft timing and lift control
Crankshaft position sensor "A"	Crankshaft position sensor
Engine speed sensor	Crankshaft position sensor
THA	Intake air temperature
Knock control module	Engine knock control module
Knock sensor	Engine knock sensor
Mass or volume air flow circuit	Mass air flow sensor circuit
Vacuum sensor	Manifold air pressure sensor
Internal control module, Control module, Engine control ECU, PCM	Power train control module
FC idle	Deceleration fuel cut
Idle air control valve	Idle speed control valve
VSV for CCV, Canister close valve VSV for canister control	Evaporative emissions canister vent valve
VSV for EVAP, Vacuum switching valve assembly No. 1, EVAP VSV, Purge VSV	Evaporative emissions canister purge valve
VSV for pressure switching valve, Bypass VSV	Evaporative emission pressure switching valve
Vapor pressure sensor, EVAP pressure sensor, Evaporative emission control system pressure sensor	Fuel tank pressure sensor
Charcoal canister	Evaporative emissions canister
ORVR system	On-board refueling vapor recovery system
Intake manifold runner control	Intake manifold tuning system
Intake manifold runner valve, IMRV, IACV (runner valve)	Intake manifold tuning valve
Intake control VSV	Intake manifold tuning solenoid valve
AFS	Air fuel ratio sensor
HO2 sensor	Heated oxygen sensor
Oxygen sensor pumping current circuit	Oxygen sensor output signal
Oxygen sensor reference ground circuit	Oxygen sensor signal ground
Accel position sensor	Accelerator pedal position sensor
Throttle actuator control motor, Actuator control motor, Electronic throttle motor, Throttle control motor	Electronic throttle actuator
Electronic throttle control system, Throttle actuator control system	Electronic throttle control system
Throttle/pedal position sensor, Throttle/pedal position switch, Throttle position sensor/switch	Throttle position sensor
Turbo pressure sensor	Turbocharger pressure sensor
Turbo VSV	Turbocharger pressure control solenoid valve
P/S pressure switch	Power-steering pressure switch
VSV for ACM	Active control engine mount
Speed sensor, Vehicle speed sensor "A", Speed sensor for stability control ECU	Vehicle speed sensor
ATF temperature sensor, Trans. fluid temp. sensor, ATF temperature sensor "A"	Transmission fluid temperature sensor
Electronic controlled automatic transmission, ECT	Electronically controlled automatic transaxle
Intermediate shaft speed sensor "A"	Counter gear speed sensor
Output speed sensor	Output shaft speed sensor

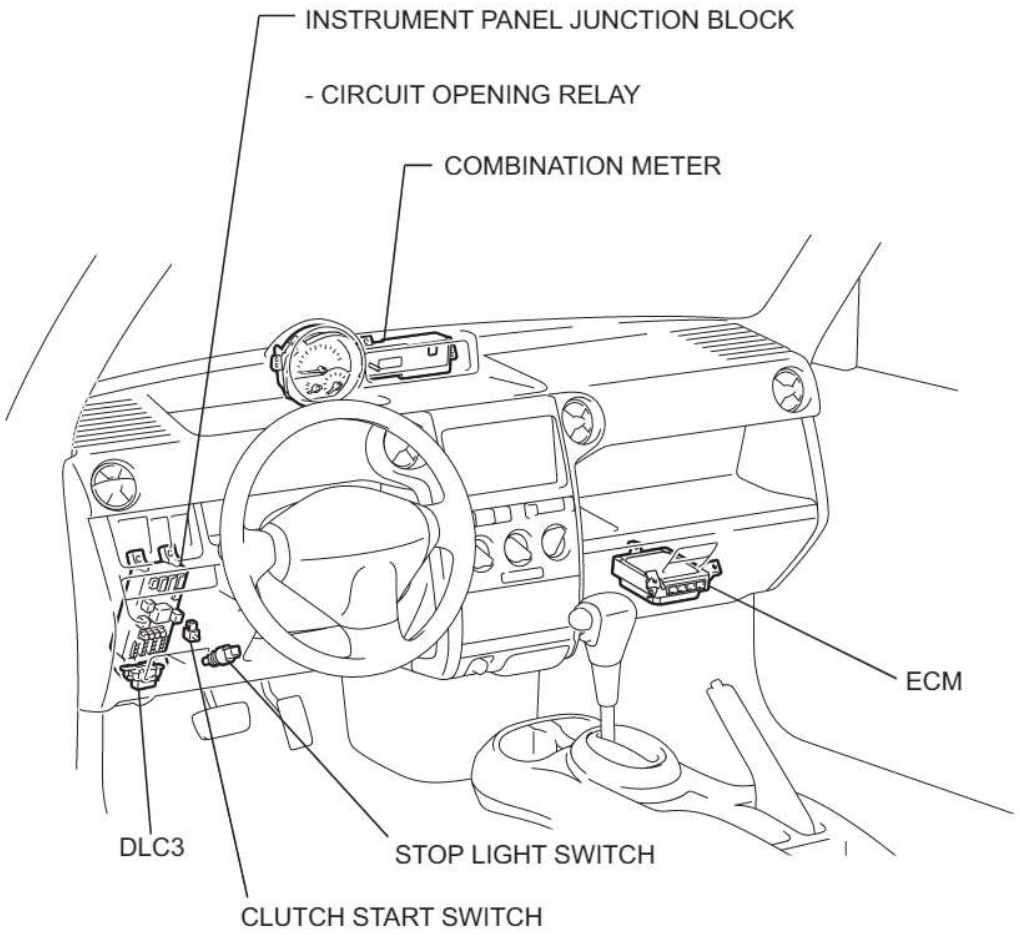
TOYOTA/LEXUS name	Definition
Input speed sensor, Input turbine speed sensor "A", Speed sensor (NT), Turbine speed sensor	Input turbine speed sensor
PNP switch, NSW	Park/neutral position switch
Pressure control solenoid	Transmission pressure control solenoid
Shift solenoid	Transmission shift solenoid valve
Transmission control switch, Shift lock control unit	Shift lock control module
Engine immobiliser system, Immobiliser system	Vehicle anti-theft system

PARTS LOCATION



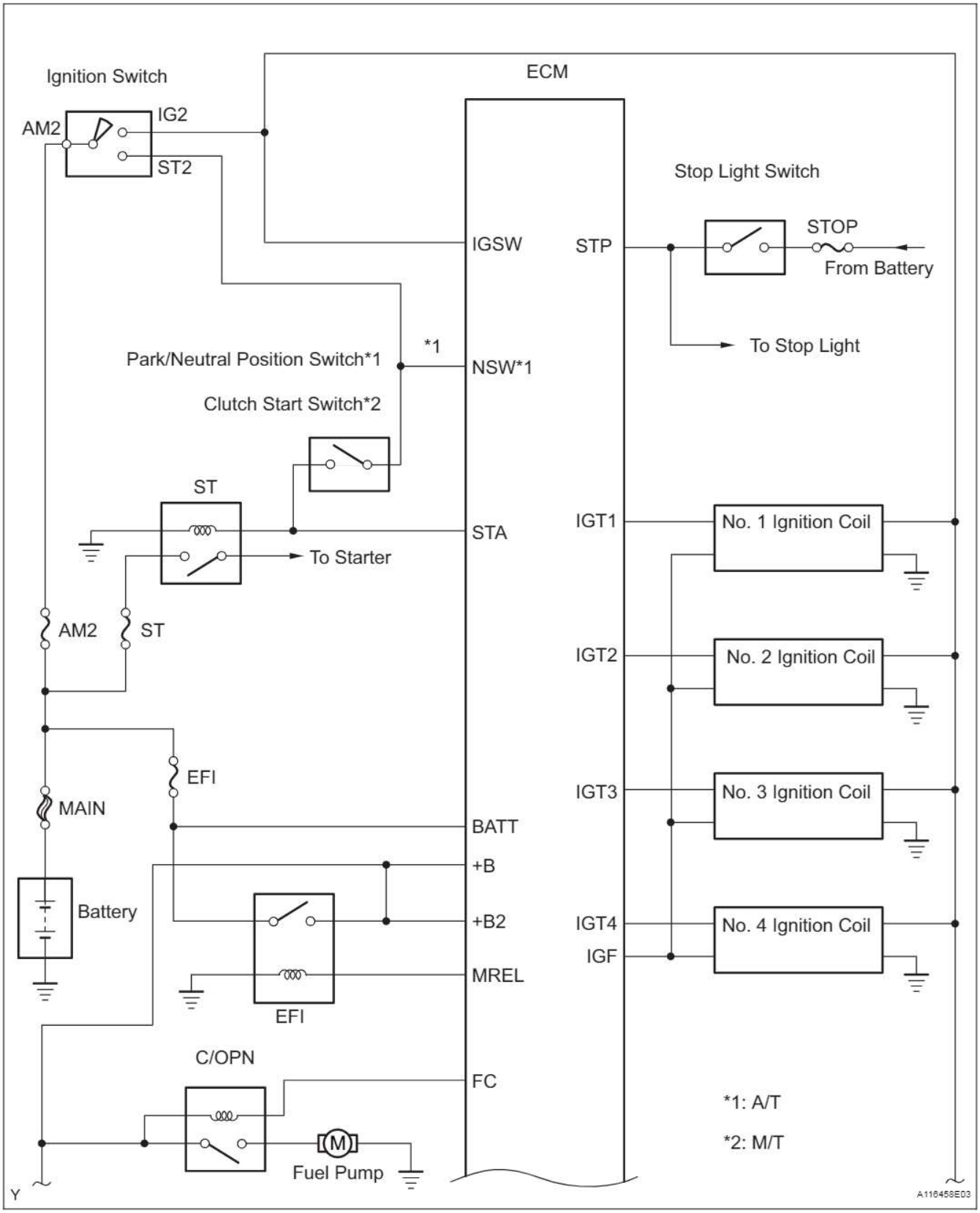
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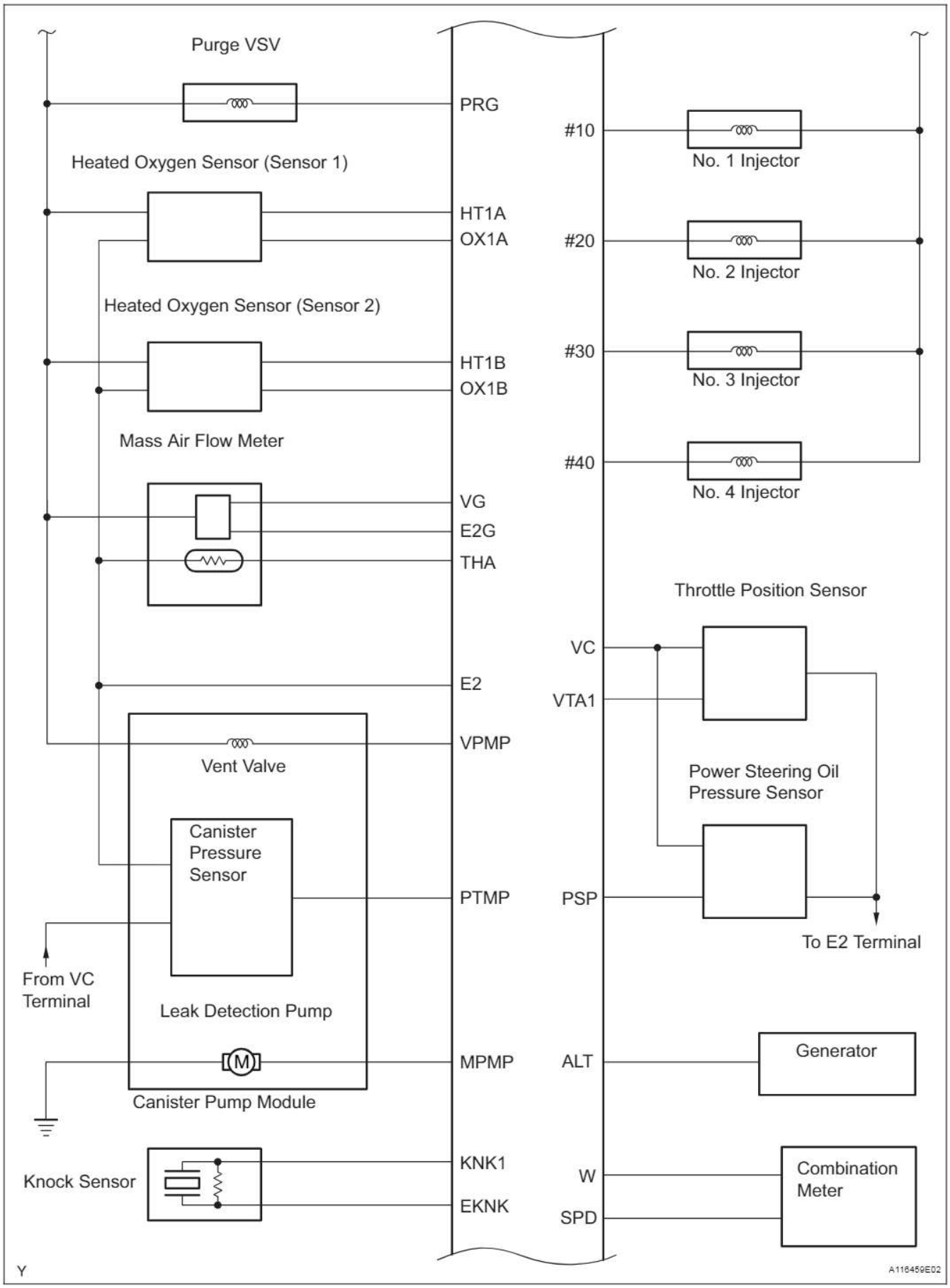

FUEL INJECTOR
IGNITION COIL
CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY
PURGE VSV
MASS AIR FLOW METER
KNOCK SENSOR
CAMSHAFT POSITION SENSOR
ENGINE COOLANT TEMPERATURE SENSOR
IDLE AIR CONTROL VALVE
CRANKSHAFT POSITION SENSOR
THROTTLE POSITION SENSOR
PARK / NEUTRAL POSITION SWITCH (A/T)
P
A119248E03

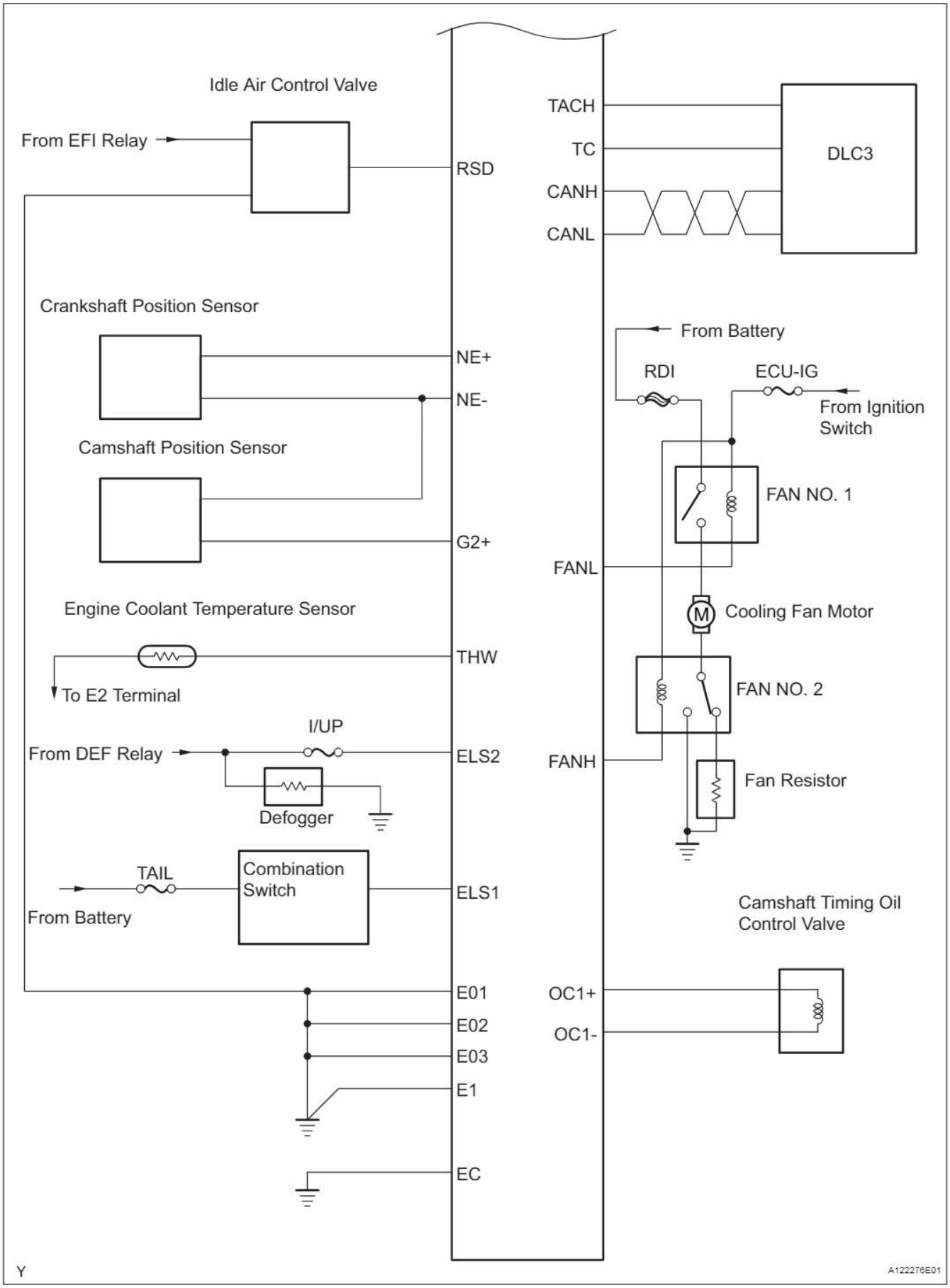


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SYSTEM DIAGRAM




Purge VSV
PRG
Heated Oxygen Sensor (Sensor 1)
HT1A
OX1A
Heated Oxygen Sensor (Sensor 2)
HT1B
OX1B
Mass Air Flow Meter
VG
E2G
THA
E2
VPMP
Vent Valve
Canister Pressure Sensor
PTMP
From VC Terminal
Leak Detection Pump
MPMP
Canister Pump Module
Knock Sensor
KNK1
EKNK
#10
No. 1 Injector
#20
No. 2 Injector
#30
No. 3 Injector
#40
No. 4 Injector
Throttle Position Sensor
VC
VTA1
Power Steering Oil Pressure Sensor
PSP
To E2 Terminal
ALT
Generator
W
SPD
Combination Meter
Y
A116459E02


Idle Air Control Valve
From EFI Relay
RSD
TACH
TC
CANH
CANL
DLC3
Crankshaft Position Sensor
NE+
NE-
Camshaft Position Sensor
G2+
From Battery
RDI
ECU-IG
From Ignition Switch
FAN NO. 1
FANL
Cooling Fan Motor
Engine Coolant Temperature Sensor
THW
To E2 Terminal
FAN NO. 2
I/UP
From DEF Relay
ELS2
FANH
Fan Resistor
Defogger
TAIL
Combination Switch
From Battery
ELS1
Camshaft Timing Oil Control Valve
E01
E02
E03
E1
OC1+
OC1-
EC
Y
A122276E01

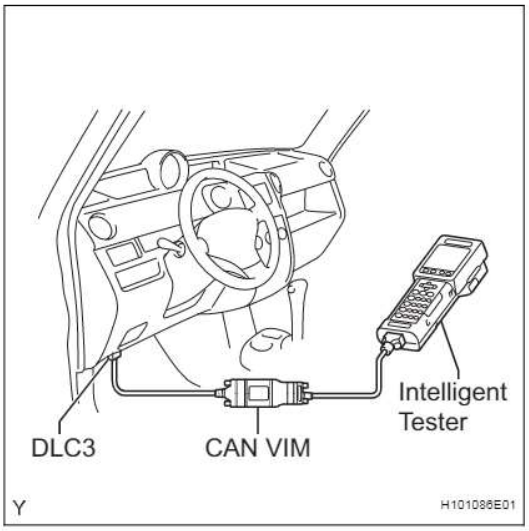
ES

DTC CHECK / CLEAR

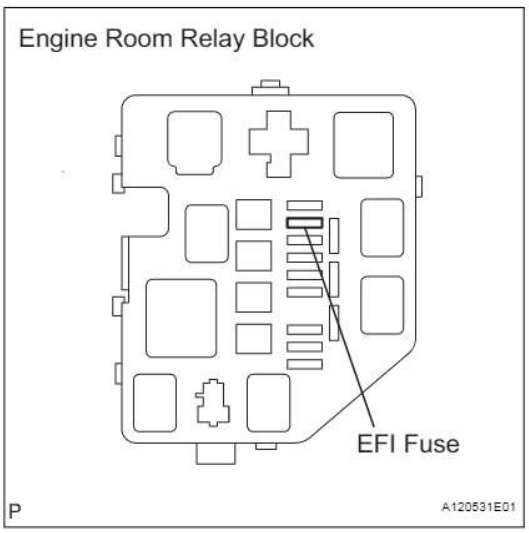
NOTICE:
When the diagnosis system is changed from normal mode to check mode or vice versa, all DTCs and freeze frame data recorded in normal mode are erased. Before changing modes, always check and make a note of DTCs and freeze frame data.

HINT:

- DTCs which are stored in the ECM can be displayed on the intelligent tester. The intelligent tester can display current and pending DTCs.
- Some DTCs are not set if the ECM does not detect the same malfunction again during a second consecutive driving cycle. However, malfunctions detected on only 1 occasion are stored as pending DTCs.



1. **CHECK DTC (Using the intelligent tester)**
   (a) Connect the intelligent tester to the DLC3.
   (b) Turn the ignition switch ON and turn the tester ON.
   (c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
   (d) Check the DTC(s) and freeze frame data, and then write them down.
   (e) Check the details of the DTC(s) (see page ES-48).
2. **CLEAR DTC (Using the intelligent tester)**
   (a) Connect the intelligent tester to the DLC3.
   (b) Turn the ignition switch ON and turn the tester ON.
   (c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CLEAR CODES.
   (d) Press the YES button.
3. **CLEAR DTC (Without using intelligent tester)**
   (a) Perform either one of the following operations.
   (1) Disconnect the negative (-) battery cable for more than 1 minute.
   (2) Remove the EFI fuse from the engine room relay block located inside the engine compartment for more than 1 minute.
   NOTICE:
   When disconnecting the battery cable, perform the initialization procedure.



FREEZE FRAME DATA

1. DESCRIPTION

Freeze frame data records the engine conditions (fuel system, calculated load, engine coolant temperature, fuel trim, engine speed, vehicle speed, etc.) when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

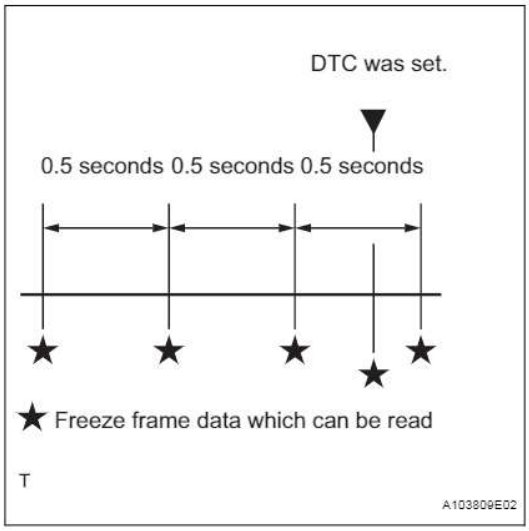
HINT:

If it is impossible to replicate the problem even though a DTC is detected, confirm the freeze frame data.

The ECM records engine conditions in the form of freeze frame data every 0.5 seconds. Using the intelligent tester, 5 separate sets of freeze frame data, including the data values at the time when the DTC was set, can be checked.

- 3 data sets before the DTC was set.
- 1 data set when the DTC was set.
- 1 data set after the DTC was set.

  These data sets can be used to simulate the condition of the vehicle around the time of the occurrence of the malfunction. The data may assist in identifying of the cause of the malfunction, and in judging whether it was temporary or not.



2. LIST OF FREEZE FRAME DATA

LABEL (Intelligent Tester Display)	Measure Item/Range	Diagnostic Note
INJECTOR	Injector	-
IGN ADVANCE	Ignition advance	-
CALC LOAD	Calculated load	Calculated load by ECM
VEHICLE LOAD	Vehicle load	-
MAF	Mass air flow volume	If value approximately 0.0 g/sec.: • Mass air flow meter power source circuit open or short • VG circuit open or short If value 160.0 g/sec. or more: • E2G circuit open
ENGINE SPD	Engine speed	-
VEHICLE SPD	Vehicle speed	Speed indicated on speedometer
COOLANT TEMP	Engine coolant temperature	If value -40°C, sensor circuit open If value 140°C or more sensor circuit shorted
INTAKE AIR	Intake air temperature	If value -40°C, sensor circuit open If value 140°C or more sensor circuit shorted
AIR-FUEL PATIO	Air-fuel ratio	-
PURGE DENSITY	Learning value of purge density	-
EVAP PURGE FLOW	EVAP purge flow	-
EVAP PURGE VSV	EVAP purge VSV duty ratio	-
KNOCK CRRT VAL	Correction learning value of knocking	-
KNOCK FB VAL	Feedback value of knocking	-

LABEL (Intelligent Tester Display)	Measure Item/Range	Diagnostic Note
THROTTLE POS	Throttle position	Read value with ignition switch ON (Do not start engine)
THROTTLE POS	Throttle sensor positioning	Read value with ignition switch ON (Do not start engine)
O2S B1 S1	Heated oxygen sensor output	Performing INJ VOL or A/F CONTROL function of ACTIVE TEST enables technician to check output voltage of sensor
O2S B1 S2	Heated oxygen sensor output	Performing INJ VOL or A/F CONTROL function of ACTIVE TEST enables technician to check output voltage of sensor
TOTAL FT #1	Total fuel trim	-
SHORT FT #1	Short-term fuel trim	Short-term fuel compensation used to maintain air-fuel ratio at stoichiometric air-fuel ratio
LONG FT #1	Long-term fuel trim	Overall fuel compensation carried out in long-term to compensate a continual deviation of short-term fuel trim from central valve
FUEL SYS #1	Fuel system status (bank 1)	• OL (Open Loop): Has not yet satisfied conditions to go closed loop • CL (Closed Loop): Using heated oxygen sensor as feedback for fuel control • OL DRIVE: Open loop due to driving conditions (fuel enrichment) • OL FAULT: Open loop due to detected system fault • CL FAULT: Closed loop but heated oxygen sensor, which used for fuel control malfunctioning
O2FT B1 S1	Fuel trim at heated oxygen sensor	Same as SHORT FT #1
O2FT B1 S2	Fuel trim at heated oxygen sensor	Same as SHORT FT #1
O2 LR B1 S1	Heated oxygen sensor response time (lean to rich)	-
O2 RL B1 S1	Heated oxygen sensor response time (rich to lean)	-
CAT TEMP B1 S1	Catalyst temperature	-
CAT TEMP B1 S2	Catalyst temperature	-
INI COOL TEMP	Initial engine coolant temperature	-
INI INTAKE TEMP	Initial intake air temperature	-
INJ VOL	Injection volume	-
PS PRESSURE	Power steering signal (history)	This signal status usually ON until ignition switch turned OFF
STARTER SIG	Starter signal	-
PS SW	Power steering switch signal	-
PS SIGNAL	Power steering signal (history)	-
CTP SW	Closed throttle position switch	-
A/C SIGNAL	A/C signal	-
PNP SW [NSW]	Neutral position switch signal	-
ELECT LOAD SIG	Electrical load signal	-
STOP LIGHT SW	Stop light switch	-
BATTERY VOLTAGE	Battery voltage	-
ATM PRESSURE	Atmospheric pressure	-
EVAP (Purge) VSV	EVAP purge VSV	-
FUEL PUMP / SPD	Fuel pump/speed status	-
VVT CTRL B1	VVT control status (bank 1)	-
VACUUM PUMP	Key-off EVAP system pump status	See page ES-273

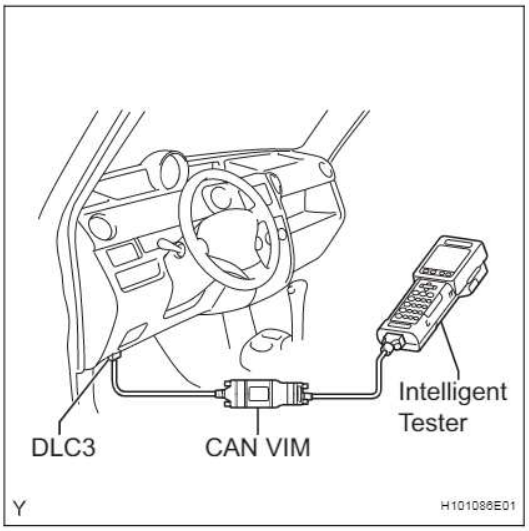
LABEL (Intelligent Tester Display)	Measure Item/Range	Diagnostic Note
EVAP VENT VAL	Key-off EVAP system vent valve status	-
FAN MOTOR	Electric fan motor	-
TC/TE1	TC and TE1 terminals of DLC3	-
FC IDL	Idle fuel cut	ON: when throttle valve fully closed and engine speed over 1,500 rpm
FC TAU	FC TAU	Fuel cut being performed under very light load to prevent engine combustion from becoming incomplete
VVTL AIM ANGL#1	VVT aim angle (bank 1)	-
VVT CHNG ANGL#1	VVT change angle (bank 1)	-
VVT OCV DUTY B1	VVT OCV operation duty (bank 1)	-
IGNITION	Ignition	-
CYL #1	Cylinder #1 misfire rate	Displayed only when idling
CYL #2	Cylinder #2 misfire rate	Displayed only when idling
CYL #3	Cylinder #3 misfire rate	Displayed only when idling
CYL #4	Cylinder #4 misfire rate	Displayed only when idling
CYL ALL	All cylinder misfire rate	Displayed only when idling
MISFIRE RPM	Misfire RPM	-
MISFIRE LOAD	Misfired load	-
MISFIRE MARGIN	Misfire monitoring	-
ENG RUN TIME	Accumulated engine running time	-
TIME DTC CLEAR	Cumulative time after DTC cleared	-
DIST DTC CLEAR	Accumulated distance after DTC cleared	-
WU CYC DTC CLEAR	Warm-up cycle after DTC cleared	-

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CHECK MODE PROCEDURE

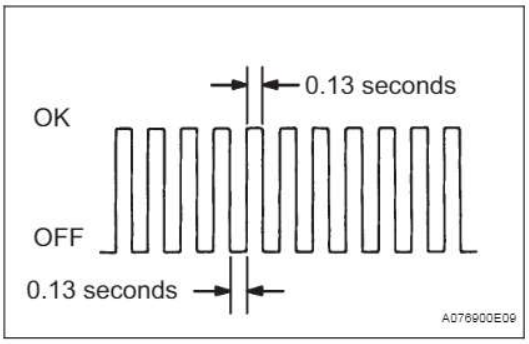
HINT:
Compared to normal mode, check mode is more sensitive to malfunctions and can detect the malfunctions that cannot be detected by normal mode.

NOTICE:
All the stored DTCs and freeze frame data are erased if: 1) the ECM is changed from normal mode to check mode or vice versa; or 2) the ignition switch is turned from ON to ACC or OFF while in check mode.
Before changing modes, always check and make a note of any DTCs and freeze frame data.



1. CHECK MODE PROCEDURE

(a) Check and ensure the following conditions:
(1) Positive (+) battery voltage 11 V or more
(2) Throttle valve fully closed
(3) Transmission in the P or N positions
(4) A/C switch OFF
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch ON and turn the tester ON.
(e) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / CHECK MODE.
(f) Switch the ECM from normal mode to check mode.



(g) Make sure the MIL flashes as shown in the illustration.
(h) Start the engine.
(i) Make sure the MIL turns off.
(j) Simulate the conditions of the malfunction described by the customer.
(k) Check DTCs and freeze frame data using the tester.

FAIL-SAFE CHART

If any of the following DTCs are set, the ECM enters fail-safe mode to allow the vehicle to be driven temporarily.

DTC	Component	Fail-safe Operation	Fail-safe Deactivation Condition
P0031, P0032, P0037 and P0038	Heated Oxygen (HO2) Sensor Heater	ECM turns off HO2 sensor heater	Ignition switch OFF
P0100, P0102 and P0103	Mass Air Flow (MAF) Meter	ECM calculates ignition timing in accordance with engine RPM and throttle valve position	Pass condition detected
P0110, P0112 and P0113	Intake Air Temperature (IAT) Sensor	ECM estimates IAT to be 20°C (68°F)	Pass condition detected
P0115, P0117 and P0118	Engine Coolant Temperature (ECT) Sensor	ECM estimates ECT to be 80°C (176°F)	Pass condition detected
P0120, P0122 and P0123	Throttle Position (TP) Sensor	ECM cuts fuel intermittently	Pass condition detected and ignition switch OFF
P0121	TP Sensor	ECM cuts fuel intermittently	Pass condition detected and ignition switch OFF
P0327 and P0328	Knock Sensor	ECM sets ignition timing to maximum retard	Ignition switch OFF
P0351 to P0354	Igniter	ECM cuts fuel	Pass condition detected

ES

SFI SYSTEM

PRECAUTION

1. **INITIALIZATION**

NOTICE:

- **When disconnecting the cable from the negative (-) battery terminal, initialize the following system(s) after the cable is reconnected.**
- **Perform the REGISTRATION (VIN registration) when replacing the ECM (see page ES-15).**
- **Perform the RESET MEMORY procedure (A/T initialization) when replacing the automatic transaxle assembly, engine assembly or ECM (see page AX-19).**

HINT:

RESET MEMORY cannot be completed by only reconnecting the cable to the negative (-) battery terminal.

2. **FOR USING INTELLIGENT TESTER**

CAUTION:

Observe the following items for safety reasons:

- **Read its instruction books before using the tester.**
- **Prevent the tester cable from being caught on the pedals, shift lever and steering wheel when driving with the tester connected to the vehicle.**
- **When driving the vehicle for testing purposes using the tester, two persons are required. One is for driving the vehicle, and the other operates the tester.**

DEFINITION OF TERMS

Terms	Definitions
Monitor description	Description of what the ECM monitors and how it detects malfunctions (monitoring purpose and its details).
Related DTCs	A group of diagnostic trouble codes that are output by ECM based on same malfunction detection logic.
Typical enabling condition	Preconditions that allow ECM to detect malfunctions. With all preconditions satisfied, ECM sets DTC when monitored value(s) exceeds malfunction threshold(s).
Sequence of operation	Order of monitor priority, applied if multiple sensors and components are involved in single malfunction detection process. Each sensor and component monitored in turn and not monitored until previous detection operation completed.
Required sensor/components	Sensors and components used by ECM to detect each malfunction.
Frequency of operation	Number of times ECM checks for each malfunction during each driving cycle. "Once per driving cycle" means ECM only performs checks for that malfunction once during single driving cycle. "Continuous" means ECM performs checks for that malfunction whenever enabling conditions are met.
Duration	Minimum time for which ECM must detect continuous deviation in monitored value(s) in order to set DTC. Timing begins when Typical Enabling Conditions are met.
Malfunction thresholds	Value beyond which ECM determines malfunctions exist and sets DTCs.
MIL operation	Timing of MIL illumination after malfunction detected. "Immediate" means ECM illuminates MIL as soon as malfunction detected. "2 driving cycle" means ECM illuminates MIL if same malfunction detected second time during next sequential driving cycle.

DATA LIST / ACTIVE TEST

1. DATA LIST

HINT:

Using the intelligent tester's DATA LIST allows switch, sensor, actuator and other item values to be read without removing any parts. Reading the DATA LIST early in troubleshooting is one way to save time.

NOTICE:

In the table below, the values listed under "Normal Condition" are reference values. Do not depend solely on these reference values when deciding whether a part is faulty or not.

ES

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch ON and turn the tester ON.
(e) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST.
(f) According to the display on the tester, use the DATA LIST.

Intelligent Tester Display	Measurement Item: Range (Display)	Normal Condition*1	Diagnostic Note
INJECTOR	Injection period of the No. 1 cylinder: Min.: 0, Max: 32.64 ms	1.0 to 3.0 ms: Idling	-
IGN ADVANCE	Ignition timing advance for No. 1 cylinder: Min.: -64, Max.: 63.5 deg.	BTDC 2 to 14 deg: Idling	-
CALC LOAD	Calculated load by ECM: Min.: 0, Max.: 100%	10 to 30%: Idling 10 to 30%: Running without load (2,500 rpm)	-
VEHICLE LOAD	Vehicle load: Min.: 0, Max.: 25700%	Actual vehicle load	-
MAF	Air flow rate from Mass Air Flow (MAF) meter: Min.: 0, Max.: 665.35 g/sec.	• 0.54 to 4.33 g/sec. for Manual Transaxle (M/T): Idling 0.58 to 4.67 g/sec. for Automatic Transaxle (A/T): Idling • 3.33 to 9.17 g/sec.: Running without load (2,500 rpm)	If value approximately 0.0 g/sec.: • MAF meter power source circuit open • VG circuit open or short If value 160.0 g/sec. or more: • E2G circuit open
ENGINE SPD	Engine speed: Min.: 0, Max.: 16,383 rpm	600 to 700 rpm: Idling (M/T) 650 to 750 rpm: Idling (A/T)	-
VEHICLE SPD	Vehicle speed: Min.: 0, Max.: 255 km/h	Actual vehicle speed	Speed indicated on speedometer
COOLANT TEMP	Engine coolant temperature (ECT): Min.: -40°C (-40°F), Max.: 140°C (284°F)	80 to 100°C (176 to 203°F): After warming up engine	• If value -40°C (-40°F): ECT sensor circuit open • If value 140°C (284°F) or more: ECT sensor circuit shorted
INTAKE AIR	Intake air temperature: Min.: -40°C (-40°F), Max.: 140°C (284°F)	Equivalent to ambient air temperature	• If value -40°C (-40°F): IAT sensor circuit open. • If value 140°C (284°F) or more: IAT sensor circuit shorted
AIR-FUEL RATIO	Air-fuel ratio: Min.: 0, Max.: 1.999	0.8 to 1.2: During idling	-
PURGE DENSITY	Learning value of purge density: Min.: -50, Max.: 350	-40 to 10%: Idling	Service data

Intelligent Tester Display	Measurement Item: Range (Display)	Normal Condition*1	Diagnostic Note
EVAP PURGE FLOW	Purge flow: Min. : 0, Max.: 102.4%	0 to 10%: Idling	Service data
EVAP PURGE VSV	EVAP (PURGE) VSV control duty: Min.: 0, Max.: 100%	10 to 50%: During Idling	Order signal from ECM
VAPOR PRES PUMP	Vapor pressure: Min.: -4.125, Max.: 2.125 kPa	0 kPa: Fuel tank cap removed	Pressure inside fuel tank monitored by vapor pressure sensor
VAPOR PRES CALC	Vapor pressure (calculated): Min.: -5.632, Max.: 715.3264 kPa	0 kPa: Fuel tank cap removed	Pressure inside fuel tank monitored by vapor pressure sensor
KNOCK CRRT VAL	Correction learning value of knocking: Min.: -64, Max.: 1,984 CA	4 to 25°CA: Driving at 70 km/h (44 mph)	Service data
KNOCK FB VAL	Feedback value of knocking: Min.: -64, Max.: 1,984 CA	-22 to 0°CA: Driving at 70 km/h (44 mph)	Service data
THROTTLE POS	Throttle position sensor: Min.: 0, Max.: 100%	• 10 to 20%: Throttle valve fully closed • 66 to 98%: Throttle fully open	• Calculated value based on VTA1 • Read value with ignition switch ON (Do not start engine)
THROTTLE POS	Absolute throttle position sensor: Min.: 0, Max.: 100%	0%: Throttle valve fully closed 70 to 100%: Throttle valve fully open	Read value with ignition switch ON (Do not start engine) • Recognition value for throttle opening angle on ECM • Read value with ignition switch ON (Do not start engine)
O2S B1 S1	Heated oxygen (HO2) sensor output voltage for bank 1 sensor 1: Min.: 0, Max.: 1.0 V	0 to 1.0 V: Idling	Performing either Active Test, INJ VOL or A/F CONTROL enables front HO2 sensor output voltage to be checked.
O2S B1 S2	HO2 sensor output voltage for bank 1 sensor 2: Min.: 0, Max.: 1.0 V	0 to 1.0 V: Idling	Performing either Active Test, INJ VOL or A/F CONTROL enables rear HO2 sensor output voltage to be checked.
TOTAL FT #1	Total fuel trim of bank 1: Average value for fuel trim system of bank 1: Min.: 0.5, Max.: 1.496	0.5 to 1.4: Idling	-
SHORT FT #1	Short-term fuel trim of bank 1: Min.: -100, Max.: 100%	-20 to 20%	-
LONG FT #1	Long-term fuel trim of bank 1: Min.: -100, Max.: 100%	-20 to 20%	Overall long-term fuel compensation that helps maintain air-fuel ratio at stoichiometric levels (moderates long-term deviations of short-term fuel trim from central value)
FUEL SYS #1	Fuel system status (Bank 1): OL or CL or OL DRIVE or OL FAULT or CL FAULT	CL: Idling with warm engine	• OL (Open Loop): Conditions for closed loop not yet satisfied • CL (Closed Loop): Using HO2 sensor as feedback for fuel control • OL DRIVE: Open loop due to driving conditions (fuel enrichment) • OL FAULT: Open loop due to detected system fault • CL FAULT: Closed loop but HO2 sensor used for fuel control malfunctioning

Intelligent Tester Display	Measurement Item: Range (Display)	Normal Condition*1	Diagnostic Note
O2FT B1 S1	Short-term fuel trim associated with bank 1 sensor 1: Min.: -100, Max.: 100%	-20 to 20%	Same as SHORT FT #1
O2FT B1 S2	Short-term fuel trim associated with bank 1 sensor 2: Min.: -100, Max.: 100%	-20 to 20%	Same as SHORT FT #2
O2 LR B1 S1	Response time of HO2 sensor, from lean to rich (bank 1 sensor 1): Min.: 0, Max.: 16,711 ms	0 to 1,000 ms: Idling with warm engine	Service data
O2 RL B1 S1	Response time of HO2 sensor, from rich to lean (bank 1 sensor 1): Min.: 0, Max.: 16,711 ms	0 to 1,000 ms: Idling with warm engine	Service data
CAT TEMP B1S1	Catalyst temperature (bank 1, sensor 1): Min.: -40, Max.: 6,513.5°C	-	-
CAT TEMP B1S2	Catalyst temperature (bank 1, sensor 2): Min.: -40, Max.: 6,513.5°C	-	-
INI COOL TEMP	Initial engine coolant temperature: Min.: -40, Max.: 120°C	Close to ambient air temperature	Service data
INI INTAKE TEMP	Initial intake air temperature: Min.: -40, Max.: 120°C	Close to ambient air temperature	Service data
INJ VOL	Injection volume (cylinder 1): Min.: 0, Max.: 2.048 ml	0.05 to 0.15 ml: Idling	Quantity of fuel injection volume for 10 times
STARTER SIG	Starter signal: ON or OFF	ON: Cranking	-
PS SW	Power steering signal: ON or OFF	ON: Power steering operation	-
PS SIGNAL	Power steering signal: ON or OFF	ON: When steering wheel first turned after ignition switch turned ON	This signal usually ON until ignition switch turned OFF
CTP SW	Closed throttle position switch: ON or OFF	• ON: Throttle fully closed • OFF: Throttle open	-
A/C SIGNAL	A/C signal: ON or OFF	ON: A/C ON	-
PNP SW [NSW]*2	Park/neutral position switch signal: ON or OFF	ON: P or N position	-
ELECT LOAD SIG	Electrical load signal: ON or OFF	ON: Defogger switch ON	-
STOP LIGHT SW	Stop light switch: ON or OFF	• ON: Brake pedal depressed • OFF: Brake pedal released	-
BATTERY VOLTAGE	Battery voltage: Min.: 0, Max.: 65.535 V	9 to 14 V: Idling	-
ATM PRESSURE	Atmosphere pressure Min.: 0, Max.: 255 kPa	Equivalent to atmospheric pressure (absolute pressure)	-
EVAP(Purge)VSV	Purge VSV status: ON or OFF	-	-
FUEL PUMP / SPD	Fuel pump / speed status: ON/H or OFF/M, L	ON: Idling	Active Test support data
VVT CTRL B1	VVT control status (bank 1): ON or OFF	ON: VVT system operation	-
VACUUM PUMP	Key-off EVAP system pump status: ON or OFF	-	Active Test support data

Intelligent Tester Display	Measurement Item: Range (Display)	Normal Condition*1	Diagnostic Note
EVAP VENT VAL	Key-off EVAP system vent valve status: ON or OFF	-	Active Test support data
FAN MOTOR	Electric fan motor: ON or OFF	ON: Electric fan motor operating	-
TC/TE1	TC and TE1 terminal of DLC3: ON or OFF	-	Active Test support data
FC IDL	Fuel cut idle: ON or OFF	ON: Fuel cut operation	FC IDL = "ON" when throttle valve fully closed and engine speed over 2,800 rpm
FC TAU	Fuel cut TAU (Fuel cut during very light load): ON or OFF	ON: Fuel cut operation	Fuel cut performed under very light load to prevent incomplete engine combustion
IGNITION	Ignition counter: Min.: 0, Max.: 400	0 to 400	-
CYL #1, #2, #3, #4	Misfire ratio of cylinder 1 to 4: Min.: 0, Max.: 50%	0%	This item displayed only when idling
CYL ALL	All cylinders misfire rate: Min.: 0, Max.: 255	0 to 35	-
MISFIRE RPM	Engine RPM for first misfire range: Min.: 0, Max.: 6,375 rpm	0 rpm: Misfire 0	-
MISFIRE LOAD	Engine load for first misfire range: Min.: 0, Max.: 3.98 g/rev	0 g/rev: Misfire 0	-
MISFIRE MARGIN	Misfire monitoring: Min.: -100, Max.: 99.22%	-100 to 99.22%	Misfire detecting margin
# CODES	#Code: Min.: 0, Max.: 255	-	Number of detected DTCs
CHECK MODE	Check mode: ON or OFF	ON: Check mode ON	See page ES-41
SPD TEST	Check mode result for vehicle speed sensor: 0: COMPL, 1: INCMPL	-	-
MISFIRE TEST	Check mode result for misfire monitor: 0: COMPL, 1: INCMPL	-	-
OXS1 TEST	Check mode result for HO2 sensor (bank 1): 0: COMPL, 1: INCMPL	-	-
MIL	MIL status: ON or OFF	ON: MIL ON	-
MIL ON RUN DIST	MIL ON run distance: Min.: 0, Max.: 65,535 km	Distance after DTC detected	-
MIL ON RUN TIME	Running time from MIL ON: Min.: 0, Max.: 65,535 minutes	Equivalent to running time after MIL ON	-
ENG RUN TIME	Engine run time: Min.: 0, Max.: 65,535 seconds	Time after engine start	-
TIME DTC CLEAR	Time after DTC cleared: Min.: 0, Max.: 65,535 minutes	Equivalent to time after DTCs erased	-
DIST DTC CLEAR	Distance after DTC cleared: Min.: 0, Max.: 65,535 km	Equivalent to drive distance after DTCs erased	-
WU CYC DTC CLEAR	Warm-up cycle after DTC cleared: Min.: 0, Max.: 255	-	Number of warm-up cycles after DTC cleared
MODEL CODE	Model code	-	Identifying model code: NCP6#
ENGINE TYPE	Engine type	-	Identifying engine type: 1NZFE

ES

Intelligent Tester Display	Measurement Item: Range (Display)	Normal Condition*1	Diagnostic Note
CYLINDER NUMBER	Number of cylinders: Min.: 0, Max.: 255	-	Identifying number of cylinders: 4
TRANSMISSION	Transmission type	-	Identifying transmission type: MT or 4AT
DESTINATION	Destination	-	Identifying destination: A (America)
MODEL YEAR	Model year: Min.: 1900, Max.: 2155	-	Identifying model year: 2006MY
SYSTEM	System identification	-	Identifying engine system: GASOLIN (gasoline engine)

ES

*1: If no idling conditions are specified, the transmission gear selector lever should be in the N or P position, and the A/C switch and all accessory switches should be OFF.
*2: A/T only

2. ACTIVE TEST

HINT:
Performing the intelligent tester's ACTIVE TEST allows relay, Vacuum Switching Valve (VSV), actuator and other items to be operated without removing any parts. Performing the ACTIVE TEST early in troubleshooting is one way to save time. The DATA LIST can be displayed during the ACTIVE TEST.

(a) Warm up the engine.
(b) Turn the ignition switch OFF.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch ON and turn the tester ON.
(e) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST.
(f) According to the display on the tester, perform the ACTIVE TEST.

Intelligent Tester Display	Test Detail	Control Range	Diagnostic Note
INJ VOL	Change injection volume	Between -12 and 24.8%	• All injectors tested at the same time • Perform test at less than 3,000 rpm • Injection volume can be changed in 1% graduations within control range
A/F CONTROL	Change injection volume	Lower by 12.5% or increase by 24.8%	• Perform test at less than 3,000 rpm • A/F CONTROL enables checking and graphing of front and rear Heated Oxygen (HO2) sensor voltage outputs • To conduct test, select following menu items: ACTIVE TEST / A/F CONTROL / USER DATA / O2S B1S1 and O2S B1S2; then press YES and ENTER followed by F4
IAC STEP POS	Change IAC step position	Between 0 and 100%	Test possible during vehicle stopping and engine idling
EVAP VSV (ALONE)	Activate purge VSV control	ON/OFF	-

Intelligent Tester Display	Test Detail	Control Range	Diagnostic Note
VVT CTRL B1	Turn on and off OCV (Oil Control Valve)	ON/OFF	• Engine stalls or idles roughly when OCV turned ON • Normal engine running or idling when OCV off
FUEL PUMP / SPD	Turn on and off fuel pump (C/OPN Relay)	ON/OFF	Test possible when following conditions met: • Ignition switch ON • Engine is stopped
TC/TE1	Turn on and off TC and TE1 connection	ON/OFF	• ON: TC and TE1 connected • OFF: TC and TE1 disconnected
FC IDL PROHBT	Turn on and off idling fuel cut control	ON/OFF	-
COOLING FAN	Control electric cooling fan	ON/OFF	Test possible when following conditions met: • Ignition switch ON • Engine is stopped
FUEL CUT #1	Cylinder #1 injector fuel cut	ON/OFF	Test possible during vehicle stopping and engine idling
FUEL CUT #2	Cylinder #2 injector fuel cut	ON/OFF	Same as above
FUEL CUT #3	Cylinder #3 injector fuel cut	ON/OFF	Same as above
FUEL CUT #4	Cylinder #4 injector fuel cut	ON/OFF	Same as above
VVT B1	Control VVT (bank 1)	-128 to 127% This valve added to present OCV control duty 100%: Maximum advance -100%: Maximum retard	• Engine stall or rough idle when VVT actuator operated by 100%. • Test possible during idle
VACUUM PUMP	Activate leak detection pump (built into canister pump module)	ON/OFF	-
VENT VALUE	Activate vent valve (built into canister pump module)	ON/OFF	-

ES

3. SYSTEM CHECK

HINT:

Performing a SYSTEM CHECK enables the system, which consists of multiple actuators, to be operated without removing any parts. In addition, it can show whether or not any DTCs are set, and can detect potential malfunctions in the system. The SYSTEM CHECK can be performed with the intelligent tester.

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / SYSTEM CHECK.
(d) Perform the SYSTEM CHECK by referring to the table below.

Intelligent Tester Display	Test Details	Recommended Fuel Temperatures	Diagnostic Notes
EVAP SYS CHECK (AUTOMATIC)	Perform 5 steps in order to operate EVAP key-off monitor automatically	35°C (95°F) or less	• If no DTCs in PENDING CODES menu after performing this test, system functioning normally • Refer to EVAP system
EVAP SYS CHECK (MANUAL)	Perform 5 steps in order to operate EVAP key-off monitor manually	35°C (95°F) or less	• Used to detect malfunctioning parts • Refer to EVAP system

DIAGNOSTIC TROUBLE CODE CHART

HINT:
The parameters listed in the chart are for reference only. Factors such as instrument type may cause readings to differ slightly from stated values. If any DTCs are displayed during a check mode DTC check, check the circuit for the DTCs listed in the table below. For details of each DTC, refer to the page indicated.

ES

DTC No.	Detection Item	Trouble Area	MIL	Memory	See page
P0010	Camshaft Position "A" Actuator Circuit (Bank 1)	- Open or short in Oil Control Valve (OCV) circuit - OCV - ECM	Comes on	DTC stored	ES-58
P0011	Camshaft Position "A" - Timing Over-Advanced or System Performance (Bank 1)	- Valve timing - OCV - OCV filter - Camshaft timing gear assembly - ECM	Comes on	DTC stored	ES-62
P0012	Camshaft Position "A" - Timing Over-Retarded (Bank 1)	- Valve timing - OCV - OCV filter - Camshaft timing gear assembly - ECM	Comes on	DTC stored	ES-62
P0016	Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor A)	- Mechanical system (timing chain has jumped tooth or chain stretched) - ECM	Comes on	DTC stored	ES-67
P0031	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 1)	- Open or short in Heated Oxygen (HO2) sensor heater circuit - HO2 sensor heater - EFI relay - ECM	Comes on	DTC stored	ES-69
P0032	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 1)	- Short in Heated Oxygen (HO2) sensor heater circuit - HO2 sensor heater - EFI relay - ECM	Comes on	DTC stored	ES-69
P0037	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2)	- Open or short in Heated Oxygen (HO2) sensor heater circuit - HO2 sensor heater - EFI relay - ECM	Comes on	DTC stored	ES-69
P0038	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 2)	- Short in Heated Oxygen (HO2) sensor heater circuit - HO2 sensor heater - EFI relay - ECM	Comes on	DTC stored	ES-69
P0100	Mass or Volume Air Flow Circuit	- Open or short in Mass Air Flow (MAF) meter circuit - MAF meter - ECM	Comes on	DTC stored	ES-75

DTC No.	Detection Item	Trouble Area	MIL	Memory	See page
P0101	Mass Air Flow Circuit Range / Performance Problem	- MAF meter	Comes on	DTC stored	ES-82
P0102	Mass or Volume Air Flow Circuit Low Input	- Open or short in MAF meter circuit - MAF meter - ECM	Comes on	DTC stored	ES-75
P0103	Mass or Volume Air Flow Circuit High Input	- Open or short in MAF meter circuit - MAF meter - ECM	Comes on	DTC stored	ES-75
P0110	Intake Air Temperature Circuit Malfunction	- Open or short in Intake Air Temperature (IAT) sensor circuit - IAT sensor (built into Mass Air Flow [MAF] meter) - ECM	Comes on	DTC stored	ES-84
P0112	Intake Air Temperature Circuit Low Input	- Short in Intake Air Temperature (IAT) sensor circuit - IAT sensor (built into Mass Air Flow [MAF] meter) - ECM	Comes on	DTC stored	ES-84
P0113	Intake Air Temperature Circuit High Input	- Open in Intake Air Temperature (IAT) sensor circuit - IAT sensor (built into Mass Air Flow [MAF] meter) - ECM	Comes on	DTC stored	ES-84
P0115	Engine Coolant Temperature Circuit Malfunction	- Open or short in Engine Coolant Temperature (ECT) sensor circuit - ECT sensor - ECM	Comes on	DTC stored	ES-90
P0116	Engine Coolant Temperature Circuit Range / Performance Problem	- ECT sensor - Thermostat	Comes on	DTC stored	ES-95
P0117	Engine Coolant Temperature Circuit Low Input	- Short in ECT sensor circuit - ECT sensor - ECM	Comes on	DTC stored	ES-90
P0118	Engine Coolant Temperature Circuit High Input	- Open in ECT sensor circuit - ECT sensor - ECM	Comes on	DTC stored	ES-90
P0120	Throttle / Pedal Position Sensor / Switch "A" Circuit	- Throttle Position (TP) sensor - ECM	Comes on	DTC stored	ES-98
P0121	Throttle / Pedal Position Sensor / Switch "A" Circuit Range / Performance Problem	- TP sensor	Comes on	DTC stored	ES-103
P0122	Throttle / Pedal Position Sensor / Switch "A" Circuit Low Input	- TP sensor - Short in VTA circuit - Open in VC circuit - ECM	Comes on	DTC stored	ES-98

DTC No.	Detection Item	Trouble Area	MIL	Memory	See page
P0123	Throttle / Pedal Position Sensor / Switch "A" Circuit High Input	- TP sensor - Open in VTA circuit - Open in E2 circuit - Short between VC and VTA circuit - ECM	Comes on	DTC stored	ES-98
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	- Cooling system - ECT sensor - Thermostat	Comes on	DTC stored	ES-105
P0128	Thermostat Malfunction	- Thermostat - Cooling system - ECT sensor - ECM	Comes on	DTC stored	ES-108
P0130	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 1)	- Open or short in Heated Oxygen (HO2) sensor (bank 1 sensor 1) circuit - HO2 sensor (bank 1 sensor 1) - HO2 sensor heater (bank 1 sensor 1) - EFI relay - Air induction system - Fuel pressure - Injector - ECM	Comes on	DTC stored	ES-111
P0133	Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 1)	- Open or short in Heated Oxygen (HO2) sensor (bank 1 sensor 1) circuit - HO2 sensor (bank 1 sensor 1) - HO2 sensor heater (bank 1 sensor 1) - EFI relay - Air induction system - Fuel pressure - Injector - ECM	Comes on	DTC stored	ES-121
P0134	Oxygen Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	- HO2S (bank 1 sensor 1) - Fuel pressure - Air induction system - Ventilation hose - Ventilation valve - Injector - Exhaust gas leakage	Comes on	DTC stored	ES-131
P0136	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)	- Open or short in Heated Oxygen (HO2) sensor (bank 1 sensor 2) circuit - HO2 sensor (bank 1 sensor 2) - HO2 sensor heater (bank 1 sensor 2) - EFI relay	Comes on	DTC stored	ES-140
P0138	Heated Oxygen Sensor Circuit High Voltage (Bank 1 Sensor 2)	- HO2 sensor (bank 1 sensor 2) - Short in HO2 sensor (bank 1 sensor 2) circuit	Comes on	DTC stored	ES-140

DTC No.	Detection Item	Trouble Area	MIL	Memory	See page
P0139	Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 2)	- HO2 sensor (bank 1 sensor 2) - Short in HO2 sensor (bank 1 sensor 2) circuit	Comes on	DTC stored	ES-140
P0171	System Too Lean (Bank 1)	- Air induction system - Injector blockage - Mass Air Flow (MAF) meter - Engine Coolant Temperature (ECT) sensor - Fuel pressure - Gas leakage from exhaust system - Open or short in HO2 sensor (bank 1 sensor 1) circuit - HO2 sensor (bank 1 sensor 1) - HO2 sensor heater (bank 1 sensor 1) - EFI relay - Ventilation valve and hose - Ventilation hose connections - ECM	Comes on	DTC stored	ES-149
P0172	System Too Rich (Bank 1)	- Injector leak, blockage - MAF meter - ECT sensor - Ignition system - Fuel pressure - Gas leakage from exhaust system - Open or short in Heated Oxygen (HO2) sensor (bank 1 sensor 1) circuit - HO2 sensor (bank 1 sensor 1) - HO2 sensor heater (bank 1 sensor 1) - EFI relay - ECM	Comes on		ES-149
P0300	Random / Multiple Cylinder Misfire Detected	- Open or short in engine wire harness - Connector connections - Vacuum hose connections - Ignition system - Injector - Fuel pressure - MAF meter - ECT sensor - Compression pressure - Valve clearance - Valve timing - Ventilation hose connections - Ventilation valve and hose - ECM	Blinks	DTC stored	ES-161

DTC No.	Detection Item	Trouble Area	MIL	Memory	See page
P0301	Cylinder 1 Misfire Detected	Same as P0300	Blinks	DTC stored	ES-161
P0302	Cylinder 2 Misfire Detected	- Same as P0300	Blinks	DTC stored	ES-161
P0303	Cylinder 3 Misfire Detected	- Same as P0300	Blinks	DTC stored	ES-161
P0304	Cylinder 4 Misfire Detected	- Same as P0300	Blinks	DTC stored	ES-161
P0327	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)	- Short in knock sensor 1 circuit - Knock sensor 1 - ECM	Comes on	DTC stored	ES-172
P0328	Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)	- Open in knock sensor 1 circuit - Knock sensor 1 - ECM	Comes on	DTC stored	ES-172
P0335	Crankshaft Position Sensor "A" Circuit	- Open or short in Crankshaft position (CKP) sensor circuit - CKP sensor - Crankshaft (sensor plate) - ECM	Comes on	DTC stored	ES-176
P0339	Crankshaft Position Sensor "A" Circuit Intermittent	- Same as P0335	-	DTC stored	ES-176
P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)	- Open or short in Camshaft Position (CMP) sensor circuit - CMP sensor - Camshaft - Timing chain has jumped tooth - ECM	Comes on	DTC stored	ES-181
P0351	Ignition Coil "A" Primary / Secondary Circuit	- Ignition system - Open or short in IGF or IGT circuit (1 to 4) between ignition coil with igniter and ECM - Ignition coils with igniters - ECM	Comes on	DTC stored	ES-185
P0352	Ignition Coil "B" Primary / Secondary Circuit	- Same as P0351	Comes on	DTC stored	ES-185
P0353	Ignition Coil "C" Primary / Secondary Circuit	- Same as P0351	Comes on	DTC stored	ES-185
P0354	Ignition Coil "D" Primary / Secondary Circuit	- Same as P0351	Comes on	DTC stored	ES-185
P0420	Catalyst System Efficiency Below Threshold (Bank 1)	- Gas leakage from exhaust system - Heated Oxygen (HO2) sensor (bank 1 sensor 1, 2) - Three-way Catalytic Converter (TWC)	Comes on	DTC stored	ES-194

DTC No.	Detection Item	Trouble Area	MIL	Memory	See page
P043E	Evaporative Emission System Leak Detection Reference Orifice Low Flow	- Canister pump module - Connector/Wire harness (Canister pump module - ECM) - EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) - ECM - Leakage from EVAP system	Comes on	DTC stored	ES-200
P043F	Evaporative Emission System Reference Orifice High Flow	- Canister pump module - Connector/Wire harness (Canister pump module - ECM) - EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) - ECM - Leakage from EVAP system	Comes on	DTC stored	ES-200
P0441	Evaporative Emission Control System Incorrect Purge Flow	- Purge VSV - Connector/Wire harness (Purge VSV - ECM) - ECM - Canister pump module - Leakage from EVAP line (Purge VSV - intake manifold) - Leakage from EVAP system	Comes on	DTC stored	ES-208
P0450	Evaporative Emission Control System Pressure Sensor Malfunction	- Canister pump module - EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) - ECM	Comes on	DTC stored	ES-216
P0451	Evaporative Emission Control System Pressure Sensor Range / Performance	- Canister pump module - Connector/ Wire harness (Canister pump module - ECM) - EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) - ECM	Comes on	DTC stored	ES-216

DTC No.	Detection Item	Trouble Area	MIL	Memory	See page
P0452	Evaporative Emission Control System Pressure Sensor / Switch Low Input	- Canister pump module - Connector/ Wire harness (Canister pump module - ECM) - EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) - ECM	Comes on	DTC stored	ES-216
P0453	Evaporative Emission Control System Pressure Sensor / Switch High Input	- Canister pump module - Connector/ Wire harness (Canister pump module - ECM) - EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) - ECM	Comes on	DTC stored	ES-216
P0455	Evaporative Emission Control System Leak Detected (Gross Leak)	- Fuel cap (loose) - Leakage from EVAP line (Canister - Fuel tank) - Leakage from EVAP line (Purge VSV - canister) - Canister pump module - Leakage from fuel tank - Leakage from canister	Comes on	DTC stored	ES-226
P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)	- Same as P0445	Comes on	DTC stored	ES-226
P0500	Vehicle Speed Sensor "A"	- Open or short in speed sensor circuit - Vehicle speed sensor - Combination meter - ECM - Skid control ECU	Comes on	DTC stored	ES-232
P0505	Idle Control System Malfunction	- Open or short in Idle Air Control (IAC) valve circuit - IAC valve stuck or closed - A/C switch circuit - Air induction system - Ventilation valve and hose - ECM	Comes on	DTC stored	ES-235
P0511	Idle Air Control Circuit	- Open or short in Idle Air Control (IAC) valve circuit - IAC valve stuck or closed - ECM	Comes on	DTC stored	ES-235

DTC No.	Detection Item	Trouble Area	MIL	Memory	See page
P0550	Power Steering Pressure Sensor Circuit Malfunction	- Open or short in power steering pressure sensor circuit - Power steering pressure sensor - ECM	Comes on	DTC stored	ES-242
P0552	Power Steering Pressure Sensor Circuit Low Input	- Open or short in power steering pressure sensor circuit - Power steering pressure sensor - ECM	Comes on	DTC stored	ES-242
P0553	Power Steering Pressure Sensor Circuit High Input	- Open or short in power steering pressure sensor circuit - Power steering pressure sensor - ECM	Comes on	DTC stored	ES-242
P0560	System Voltage	- Open in back-up power source circuit - EFI fuse - ECM	Comes on	DTC stored	ES-245
P0606	ECM / PCM Processor	- ECM	-	-	ES-249
P0617	Starter Relay Circuit High	- Short in Park/ Neutral Position (PNP) switch circuit - PNP switch - Clutch start switch - ECM	Comes on	DTC stored	ES-250
P0630	VIN not Programmed or Mismatch - ECM / PCM	- ECM	Comes on	DTC stored	ES-254
P2195	Oxygen Sensor Signal Stuck Lean (Bank 1 Sensor 1)	- Open or short in Heated Oxygen (HO2) sensor (bank 1 sensor 1) circuit - HO2 sensor (bank 1 sensor 1) - HO2 sensor heater (bank 1 sensor 1) - EFI relay - Air induction system - Fuel pressure - Injector - ECM	Comes on	DTC stored	ES-111
P2196	Oxygen Sensor Signal Stuck Rich (Bank 1 Sensor 1)	- Same as P2195	Comes on	DTC stored	ES-111
P2401	Evaporative Emission Leak Detection Pump Stuck OFF	- Canister pump module - Connector/Wire harness (Canister pump module - ECM) - EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) - ECM	Comes on	DTC stored	ES-256

DTC No.	Detection Item	Trouble Area	MIL	Memory	See page
P2402	Evaporative Emission Leak Detection Pump Stuck ON	- Canister pump module - Connector/Wire harness (Canister pump module - ECM) - EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) - ECM	Comes on	DTC stored	ES-256
P2419	Evaporative Emission Pressure Switching Valve Stuck ON	- Canister pump module - Connector/Wire harness (Canister pump module - ECM) - EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) - ECM	Comes on	DTC stored	ES-264
P2420	Evaporative Emission Pressure Switching Valve Stuck OFF	- Canister pump module - Connector/Wire harness (Canister pump module - ECM) - ECM	Comes on	DTC stored	ES-264
P2610	ECM / PCM Internal Engine Off Timer Performance	- ECM	Comes on	DTC stored	ES-271

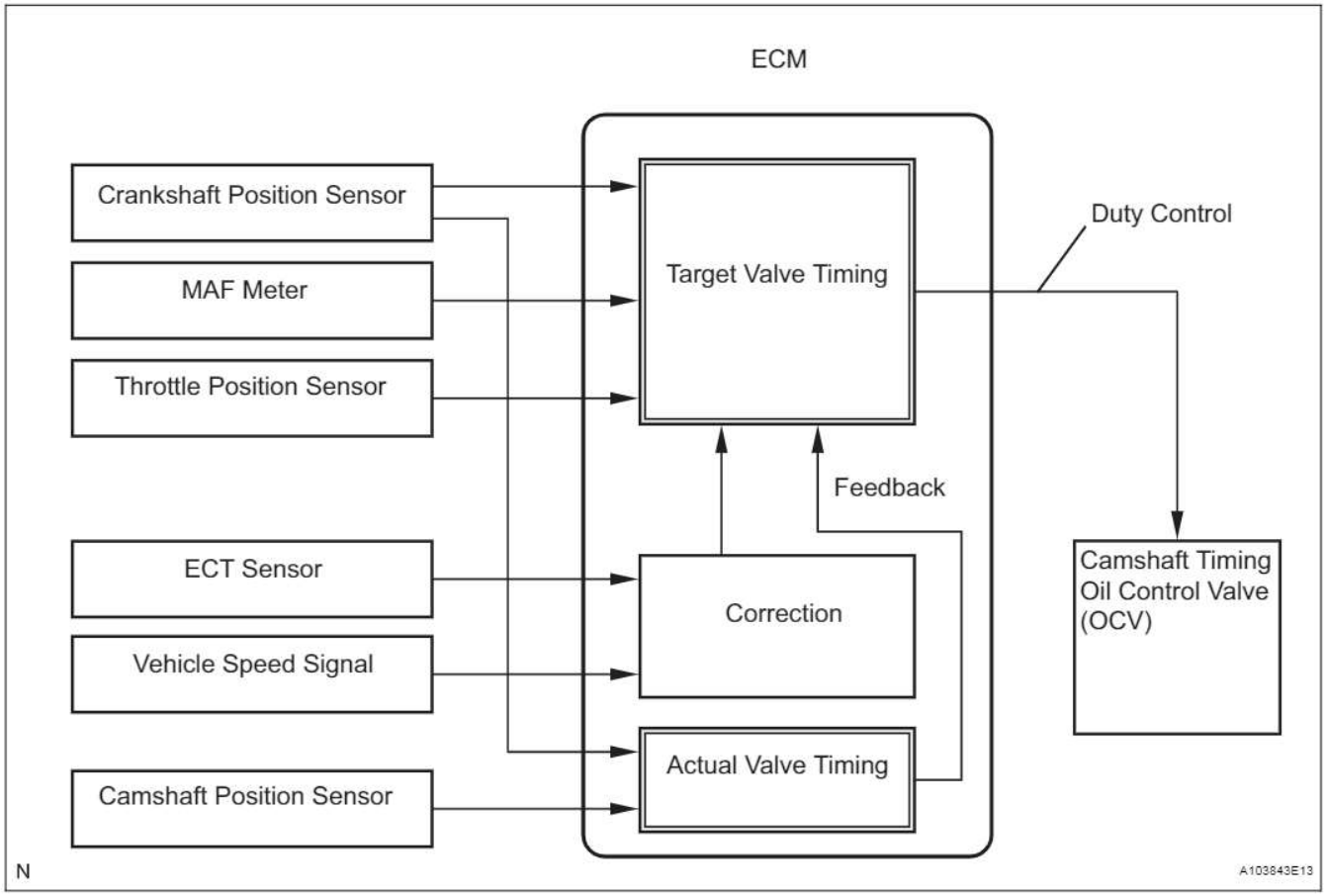
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DTC	P0010	Camshaft Position "A" Actuator Circuit (Bank 1)

DESCRIPTION

The Variable Valve Timing (VVT) system includes the ECM, Oil Control Valve (OCV) and VVT controller. The ECM sends a target duty-cycle control signal to the OCV. This control signal regulates the oil pressure supplied to the VVT controller. Camshaft timing control is performed according to engine operating conditions such as the intake air volume, throttle valve position and engine coolant temperature. The ECM controls the OCV based on the signals transmitted by several sensors. The VVT controller regulates the intake camshaft angle using oil pressure through the OCV. As a result, the relative positions of the camshaft and crankshaft are optimized, the engine torque and fuel economy improve, and the exhaust emissions decrease under overall driving conditions. The ECM detects the actual intake valve timing using signals from the camshaft and crankshaft position sensors, and performs feedback control. This is how the target intake valve timing is verified by the ECM.

ES



DTC No.	DTC Detection Condition	Trouble Area
P0010	Open or short in Oil Control Valve (OCV) circuit (1 trip detection logic)	• Open or short in Oil Control Valve (OCV) circuit • OCV • ECM

MONITOR DESCRIPTION

The ECM optimizes the valve timing using the VVT system to control the intake camshaft. The VVT system includes the ECM, the OCV and the VVT controller. The ECM sends a target duty-cycle control signal to the OCV. This control signal regulates the oil pressure supplied to the VVT controller. The VVT controller can advance or retard the intake camshaft.

After the ECM sends the target duty-cycle signal to the OCV, the ECM monitors the OCV current to establish an actual duty-cycle. The ECM determines the existence of a malfunction and sets the DTC when the actual duty-cycle ratio varies from the target duty-cycle ratio.

MONITOR STRATEGY

Related DTCs	P0010: VVT OCV range check
Required sensors / components (Main)	VVT OCV
Required sensors / components (Related)	-
Frequency of operation	Continuous
Duration	1 second
MIL operation	Immediate
Sequence of operation	None

ES

TYPICAL ENABLING CONDITIONS

Monitor runs whenever these following DTCs not present	None
Battery voltage	11 to 13 V
Target duty ratio for OCV	70% or less
Starter	OFF
Current cut status for OCV	Not cut

TYPICAL MALFUNCTION THRESHOLDS

Either of following conditions set:	-
OCV duty ratio	100% (always ON) despite target duty ratio being less than 70%
OCV duty ratio when ECM supplies current to OCV	3% or less despite ECM supplying current to the OCV

COMPONENT OPERATING RANGE

VVT OCV duty ratio	3 to 100%

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester. Freeze frame data records the engine conditions when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 **PERFORM ACTIVE TEST BY INTELLIGENT TESTER (OPERATE OCV)**

(a) Connect the intelligent tester to the DLC3.
(b) Start the engine and turn the tester ON.
(c) Warm up the engine.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / VVT CTRL B1.
(e) Check the engine speed while operating the Oil Control Valve (OCV) using the tester.

OK

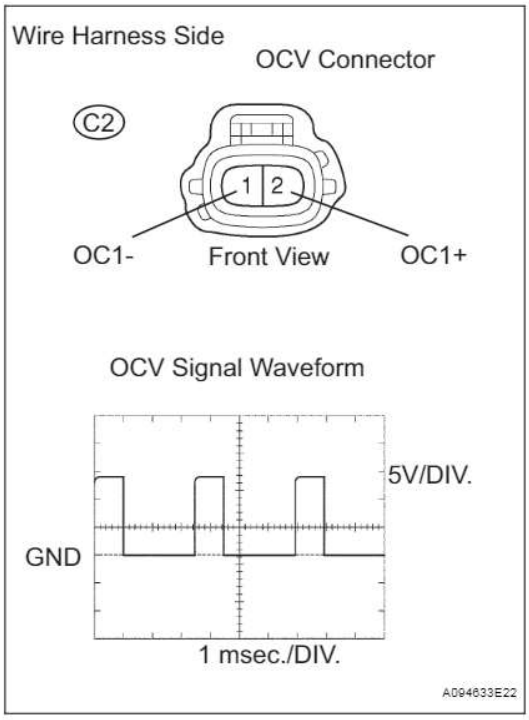
Tester Operation	Specified Condition
OCV OFF	Normal engine speed
OCV ON	Engine idles roughly or stalls (soon after OCV switched from OFF to ON)

NG → **Go to step 2**

OK →

CHECK FOR INTERMITTENT PROBLEMS

2 **INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (OCV SIGNAL)**



(a) Disconnect the C2 OCV connector.
(b) While idling, check the waveform between the terminals of the C2 OCV connector using an oscilloscope.
Standard voltage

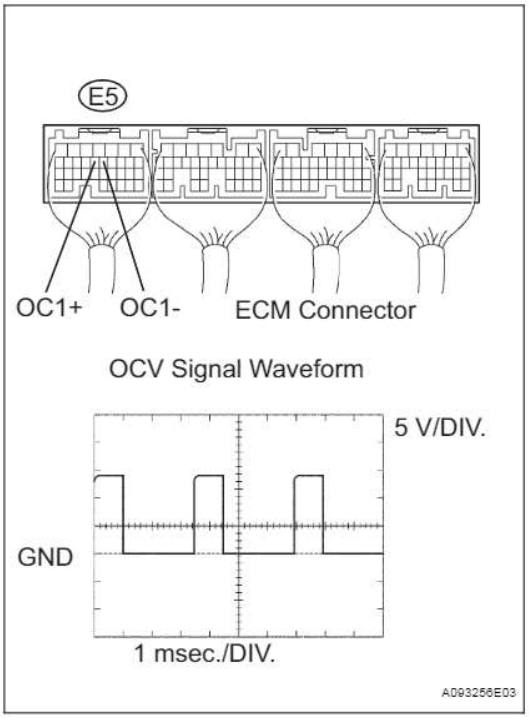
Tester Connection	Specified Condition
OC1+ (C2-2) - OC1- (C2-1)	Correct waveform is as shown

NG → **Go to step 3**

OK

REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

3 INSPECT ECM (OCV SIGNAL)



(a) Inspect the ECM using an oscilloscope.
(b) While idling, check the waveform between the terminals of the E5 ECM connector.
Standard voltage

Tester Connection	Specified Condition
OC1+ (E5-13) - OC1- (E5-12)	Correct waveform is as shown

NG → **REPLACE ECM**

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

DTC	P0011	Camshaft Position "A" - Timing Over-Advanced or System Performance (Bank 1)

DTC	P0012	Camshaft Position "A" - Timing Over-Retarded (Bank 1)

DESCRIPTION

HINT:
If DTC P0011 or P0012 is present, check the Variable Valve Timing (VVT) system.
Refer to DTC P0010 (see page ES-58).

DTC No.	DTC Detection Condition	Trouble Area
P0011	Advanced cam timing: With warm engine and engine speed between 450 rpm and 4,000 rpm, all conditions (a), (b) and (c) met (1 trip detection logic): (a) Difference between target and actual intake valve timings more than 5°CA (Crankshaft Angle) for 4.5 seconds (b) Current intake valve timing fixed (timing changes less than 5°CA in 5 seconds) (c) Variations in VVT controller timing more than 19°CA of maximum delayed timing (advanced)	• Valve timing • Oil control valve (OCV) • OCV filter • Camshaft timing gear assembly • ECM
P0012	Retarded cam timing: With warm engine and engine speed between 450 rpm and 4,000 rpm, all conditions (a), (b) and (c) met (2 trip detection logic): (a) Difference between target and actual intake valve timings more than 5°CA (Crankshaft Angle) for 4.5 seconds (b) Current intake valve timing fixed (timing changes less than 5°CA in 5 seconds) (c) Variations in VVT controller timing 19°CA or less of maximum delayed timing (retarded)	• Valve timing • OCV • OCV filter • Camshaft timing gear assembly • ECM

ES

MONITOR DESCRIPTION

The ECM optimizes the intake valve timing using the Variable Valve Timing (VVT) system to control the intake camshaft. The VVT system includes the ECM, the Oil Control Valve (OCV) and the VVT controller. The ECM sends a target duty-cycle control signal to the OCV. This control signal regulates the oil pressure supplied to the VVT controller. The VVT controller can advance or retard the intake camshaft. If the difference between the target and actual intake valve timings is large, and changes in actual intake valve timing are small, the ECM interprets this as the VVT controller stuck malfunction and sets a DTC.
Example:
A DTC is set when the following conditions 1), 2) and 3) are met:
1) The difference between the target and actual intake valve timings is more than 5°CA (Crankshaft Angle) and the condition continues for more than 4.5 seconds.
2) It takes 5 seconds or more to change the valve timing by 5°CA.
3) After above conditions 1) and 2) are met, the OCV is forcibly activated 63 times or more.
DTC P0011 (Advanced Cam Timing) is subject to 1 trip detection logic.
DTC P0012 (Retarded Cam Timing) is subject to 2 trip detection logic.
These DTCs indicate that the VVT controller cannot operate properly due to OCV malfunctions or the presence of foreign objects in the OCV.
The monitor will not run unless the following conditions are met:

- The engine is warm (the engine coolant temperature is 75°C [167°F] or more).
- The vehicle has been driven at more than 64 km/h (40 mph) for 3 minutes.
- The engine has idled for 3 minutes.

MONITOR STRATEGY

Related DTCs	P0011: Advanced camshaft timing P0012: Retarded camshaft timing
Required sensors/ components (Main)	VVT OCV and VVT Actuator
Required sensors/ components (Related)	Crankshaft position sensor, Camshaft position sensor and Engine coolant temperature sensor
Frequency of operation	Once per driving cycle
Duration	Within 10 seconds
MIL operation	P0011: Immediate P0012: 2 driving cycles
Sequence of operation	None

ES

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	P0100 - P0103 (MAF sensor) P0115 - P0118 (ECT sensor) P0125 (insufficient ECT for closed loop) P0335 (crankshaft position sensor) P0340 (camshaft position sensor) P0351 - P0354 (igniter)

P0011 and P0012 (Advance/retard malfunction):

Battery voltage	11 V or more
Engine RPM	450 to 4,000 rpm
Engine coolant temperature	75 to 100°C (167 and 212°F)

TYPICAL MALFUNCTION THRESHOLDS

P0011 and P0012 (Advance/retard malfunction)

When both conditions below are met:	-
Difference between target and actual of valve timings	5°CA (Crankshaft Angle) or more
Valve timing	No change

If the difference between the target and actual camshaft timings is greater than the specified value, the ECM operates the Variable Valve Timing (VVT) actuator.
Then, the ECM monitors the camshaft timing change for 5 seconds.

WIRING DIAGRAM

Refer to DTC P0010 (see page ES-59).

INSPECTION PROCEDURE

NOTICE:

DTC P0011 or P0012 may be set when foreign objects in the engine oil are caught in some parts of the system. The DTC will remain set even if the system returns to normal after a short time. Foreign objects are filtered out by the oil filter.

HINT:

Reed freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0011 OR P0012)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.

(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed to
P0011 or P0012	A
P0011 or P0012 and other DTCs	B

HINT:
If any DTCs other than P0011 or P0012 are output, troubleshoot those DTCs first.

B → GO TO DTC CHART

A

2 PERFORM ACTIVE TEST BY INTELLIGENT TESTER (OPERATE OCV)

(a) Connect the intelligent tester to the DLC3.
(b) Start the engine and turn the tester ON.
(c) Warm up the engine.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / VVT CTRL B1.
(e) Check the engine speed while operating the Oil Control Valve (OCV) using the tester.

OK

Tester Operation	Specified Condition
OCV OFF	Normal engine speed
OCV ON	Engine idles roughly or stalls (soon after OCV switched from OFF to ON)

NG → Go to step 4

OK

3 CHECK WHETHER DTC OUTPUT RECURS (DTC P0011 OR P0012)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Clear DTCs (see page ES-37).
(d) Start the engine and warm it up.
(e) Switch the ECM from normal mode to check mode using the tester (see page ES-41).
(f) Drive the vehicle for more than 10 minutes.
(g) Read DTCs using the tester.
OK:
No DTC output.

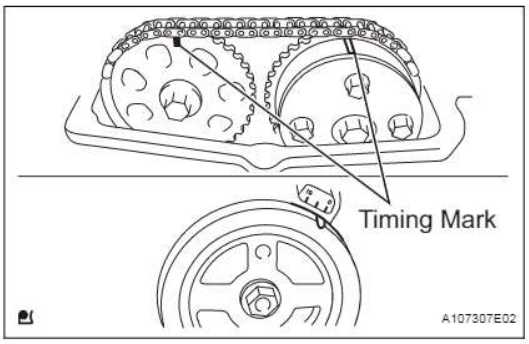
NG → Go to step 4

OK

END

ES

4	CHECK VALVE TIMING (CHECK TIMING CHAIN FOR LOOSENESS AND JUMPED)

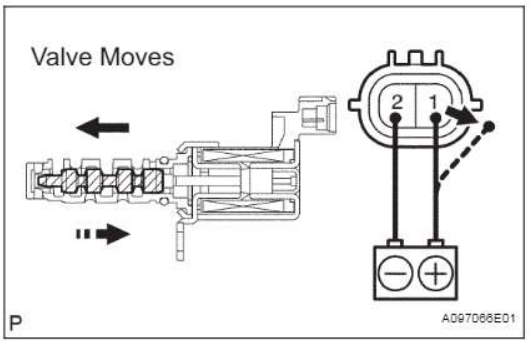


(a) Remove the cylinder head cover (see page EM-25).
(b) Turn the crankshaft pulley, then align its groove with the timing mark "0" of the timing chain cover.
(c) Check that both timing marks on the camshaft timing sprocket and camshaft timing gear are facing upward as shown in the illustration.
If not, turn the crankshaft 1 revolution (360°), then align the marks as above.
OK:
The timing marks on the camshaft timing gears are aligned with the timing chain cover surface.

NG → **ADJUST VALVE TIMING**

OK

5	INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY (OCV)

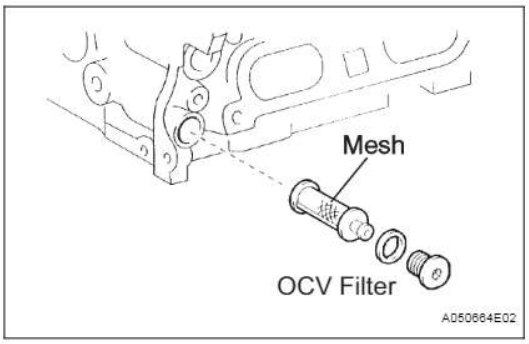


(a) Remove the OCV (see page ES-333).
(b) Measure the resistance between the terminals of the OCV.
Standard resistance:
6.9 to 7.9 Ω at 20°C (68°F)
(c) Apply the positive battery voltage to terminal 1 and negative battery voltage to terminal 2. Check the valve operation.
OK:
Valve moves quickly.

NG → **REPLACE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY**

OK

6	INSPECT OIL CONTROL VALVE FILTER



(a) Remove the generator (see page CH-9).
(b) Remove the OCV filter (see page EM-43).
(c) Check that the filter is not clogged.
OK:
Filter is not clogged.

NG → **CLEAN OIL CONTROL VALVE FILTER**

OK

7	REPLACE CAMSHAFT TIMING GEAR ASSEMBLY

(a) Replace the camshaft timing gear assembly (see page EM-40).

NEXT

8	CHECK IF DTC OUTPUT RECURS

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Clear DTCs (see page ES-37).
(d) Start the engine and warm it up.
(e) Switch the ECM from normal mode to check mode using the tester (see page ES-41).
(f) Drive the vehicle for more than 10 minutes.
(g) Confirm that no DTC is set using the tester.
Standard:
No DTC output.
HINT:
DTC P0011 or P0012 is output when foreign objects in engine oil are caught in some parts of the system. These codes will stay registered even if the system returns to normal after a short time. These foreign objects are then captured by the oil filter, thus eliminating the source of the problem.

OK	SYSTEM OK

NG

REPLACE ECM

DTC	P0016	Crankshaft Position - Camshaft Position Correlation (Bank 1 Sensor A)

DESCRIPTION

Refer to DTC P0335 (see page ES-176).

DTC No.	DTC Detection Condition	Trouble Area
P0016	Deviation in crankshaft position sensor signal and camshaft position sensor signal (2 trip detection logic)	• Mechanical system (timing chain has jumped tooth or chain stretched) • ECM

ES

MONITOR DESCRIPTION

The ECM optimizes the valve timing by using the VVT (Variable Valve Timing) system to control the intake camshaft. The VVT system includes the ECM, the Oil Control Valve (OCV) and the VVT controller.
The ECM sends a target duty-cycle control signal to the OCV. This control signal regulates the oil pressure supplied to the VVT controller. The VVT controller can advance or retard the intake camshaft.
The ECM calibrates the intake valve timing by setting the intake camshaft to the most retarded angle while the engine is idling. The ECM closes the OCV to retard the cam. The ECM stores this value as the VVT learning value. When the difference between the target and actual intake valve timings is 5°CA (Crankshaft Angle) or less, the ECM stores it.
If the learned value meets both of the following conditions, the ECM interprets this as a defect in the VVT system and set a DTC.

- VVT learning value: Less than 25°CA, or more than 51°CA.
- Above condition continues for 18 seconds or more.

This DTC indicates that the intake camshaft has been installed toward the crankshaft at an incorrect angle, caused by factors such as the timing chain having jumped a tooth.
This monitor begins to run after the engine has idled for 5 minutes.

MONITOR STRATEGY

Related DTCs	P0016: Camshaft timing misalignment at idling
Required sensors/ components (Main)	VVT actuator
Required sensors/ components (Related)	Camshaft position sensor, Crankshaft position sensor
Frequency of operation	Once per driving cycle
Duration	1 minute
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	P0011 (VVT system 1 - advance) P0012 (VVT system 1 - retard) P0115 - P0118 (ECT sensor)
Engine RPM	450 to 1,400 rpm

TYPICAL MALFUNCTION THRESHOLDS

When either condition below is met:	-
VVT learning value	Less than 25°CA
VVT learning value	More than 51°CA

WIRING DIAGRAM

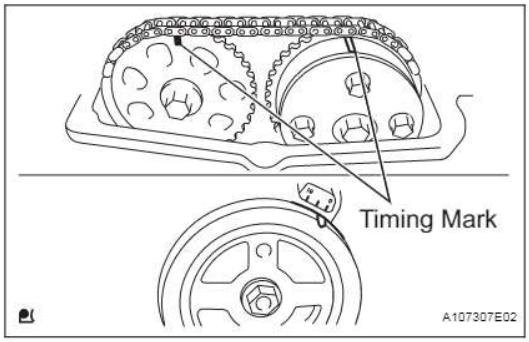
Refer to DTC P0335 (see page ES-178).

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	CHECK VALVE TIMING (CHECK TIMING CHAIN FOR LOOSENESS AND JUMPED TOOTH)



(a) Remove the cylinder head cover (see page EM-25).
(b) Turn the crankshaft pulley, then align its groove with the timing mark "0" on the timing chain cover.
(c) Check that both timing marks on the camshaft timing sprocket and camshaft timing gear are facing upward as shown in the illustration.
If not, turn the crankshaft 1 revolution (360°), then align the marks as above.

OK:

The timing marks on the camshaft timing gears are aligned with the timing chain cover surface.

NG → **ADJUST VALVE TIMING**

OK

2	REPLACE ECM

After replacing the ECM or adjusting intake valve timing, confirm that the DTC output does not recur.

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Clear DTCs (see page ES-37).
(d) Switch the ECM from normal mode to check mode (see page ES-41).
(e) Start the engine and warm it up.
(f) Allow the engine to idle for 1 minute or more, and then drive the vehicle for 1 minute or more.
(g) Confirm that no DTC is set using the tester.

NEXT

END

DTC	P0031	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 1)
DTC	P0032	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 1)
DTC	P0037	Oxygen Sensor Heater Control Circuit Low (Bank 1 Sensor 2)
DTC	P0038	Oxygen Sensor Heater Control Circuit High (Bank 1 Sensor 2)

ES

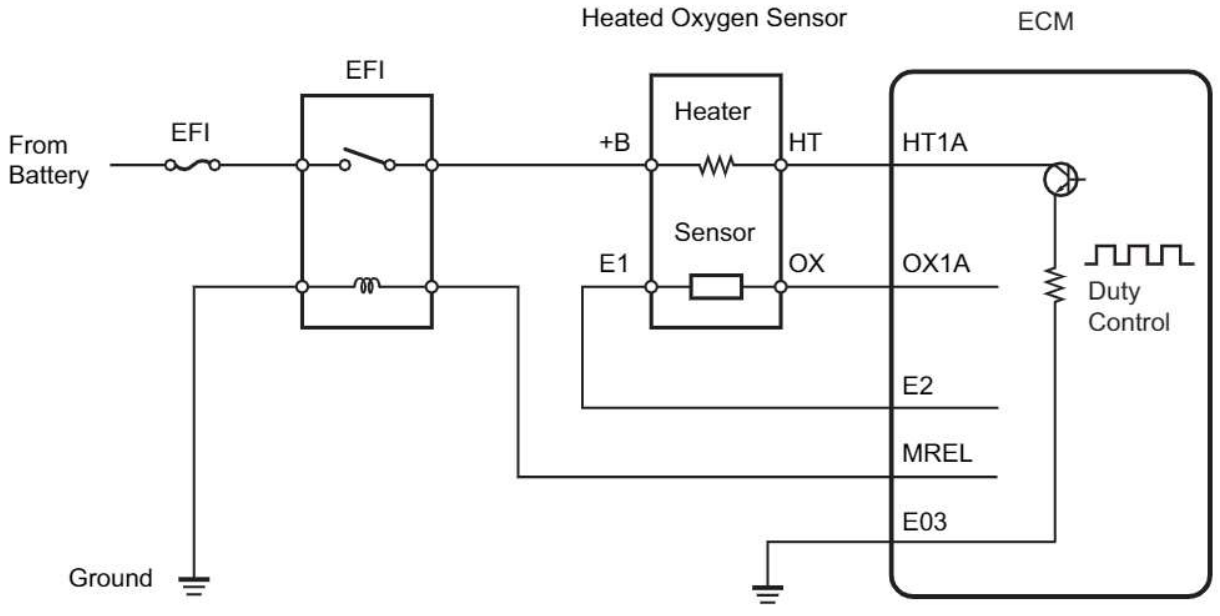
DESCRIPTION

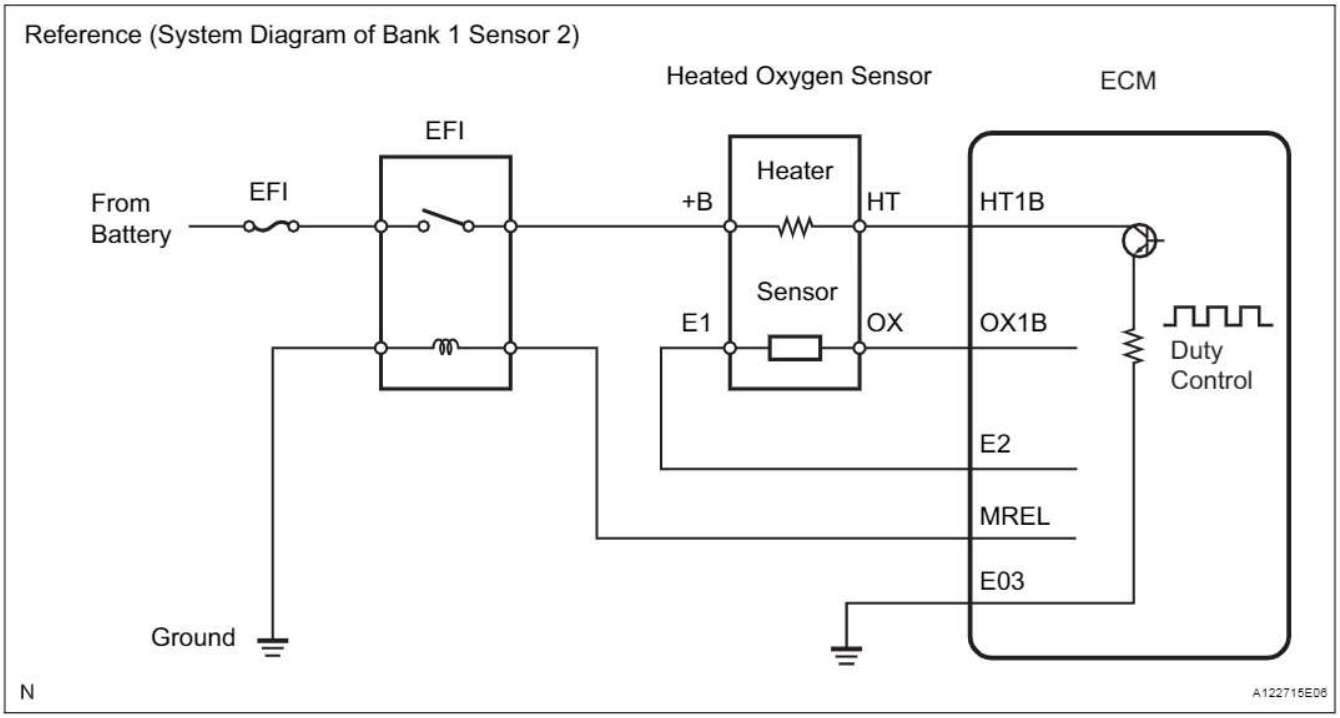
Refer to DTC P0130 (see page ES-111).

HINT:

- Sensor 1 refers to the sensor mounted in front of the Three-Way Catalytic Converter (TWC), and located near the engine assembly.
- Sensor 2 refers to the sensor mounted behind the TWC, and located far from the engine assembly.
- When any of these DTCs are set, the ECM enters fail-safe mode. During fail-safe mode, the ECM turns off the Heated Oxygen (HO2) sensor heater. Fail-safe mode continues until the ignition switch is turned OFF.
- The ECM provides a pulse width modulated control circuit to adjust current through the heater. The sensor heater circuit uses a relay on the +B side of the circuit.

Reference (System Diagram of Bank 1 Sensor 1)





DTC No.	DTC Detection Condition	Trouble Area
P0031 P0037	Heated current 0.3 A or less when heater operates with +B greater than 11.5 V (1 trip detection logic)	• Open or short in Heated Oxygen (HO2) sensor heater circuit • HO2 sensor heater • EFI relay • ECM
P0032 P0038	Heated current exceeds 2 A when heater operates (1 trip detection logic)	• Short in HO2 sensor • HO2 sensor heater • EFI relay • ECM

MONITOR DESCRIPTION

The ECM uses information from the Heated Oxygen (HO2) sensor to regulate the air-fuel ratio and keep it close to the stoichiometric level. This maximizes the ability of the Three-Way Catalytic Converter (TWC) to purify the exhaust gases.

The HO2 sensor detects oxygen levels in the exhaust gas and transmits the information to the ECM. The inner surface of the sensor element is exposed to outside air. The outer surface of the sensor element is exposed to the exhaust gas. The sensor element is made of platinum coated zirconia and includes an integrated heating element.

The zirconia element generates a small voltage when there is a large difference in the oxygen concentrations between the exhaust gas and outside air. The platinum coating amplifies the voltage generation.

The HO2 sensor is more efficient when heated. When the exhaust gas temperature is low, the sensor cannot generate useful voltage signals without supplementary heating. The ECM regulates the supplementary heating using a duty-cycle approach to adjust the average current in the sensor heater element. If the heater current is outside the normal range, the signal transmitted by the HO2 sensor will be inaccurate. As a result, the ECM will be unable to regulate air-fuel ratio properly.

When the current in the HO2 sensor heater is outside the normal operating range, the ECM interprets this as a malfunction in the sensor heater and sets a DTC.

Example:

The ECM sets either DTC P0032 or P0038 when the current in the HO2 sensor heater is more than 2 A despite the heater being OFF. Conversely, when the heater current is less than 0.3 A despite the heater being ON, DTC P0031 or P0037 is set.

MONITOR STRATEGY

Related DTCs	P0031: HO2S heater (bank 1 sensor 1) range check (low current) P0032: HO2S heater (bank 1 sensor 1) range check (high current) P0037: HO2S heater (bank 1 sensor 2) range check (low current) P0038: HO2S heater (bank 1 sensor 2) range check (high current)
Required sensors/components (Main)	HO2S heater
Required sensors/components (Related)	Vehicle Speed Sensor (VSS)
Frequency of operation	Continuous
Duration	0.3 seconds
MIL operation	Immediate
Sequence of operation	None

ES

TYPICAL ENABLING CONDITIONS

Battery voltage	10.5 V or more
Engine	Running
Starter	OFF
Intrusive heating	Not operating

P0031 and P0037:

Duration of following conditions	0.5 seconds or more
Learned heater current during heater OFF	Completed
Heater current	Less than 0.3 A
Intrusive heating for high current monitor	Not operating
Time after all heaters are OFF	1 second or more

P0032 and P0038:

Duration of following conditions	0.3 seconds or more
Learned heater current during heater OFF	Completed
Heater current	2 A or more
Time after all heaters are OFF	1 second or more

TYPICAL MALFUNCTION THRESHOLDS

P0031 and P0037:

HO2 sensor heater current when heated oxygen sensor heater ON	Less than 0.3 A

P0032 and P0038:

HO2 sensor heater current when heated oxygen sensor heater OFF	More than 2 A

COMPONENT OPERATING RANGE

HO2 sensor heater current	0.3 to 2 A (when idling with warm engine and battery voltage 11 to 14 V)

MONITOR RESULT

Refer to CHECKING MONITOR STATUS (see page ES-19).

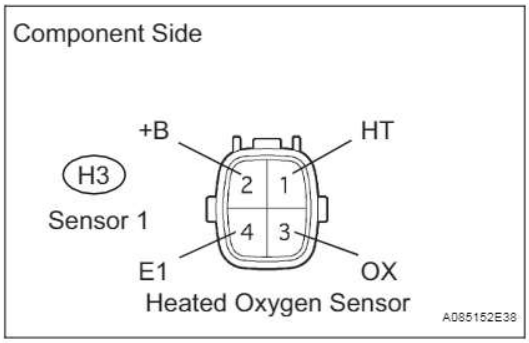
WIRING DIAGRAM

Refer to DTC P0130 (see page ES-114).

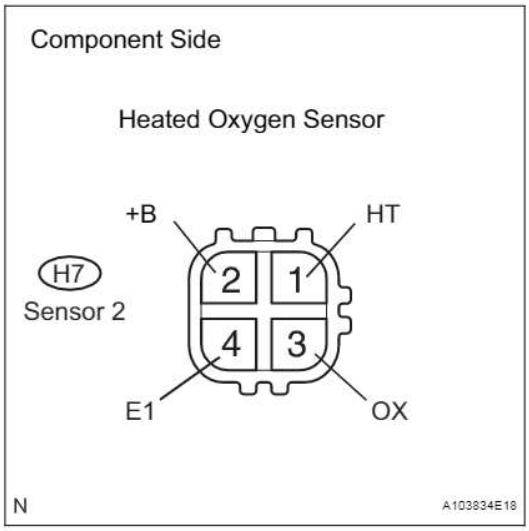
INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester. Freeze frame data records the engine conditions when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)



(a) Disconnect the H3 or H7 Heated Oxygen (HO2) sensor connector.



(b) Measure the resistance of the HO2 sensor connector.

Standard resistance (Sensor 1)

Tester Connection	Specified Condition
HT (1) - +B (2)	11 to 16 Ω at 20°C (68°F)
HT (1) - E1 (4)	10 kΩ or higher

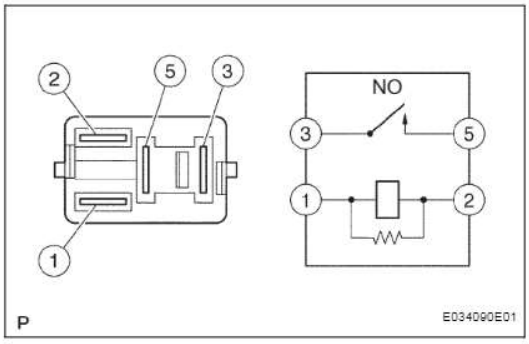
Standard resistance (Sensor 2)

Tester Connection	Specified Condition
HT (1) - +B (2)	11 to 16 Ω at 20°C (68°F)
HT (1) - E1 (4)	10 kΩ or higher

NG → REPLACE HEATED OXYGEN SENSOR

OK

2 INSPECT EFI RELAY (Marking: EFI)



(a) Remove the EFI relay from the engine room relay block.
(b) Measure the resistance of the EFI relay.

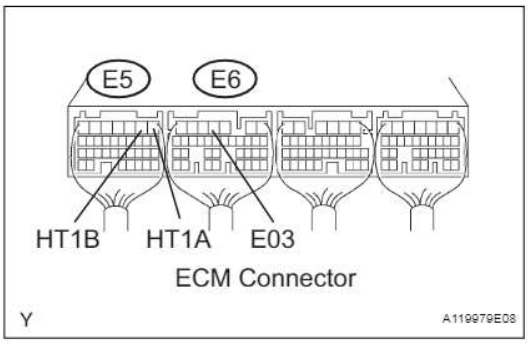
Standard resistance

Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

NG → REPLACE EFI RELAY

OK

3	INSPECT ECM (HT1A, HT1B VOLTAGE)



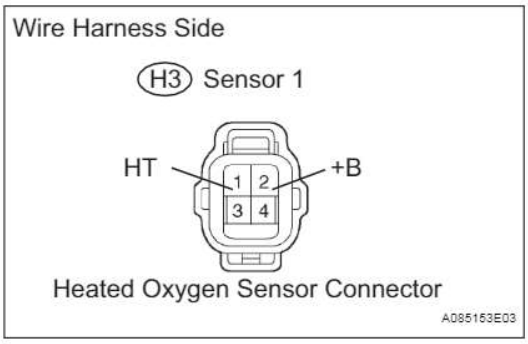
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.
Standard voltage

Tester Connection	Specified Condition
HT1A (E5-1) - E03 (E6-4)	9 to 14 V
HT1B (E5-2) - E03 (E6-4)	9 to 14 V

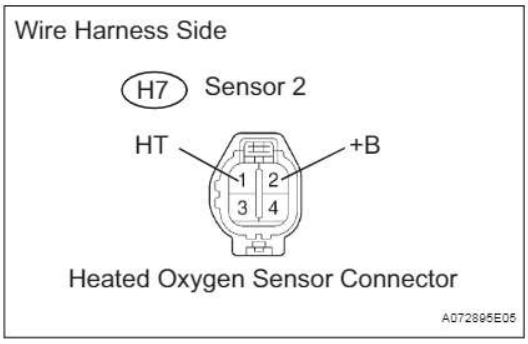
OK → REPLACE ECM

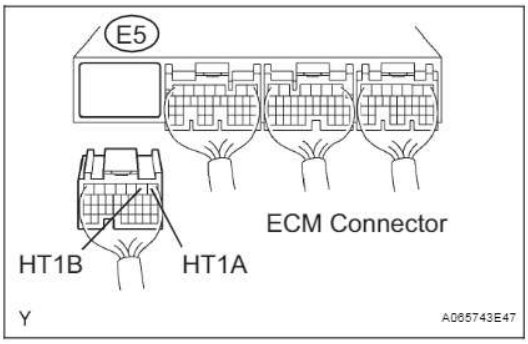
NG

4	CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - ECM, HEATED OXYGEN SENSOR - EFI RELAY)



(a) Check the harness and connectors between the ECM and HO2 sensor.
(1) Disconnect the H3 or H7 HO2 sensor connector.





(2) Disconnect the E5 ECM connector.
(3) Measure the resistance of the wire harness side connectors.
Standard resistance (Check for open)

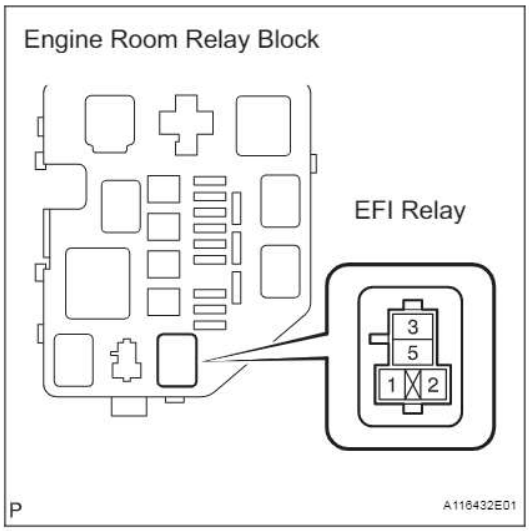
Tester Connection	Specified Condition
HT (H3-1) - HT1A (E5-1)	Below 1 Ω
HT (H7-1) - HT1B (E5-2)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
HT (H3-1) or HT1A (E5-1) - Body ground	10 kΩ or higher

Tester Connection	Specified Condition
HT (H7-1) or HT1B (E5-2) - Body ground	10 kΩ or higher

(b) Check the harness and connectors between the HO2 sensor and EFI relay.
(1) Disconnect the H3 or H7 HO2 sensor connector.
(2) Remove the EFI relay from the engine room relay block.
(3) Measure the resistance of the wire harness side connectors.



Standard resistance (Check for open)

Tester Connection	Specified Condition
+B (H3-2) - Engine room relay block (EFI relay terminal 3)	Below 1 Ω
+B (H7-2) - Engine room relay block (EFI relay terminal 3)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
+B (H3-2) or Engine room relay block (EFI relay terminal 3) - Body ground	10 kΩ or higher
+B (H7-2) or Engine room relay block (EFI relay terminal 3) - Body ground	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ECM

DTC	P0100	Mass or Volume Air Flow Circuit

DTC	P0102	Mass or Volume Air Flow Circuit Low Input

DTC	P0103	Mass or Volume Air Flow Circuit High Input

DESCRIPTION

The Mass Air Flow (MAF) meter is a sensor that measures the amount of air flowing through the valve. The ECM uses this information to determine the fuel injection time and to provied appropriate air-fuel ratio.

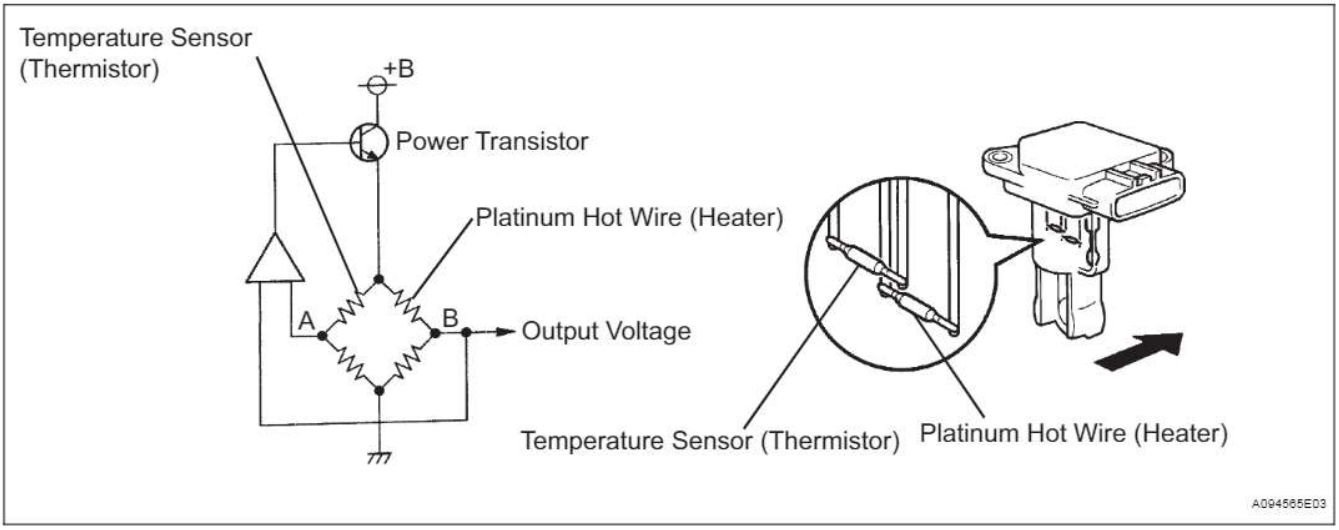
ES

Inside the MAF meter, there is a heated platinum wire which is exposed to the flow of intake air. By applying a specific electrical current to the wire, the ECM heats it to a given temperature. The flow of incoming air cools both the wire and an internal thermistor, affecting their resistance. To maintain a constant current value, the ECM varies the voltage applied to these components in the MAF meter. The voltage level is proportional to the airflow through the sensor, and the ECM uses it to calculate the intake air volume.

The circuit is constructed so that the platinum hot wire and the temperature sensor provide a bridge circuit, and the power transistor is controlled so that the potentials of A and B remain equal to maintain the predetermined temperature.

HINT:

When any of these DTCs are set, the ECM enters fail-safe mode. During fail-safe mode, the ignition timing is calculated by the ECM according to the engine RPM and throttle valve position. Fail-safe mode continues until a pass condition is detected.



DTC No.	DTC Detection Condition	Trouble Area
P0100	Open or short in Mass Air Flow (MAF) meter circuit for more than 3 seconds at engine speed of less than 4,000 rpm	• Open or short in Mass Air Flow (MAF) meter circuit • MAF meter • ECM
P0102	Open in Mass Air Flow (MAF) meter circuit for more than 3 seconds at engine speed of less than 4,000 rpm	• Open in MAF meter circuit • Short in MAF meter circuit • MAF meter • ECM
P0103	Short in Mass Air Flow (MAF) meter circuit for more than 3 seconds at engine speed of less than 4,000 rpm	• Short in MAF meter circuit (+B circuit) • MAF meter • ECM

HINT:
When any of these DTCs are set, check the air-flow rate by entering the following menus on the intelligent tester: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / MAF.

Mass Air Flow Rate (g/sec.)	Malfunctions
Approximately 0.0	• Open in Mass Air Flow (MAF) meter power source circuit • Open or short in VG circuit
271.0 or more	• Open in EVG circuit

MONITOR DESCRIPTION

If there is a defect in the MAF meter or an open short circuit, the voltage level deviates from the normal operating range. The ECM interprets this deviation as a malfunction in the MAF meter and sets a DTC.
Example:
When the sensor output voltage remains at less than 0.2 V or more than 4.9 V for more than 3 seconds, the ECM sets a DTC.
If the malfunction is not repaired successfully, a DTC is set 3 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0100: Mass air flow meter range check (Fluctuating) P0102: Mass air flow meter range check (Low voltage) P0103: Mass air flow meter range check (High voltage)
Required Sensors/Components (Main)	MAF meter
Required Sensors/Components (Related)	Crankshaft position sensor
Frequency of Operation	Continuous
Duration	3 seconds
MIL Operation	Immediate: Engine RPM less than 4,000 rpm 2 driving cycles: Engine RPM 4,000 rpm or more
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	None

TYPICAL MALFUNCTION THRESHOLDS

P0100:

Mass air flow meter voltage	Less than 0.2 V or more than 4.9 V

P0102:

Mass air flow meter voltage	Less than 0.2 V

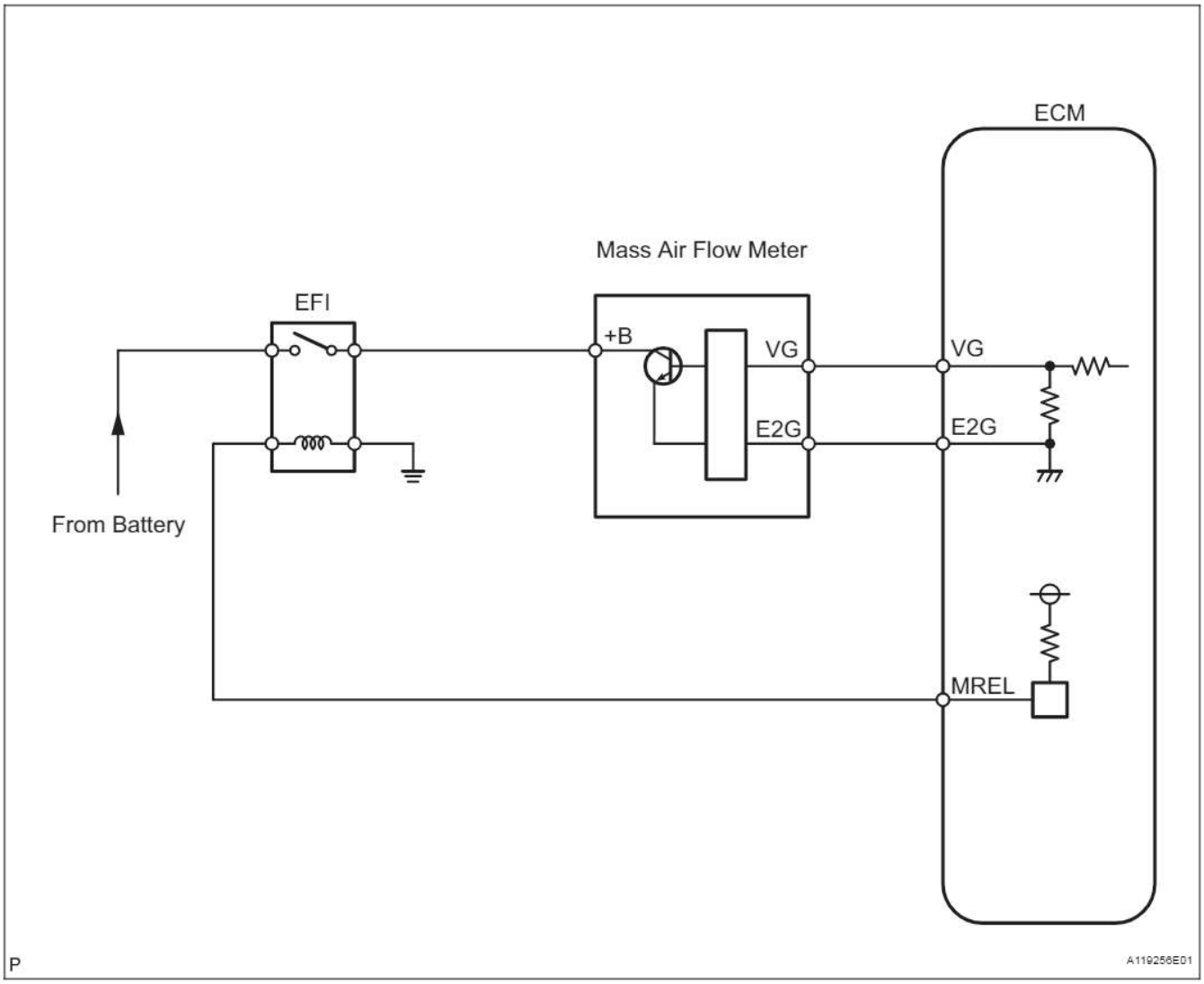
P0103:

Mass air flow meter voltage	More than 4.9 V

COMPONENT OPERATING RANGE

Mass air flow meter voltage	0.2 to 4.9 V

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester. Freeze frame data records the engine conditions when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	READ VALUE OF INTELLIGENT TESTER (MASS AIR FLOW RATE)

(a) Connect the intelligent tester to the DLC3.
(b) Start the engine.
(c) Turn the tester ON.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / MAF.
(e) Read the values displayed on the tester.

Result

Mass Air Flow Rate (g/sec.)	Proceed to
0.0	A

Mass Air Flow Rate (g/sec.)	Proceed to
271.0 or more	B
Between 1.0 and 270.0*	C

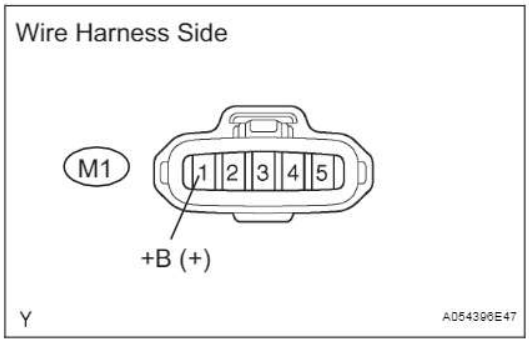
*: The value must change when the throttle valve is open or closed.

B → Go to step 6

C → CHECK FOR INTERMITTENT PROBLEMS

A

2 INSPECT MASS AIR FLOW METER (POWER SOURCE VOLTAGE)



(a) Disconnect the M1 Mass Air Flow (MAF) meter connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage of the wire harness side connector and body ground.

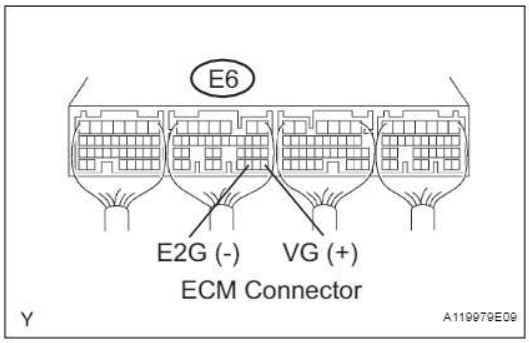
Standard voltage

Tester Connection	Specified Condition
+B (M1-1) - Body ground	9 to 14 V

NG → Go to step 5

OK

3 INSPECT ECM (VG VOLTAGE)



(a) Start the engine.
(b) Measure the voltage of the ECM connector.
HINT:
The transmission gear selector lever should be in the P or N position and the A/C switch should be turned OFF.

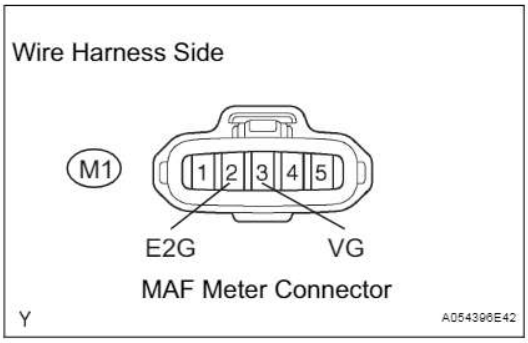
Standard voltage

Tester Connection	Condition	Specified Condition
VG (E6-28) - E2G (E6-30)	Engine idling	0.5 to 3.0 V

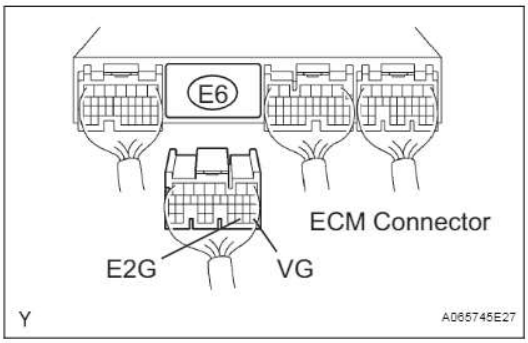
OK → REPLACE ECM

NG

4	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)



(a) Disconnect the M1 MAF meter connector.
(b) Disconnect the E6 ECM connector.



(c) Measure the resistance of the wire harness side connectors.

Standard resistance (Check for open)

Tester Connection	Specified Condition
VG (M1-3) - VG (E6-28)	Below 1 Ω
E2G (M1-2) - E2G (E6-30)	Below 1 Ω

Standard resistance (Check for short)

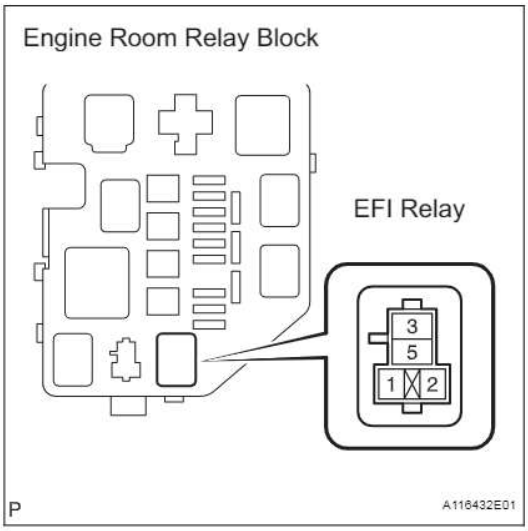
Tester Connection	Specified Condition
VG (M1-3) or VG (E6-28) - Body ground	10 kΩ or higher

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

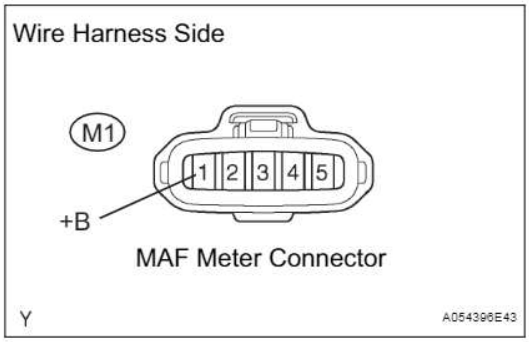
OK

REPLACE MASS AIR FLOW METER

5	CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - EFI RELAY)



(a) Remove the EFI relay from the engine room relay block.
(b) Disconnect the M1 MAF meter connector.



(c) Measure the resistance of the wire harness side connectors.

Standard resistance (Check for open)

Tester Connection	Specified Condition
+B (M1-1) - Engine room relay block (EFI relay terminal 3)	Below 1 Ω

Standard resistance (Check for short)

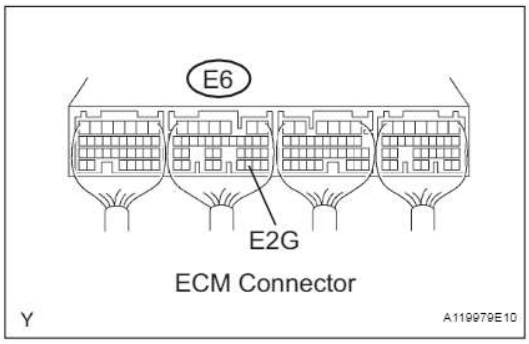
Tester Connection	Specified Condition
+B (M1-1) or Engine room relay block (EFI relay terminal 3) - Body ground	10 kΩ or higher

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

INSPECT ECM POWER SOURCE CIRCUIT

6 INSPECT ECM (SENSOR GROUND)



(a) Measure the resistance of the ECM connector and body ground.

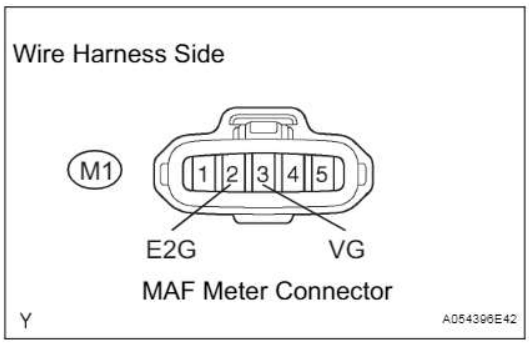
Standard resistance

Tester Connection	Specified Condition
E2G (E6-30) - Body ground	Below 1 Ω

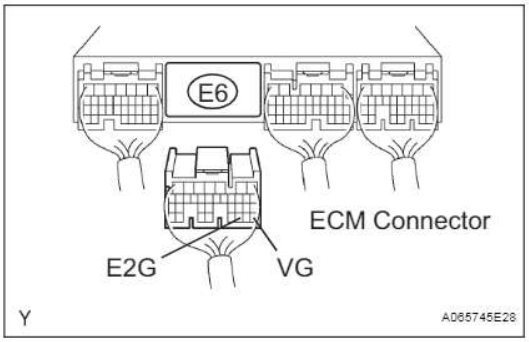
NG → **REPLACE ECM**

OK

7 CHECK HARNESS AND CONNECTOR (MASS AIR FLOW METER - ECM)



(a) Disconnect the M1 MAF meter connector.
(b) Disconnect the E6 ECM connector.



(c) Measure the resistance of the wire harness side connectors.

Standard resistance (Check for open)

Tester Connection	Specified Condition
VG (M1-3) - VG (E6-28)	Below 1 Ω
E2G (M1-2) - E2G (E6-30)	Below 1 Ω

Standard resistance (Check for short)

Tester Connections	Specified Conditions
VG (M1-3) or VG (E6-28) - Body ground	10 kΩ or higher

ES

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE MASS AIR FLOW METER

DTC	P0101	Mass Air Flow Circuit Range / Performance Problem

DESCRIPTION

Refer to DTC P0100 (see page ES-75).

DTC No.	DTC Detection Condition	Trouble Area
P0101	• High voltage: Conditions (a), (b) and (c) continue for more than 10 seconds (2 trip detection logic): (a) Engine speed less than 2,000 rpm (b) Engine coolant temperature 70°C (158°F) or higher (c) Output voltage of Mass Air Flow (MAF) meter more than specified value example 2.2 V at throttle position equal to 0 (varies with throttle position sensor voltage) • Low voltage: Conditions (a) and (b) continue for more than 10 seconds (2 trip detection logic): (a) Engine speed more than 300 rpm (b) Output voltage of MAF meter less than specified value example 0.65 V at throttle position equal to 0 (varies with throttle position sensor voltage)	Mass Air Flow (MAF) meter

ES

MONITOR DESCRIPTION

The MAF meter is a sensor that measures the amount of air flowing through the throttle valve. The ECM uses this information to determine the fuel injection time and to provide an appropriate air-fuel ratio. Inside the MAF meter, there is a heated platinum wire which is exposed to the flow of intake air. By applying a specific electrical current to the wire, the ECM heats it to a specific temperature. The flow of incoming air cools both the wire and an internal thermistor, affecting their resistance. To maintain a constant current value, the ECM varies the voltage applied to these components of the MAF meter. The voltage level is proportional to the airflow through the sensor, and the ECM uses it to calculate the intake air volume. If there is a defect in the sensor, or an open or short in the circuit, the voltage level deviates from the normal operating range. The ECM interprets this deviation as a malfunction in the MAF meter and sets the DTC.
Example:
If the voltage is more than 2.2 V, or less than 0.65 V while idling, the ECM determines that there is a malfunction in the MAF meter and sets the DTC.

MONITOR STRATEGY

Related DTCs	P0101: Mass air flow meter rationality
Required Sensors/Components (Main)	Mass air flow meter
Required Sensors/Components (Related)	Engine speed sensor, engine coolant temperature sensor and throttle position sensor
Frequency of Operation	Continuous
Duration	10 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	P0115 - P0118 (ECT sensor) P0120 - P0123 (TP sensor) P0125 (insufficient ECT for closed loop) P0335 (crankshaft position sensor) P0340 (camshaft position sensor)

Mass Air Flow Meter Rationality (High Voltage):

Engine speed	Less than 2,000 rpm
Engine coolant temperature	70°C (158°F) or more

Mass Air Flow Meter Rationality (Low Voltage):

Engine speed	More than 300 rpm
Fuel cut	OFF

TYPICAL MALFUNCTION THRESHOLDS

Mass Air Flow Meter Rationality (High Voltage):

Mass air flow meter voltage	More than 2.2 V (varies with throttle position sensor voltage)

ES

Mass Air Flow Meter Rationality (Low Voltage):

Mass air flow meter voltage	Less than 0.65 V (varies with throttle position sensor voltage)

WIRING DIAGRAM

Refer to DTC P0100 (see page ES-77).

INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0101)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed to
P0101 and other DTCs	A
P0101	B

HINT:
If any DTCs other than P0101 are output, troubleshoot those DTCs first.

B → **REPLACE MASS AIR FLOW METER**

A → **GO TO DTC CHART**

HOW TO PROCEED WITH TROUBLESHOOTING

HINT:
*: Use the intelligent tester.

1	VEHICLE BROUGHT TO WORKSHOP

NEXT

2	CUSTOMER PROBLEM ANALYSIS

NEXT

3	CONNECT INTELLIGENT TESTER TO DLC3*

HINT:
If the display indicates a communication fault in the tester, inspect the DLC3.

NEXT

4	CHECK DTC AND FREEZE FRAME DATA*

HINT:
Record or print DTCs and freeze frame data, if necessary.

NEXT

5	CLEAR DTC AND FREEZE FRAME DATA*

NEXT

6	CONDUCT VISUAL INSPECTION

NEXT

7	SET CHECK MODE DIAGNOSIS*

NEXT

8	CONFIRM PROBLEM SYMPTOMS

HINT:
If the engine does not start, first perform the "check DTC" procedures and "conduct basic inspection" procedures below.

Result	Proceed to
Malfunction does not occur	A
Malfunction occurs	B

B → GO TO STEP 10

ES

A

9	SIMULATE SYMPTOMS

NEXT

10	CHECK DTC*

Result	Proceed to
Malfunction code	A
No code	B

B → GO TO STEP 12

A

11	REFER TO DTC CHART

NEXT

GO TO STEP 14

12	CONDUCT BASIC INSPECTION

Result	Proceed to
Malfunctioning parts not confirmed	A
Malfunctioning parts confirmed	B

B → GO TO STEP 17

A

13	REFER TO PROBLEM SYMPTOMS TABLE

Result	Proceed to
Malfunctioning circuit confirmed	A
Malfunctioning parts confirmed	B

B → GO TO STEP 17

A

14	CHECK ECM POWER SOURCE CIRCUIT

ES

NEXT

15	CONDUCT CIRCUIT INSPECTION

Result	Proceed to
Malfunction not confirmed	A
Malfunction confirmed	B

B → GO TO STEP 18

A

16	CHECK FOR INTERMITTENT PROBLEMS

NEXT

GO TO STEP 18

17	CONDUCT PARTS INSPECTION

NEXT

18	IDENTIFY PROBLEM

NEXT

19	ADJUST, REPAIR OR REPLACE

NEXT

20	CONDUCT CONFIRMATION TEST

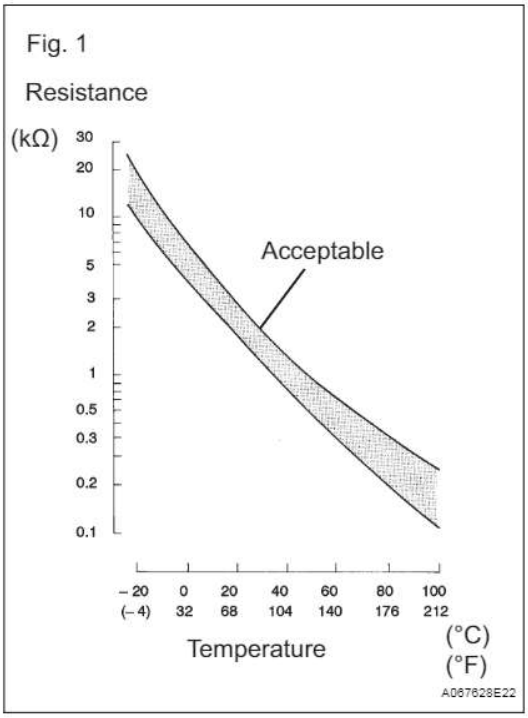
NEXT

END

DTC	P0110	Intake Air Temperature Circuit Malfunction
DTC	P0112	Intake Air Temperature Circuit Low Input
DTC	P0113	Intake Air Temperature Circuit High Input

DESCRIPTION

Fig. 1



The Intake Air Temperature (IAT) sensor, mounted on the Mass Air Flow (MAF) meter, monitors the IAT. The IAT sensor has a built-in thermistor with a resistance that varies according to the temperature of the intake air. When the IAT is low, the resistance of the thermistor increases. When the temperature is high, the resistance drops. These variations in resistance are transmitted to the ECM as voltage changes (see Fig. 1).

The IAT sensor is powered by a 5 V supply from the THA terminal of the ECM, via resistor R.

Resistor R and the IAT sensor are connected in series. When the resistance value of the IAT sensor changes according to changes in the IAT, the voltage at terminal THA also varies. Based on this signal, the ECM increases the fuel injection volume when the engine is cold to improve driveability.

HINT:

When any of DTCs P0110, P0112 and P0113 are set, the ECM enters fail-safe mode. During fail-safe mode, the IAT is estimated to be 20°C (68°F) by the ECM. Fail-safe mode continues until a pass condition is detected.

DTC No.	DTC Detection Condition	Trouble Area
P0110	Open or short in IAT sensor circuit for 0.5 seconds (1 trip detection logic)	• Open or short in IAT sensor circuit • IAT sensor (built into MAF meter) • ECM
P0112	Short in IAT sensor circuit for 0.5 seconds (1 trip detection logic)	• Short in IAT sensor circuit • IAT sensor (built into MAF meter) • ECM
P0113	Open in IAT sensor circuit for 0.5 seconds (1 trip detection logic)	• Open in IAT sensor circuit • IAT sensor (built into MAF meter) • ECM

HINT:
When any of these DTCs are set, check the IAT by entering the following menus on the intelligent tester: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / INTAKE AIR.

Temperature Displayed	Malfunction
-40°C (-40°F)	Open circuit
140°C (284°F) or higher	Short circuit

MONITOR DESCRIPTION

The ECM monitors the sensor voltage and uses this value to calculate the Intake Air Temperature (IAT). When the sensor output voltage deviates from the normal operating range, the ECM interprets this as a malfunction in the IAT sensor and sets a DTC.

ES

Example:
If the sensor output voltage is 4.91 V for 0.5 seconds or more, the ECM determines that there is an open in the IAT sensor circuit, and sets DTC P0113. Conversely, if the output voltage is more than 0.18 V for 0.5 seconds or more, the ECM determines that there is a short in the sensor circuit, and sets DTC P0112.
If the malfunction is not repaired successfully, a DTC is set 0.5 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0110: Intake air temperature sensor range check (Fluctuating) P0112: Intake air temperature sensor range check (Low resistance) P0113: Intake air temperature sensor range check (High resistance)
Required Sensors/Components (Main)	Intake Air Temperature (IAT) sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds
MIL Operation	Immediate
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	None

TYPICAL MALFUNCTION THRESHOLDS

P0110:

IAT sensor voltage	Less than 0.18 V, or more than 4.91 V

P0112:

IAT sensor voltage	Less than 0.18 V

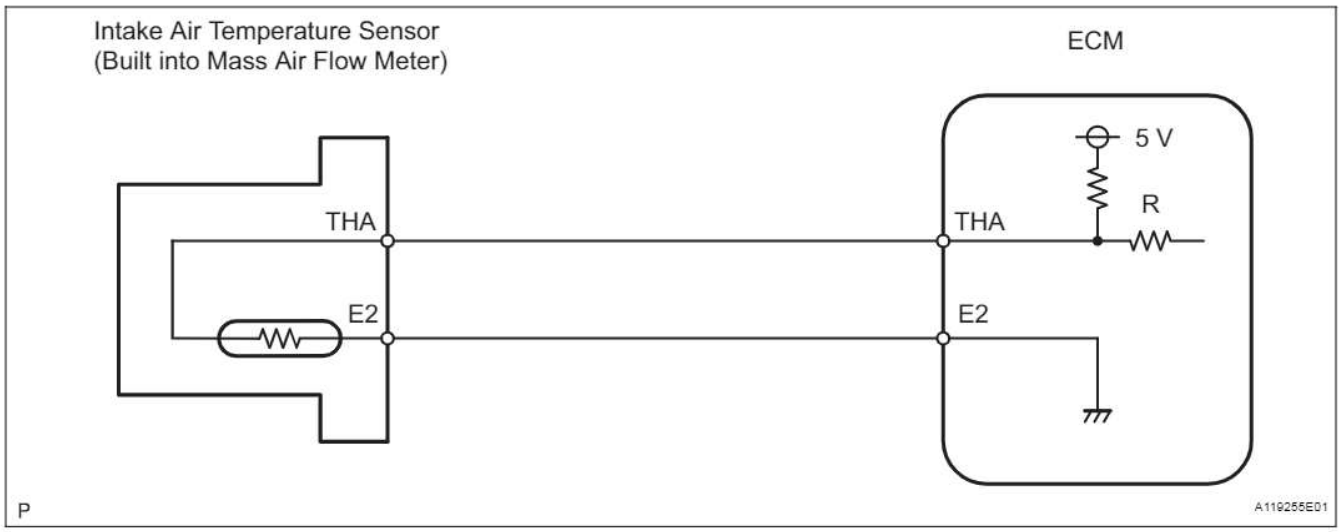
P0113:

IAT sensor voltage	More than 4.91 V

COMPONENT OPERATING RANGE

IAT sensor voltage	0.18 to 4.91 V

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If other DTCs relating to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.
- Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	READ VALUE OF INTELLIGENT TESTER (INTAKE AIR TEMPERATURE)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / INTAKE AIR.
(d) Read the value displayed on the tester.

Standard:
Same as actual Intake Air Temperature (IAT).

Result

Temperature Displayed	Proceed to
-40°C (-40°F)	A
140°C (284°F) or higher	B
Same as actual IAT	C

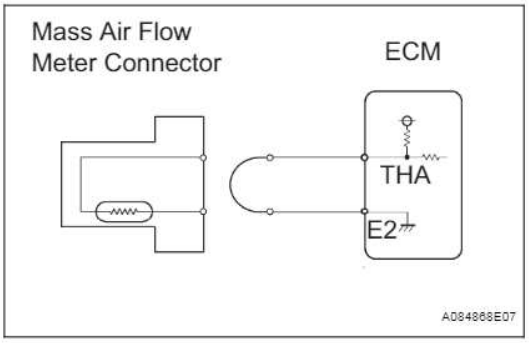
HINT:

- If there is an open circuit, the intelligent tester indicates -40°C (-40°F).
- If there is a short circuit, the intelligent tester indicates 140°C (284°F) or higher.

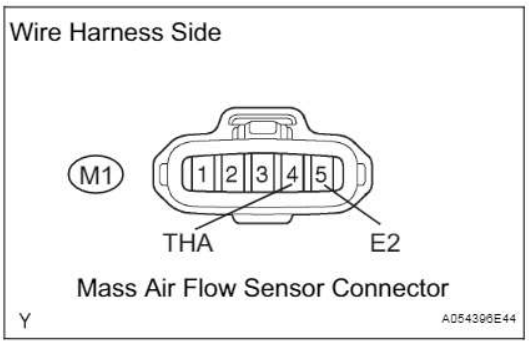
B	Go to step 4
C	CHECK FOR INTERMITTENT PROBLEMS

A

2	READ VALUE OF INTELLIGENT TESTER (CHECK FOR OPEN IN WIRE HARNESS)



(a) Disconnect the M1 Mass Air Flow (MAF) meter connector.

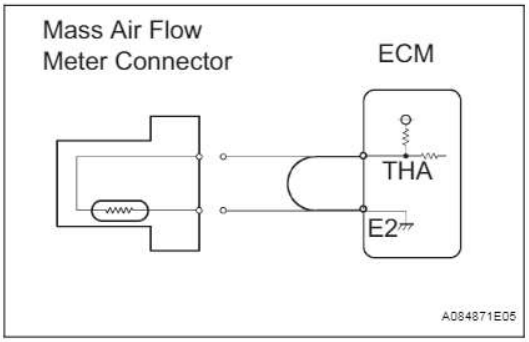


(b) Connect terminals THA and E2 of the MAF meter wire harness side connector.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch ON and turn the tester ON.
(e) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / INTAKE AIR.
(f) Read the value displayed on the tester.
Standard:
140°C (284°F) or higher

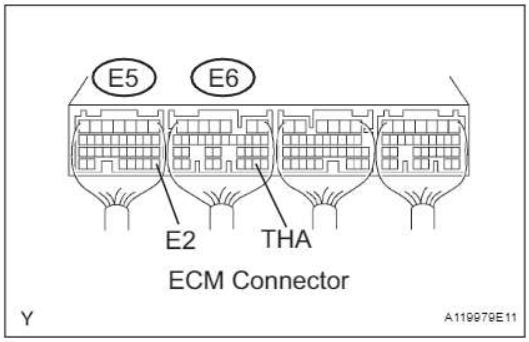
OK	CONFIRM GOOD CONNECTION TO SENSOR. IF OK, REPLACE MASS AIR FLOW METER

NG

3	READ VALUE OF INTELLIGENT TESTER (CHECK FOR OPEN IN ECM)



(a) Disconnect the M1 MAF meter connector.



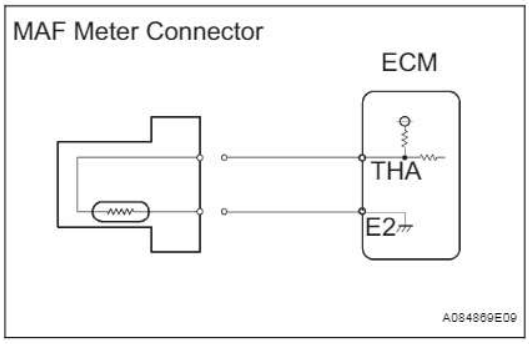
(b) Connect terminals THA and E2 of the E5 and E6 ECM connectors.
HINT:
Before checking, perform visual and contact pressure checks on the ECM connector.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch ON and turn the tester ON.
(e) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / INTAKE AIR.
(f) Read the value displayed on the tester.
Standard:
140°C (284°F) or higher

OK	**REPAIR OR REPLACE HARNESS OR CONNECTOR**

NG

CONFIRM GOOD CONNECTION TO ECM. IF OK, REPLACE ECM

4 READ VALUE OF INTELLIGENT TESTER (CHECK FOR SHORT IN WIRE HARNESS)

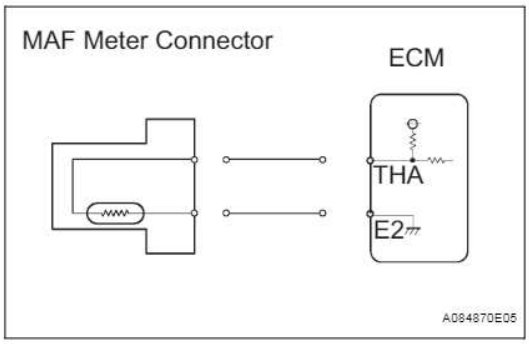


(a) Disconnect the M1 MAF meter connector.
(b) Connect the intelligent tester to the DLC3.
(c) Turn the ignition switch ON and turn the tester ON.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / INTAKE AIR.
(e) Read the value displayed on the tester.
Standard:
-40°C (-40°F)

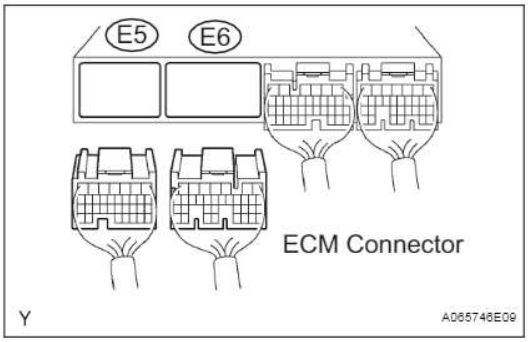
OK	**REPLACE MASS AIR FLOW METER**

NG

5 READ VALUE OF INTELLIGENT TESTER (CHECK FOR SHORT IN ECM)



(a) Disconnect the E5 and E6 ECM connectors.



(b) Connect the intelligent tester to the DLC3.
(c) Turn the ignition switch ON and turn the tester ON.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / INTAKE AIR.
(e) Read the value displayed on the tester.
Standard:
-40°C (-40°F)

OK → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

NG

REPLACE ECM

DTC	P0115	Engine Coolant Temperature Circuit Malfunction

DTC	P0117	Engine Coolant Temperature Circuit Low Input

DTC	P0118	Engine Coolant Temperature Circuit High Input

DESCRIPTION

A thermistor is built into the Engine Coolant Temperature (ECT) sensor, of which the resistance value varies according to the ECT.

The structure of the sensor and its connection to the ECM are the same as those of the Intake Air Temperature (IAT) sensor.

HINT:

When any of DTCs P0115, P0117 and P0118 are set, the ECM enters fail-safe mode. During fail-safe mode, the ECT is estimated to be 80°C (176°F) by the ECM. Fail-safe mode continues until a pass condition is detected.

ES

DTC No.	DTC Detection Condition	Trouble Area
P0115	Open or short in ECT sensor circuit for 0.5 seconds (1 trip detection logic)	• Open or short in ECT sensor circuit • ECT sensor • ECM
P0117	Short in ECT sensor circuit for 0.5 seconds (1 trip detection logic)	• Short in ECT sensor • ECT sensor • ECM
P0118	Open in ECT sensor circuit for 0.5 seconds (1 trip detection logic)	• Open in ECT sensor circuit • ECT sensor • ECM

HINT:

When any of these DTCs are set, check the ECT by entering the following menus on the intelligent tester: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / COOLANT TEMP.

Temperature Displayed	Malfunction
-40°C (-40°F)	Open circuit
140°C (284°F) or higher	Short circuit

MONITOR DESCRIPTION

The Engine Coolant Temperature (ECT) sensor is used to monitor the ECT. The ECT sensor has a thermistor with a resistance that varies according to the temperature of the engine coolant. When the coolant temperature is low, the resistance in the thermistor increases. When the temperature is high, the resistance drops. These variations in resistance are reflected in the output voltage from the sensor. The ECM monitors the sensor voltage and uses this value to calculate the ECT. When the sensor output voltage deviates from the normal operating range, the ECM interprets this as a fault in the ECT sensor and sets a DTC.

Example:

If the sensor output voltage is 4.91 V for 0.5 seconds or more, the ECM determines that there is an open in the ECT sensor circuit, and sets DTC P0118. Conversely, if the voltage output is more than 0.14 V for 0.5 seconds or more, the ECM determines that there is a short in the sensor circuit, and sets DTC P0117. If the malfunction is not repaired successfully, a DTC is set 0.5 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0115: Engine coolant temperature sensor range check (Fluctuating) P0117: Engine coolant temperature sensor range check (Low resistance) P0118: Engine coolant temperature sensor range check (High resistance)
Required sensors/components (Main)	Engine coolant temperature (ECT) sensor
Required sensors/components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds
MIL Operation	Immediate
Sequence of Operation	None

ES

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	None

TYPICAL MALFUNCTION THRESHOLDS

P0115:

ECT sensor voltage	Less than 0.14 V, or more than 4.91 V

P0117:

ECT sensor voltage	Less than 0.14 V

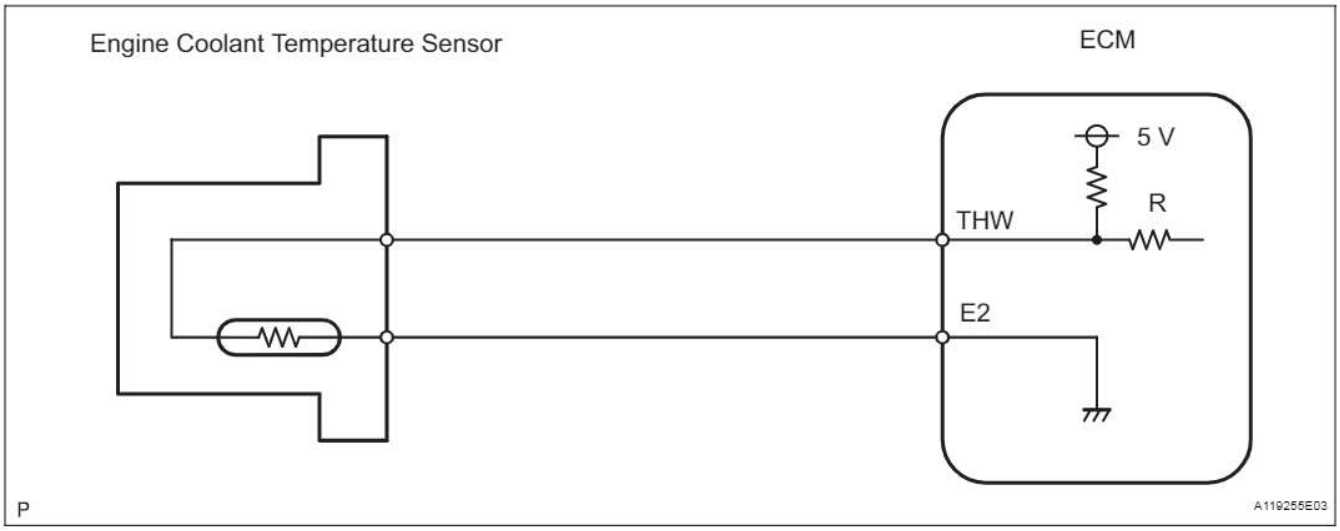
P0118:

ECT sensor voltage	More than 4.91 V

COMPONENT OPERATING RANGE

ECT sensor voltage	0.14 to 4.91 V

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- If other DTCs relating to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.
- Read freeze frame data using the intelligent tester. Freeze frame data records the engine conditions when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	READ VALUE OF INTELLIGENT TESTER (ENGINE COOLANT TEMPERATURE)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / COOLANT TEMP.
(d) Read the value displayed on the tester.
Standard:
Between 80°C and 97°C (176°F and 207°F) with warm engine.

ES

Result

Temperature Displayed	Proceed to
-40°C (-40°F)	A
140°C (284°F) or higher	B
Between 80°C and 97°C (176°F and 207°F)	C

HINT:

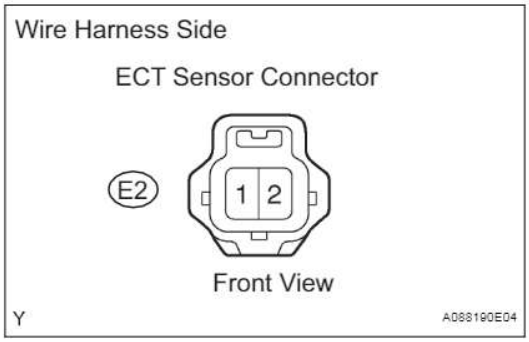
- If there is an open circuit, the intelligent tester indicates -40°C (-40°F).
- If there is a short circuit, the intelligent tester indicates 140°C (284°F) or higher.

B → Go to step 4

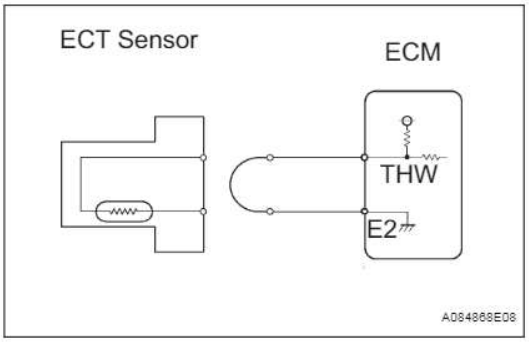
C → CHECK FOR INTERMITTENT PROBLEMS

A

2	READ VALUE OF INTELLIGENT TESTER (CHECK FOR OPEN IN WIRE HARNESS)



(a) Disconnect the E2 Engine Coolant Temperature (ECT) sensor connector.



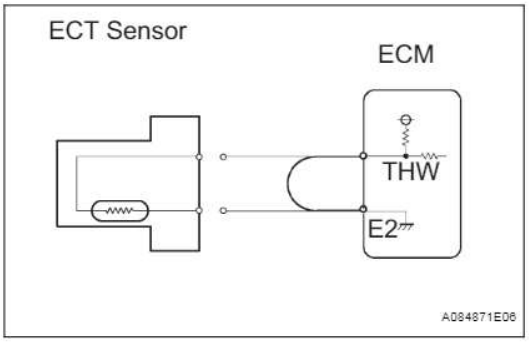
(b) Connect terminals 1 and 2 of the ECT sensor connector on the wire harness side.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch ON and turn the tester ON.
(e) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / COOLANT TEMP.
(f) Read the value displayed on the tester.
Standard:
140°C (284°F) or higher.

OK → **CONFIRM GOOD CONNECTION TO SENSOR. IF OK, REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

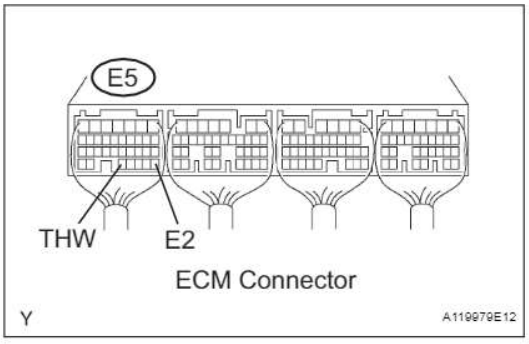
ES

NG

3	READ VALUE OF INTELLIGENT TESTER (CHECK FOR OPEN IN ECM)



(a) Disconnect the E2 ECT sensor connector.



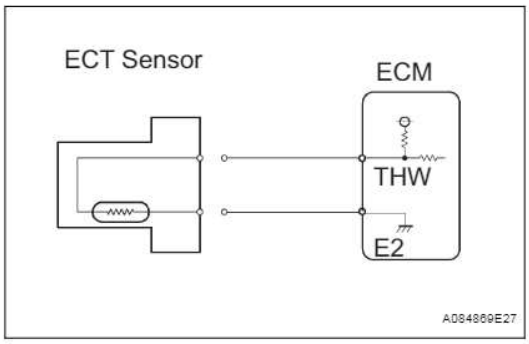
(b) Connect terminals THW and E2 of the ECM connector.
HINT:
Before checking, perform visual and contact pressure checks on the ECM connector.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch ON and turn the tester ON.
(e) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / COOLANT TEMP.
(f) Read the value displayed on the tester.
Standard:
140°C (284°F) or higher.

OK → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

NG

CONFIRM GOOD CONNECTION TO ECM. IF OK, REPLACE ECM

4	READ VALUE OF INTELLIGENT TESTER (CHECK FOR SHORT IN WIRE HARNESS)

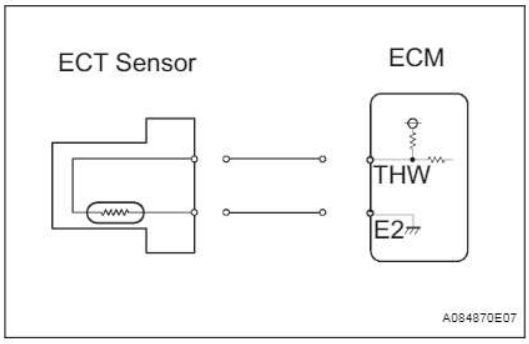


(a) Disconnect the E2 ECT sensor connector.
(b) Connect the intelligent tester to the DLC3.
(c) Turn the ignition switch ON and turn the tester ON.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / COOLANT TEMP.
(e) Read the value displayed on the tester.
Standard:
-40°C (-40°F)

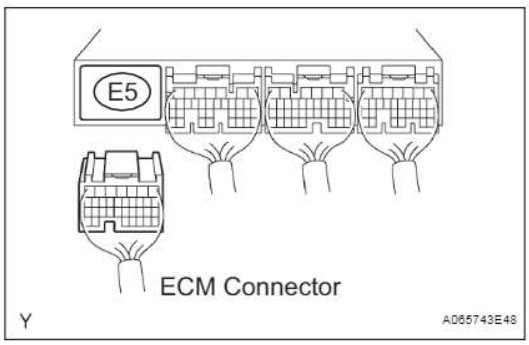
OK → **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

NG

5	READ VALUE OF INTELLIGENT TESTER (CHECK FOR SHORT IN ECM)



(a) Disconnect the E5 ECM connector.



(b) Connect the intelligent tester to the DLC3.
(c) Turn the ignition switch ON and turn the tester ON.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / INTAKE AIR.
(e) Read the value displayed on the tester.
Standard:
-40°C (-40°F)

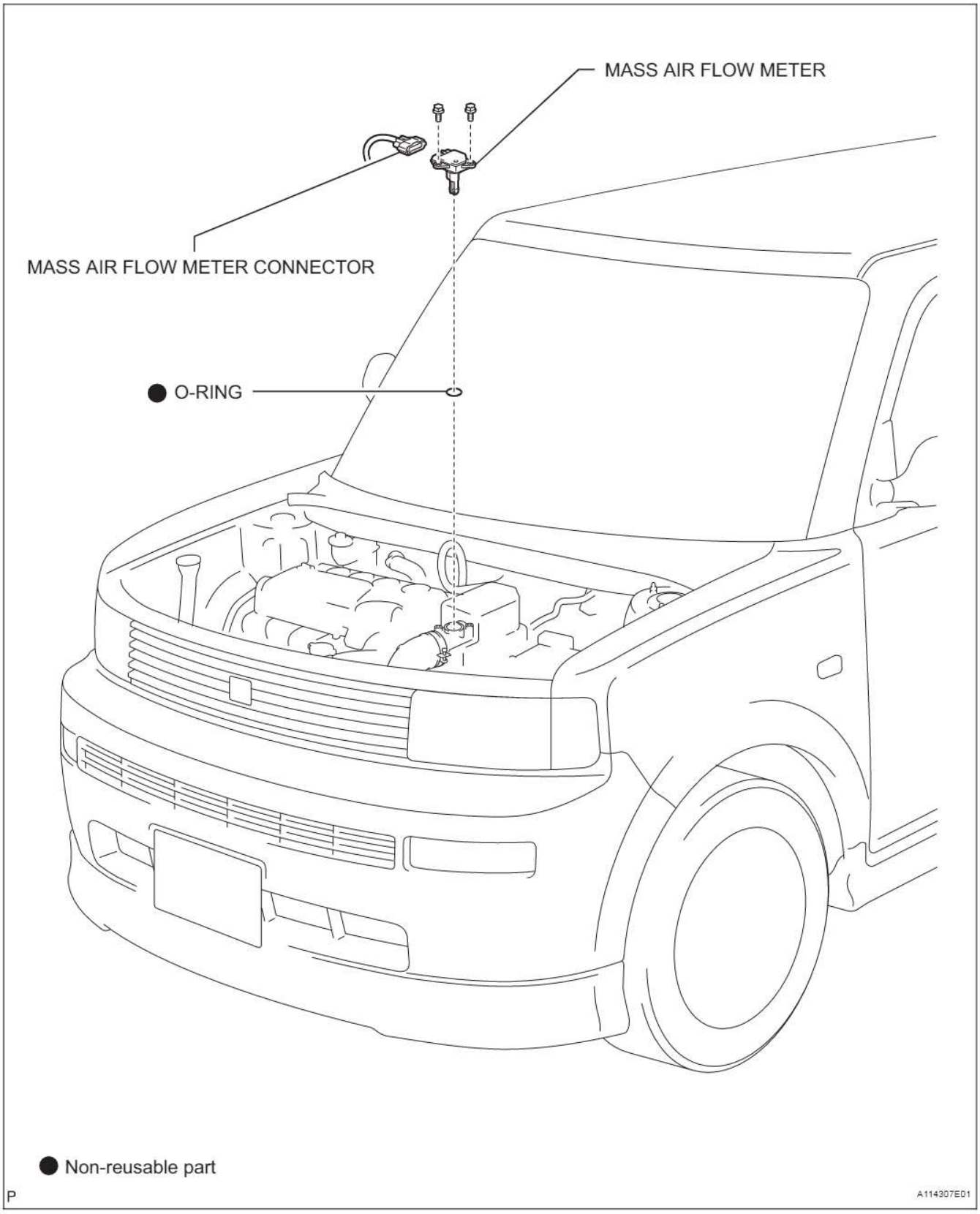
OK → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

NG

REPLACE ECM

MASS AIR FLOW METER

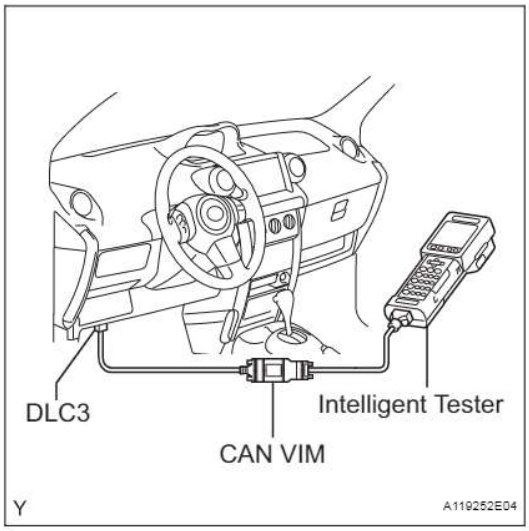
COMPONENTS



ON-VEHICLE INSPECTION

NOTICE:

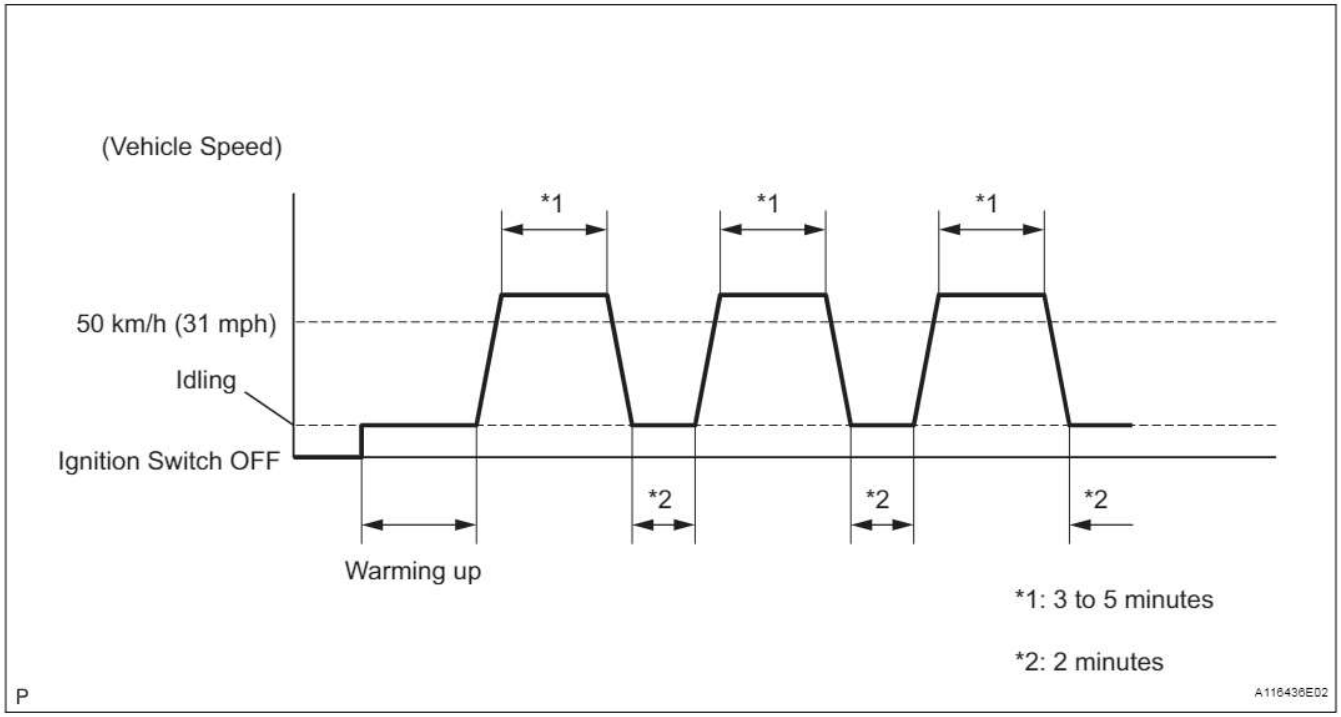
- **Perform the MAF meter inspection according to the procedures below.**
- **Only replace the MAF meter when both the LONG FT#1 value and MAF value in the DATA LIST (with the engine stopped) are not within the normal operating range.**



1. CHECK MASS AIR FLOW METER

(a) Perform confirmation driving pattern.

(1) Connect the intelligent tester to the DLC3.
(2) Turn the ignition switch ON.
(3) Turn the tester ON.
(4) Clear the DTCs (see page ES-37).
(5) Start the engine and warm it up with all accessory switches OFF (until the engine coolant temperature is 75°C (167°F) or more).
(6) Drive the vehicle at 50 km/h (31 mph) or more for 3 to 5 minutes*1.
(7) Allow the engine to idle for 2 minutes*2.
(8) Perform steps *1 and *2 at least 3 times.



(b) Read value using intelligent tester (LONG FT#1).

(1) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / LONG FT#1.
(2) Read the values displayed on the tester.
Standard value:
Within -15 to +15 %

If the result is not within the specified range, perform the inspection below.

(c) Read value using intelligent tester (MAF).

NOTICE:

- **Turn off the engine.**
- **Perform the inspection with the vehicle indoors and on a level surface.**
- **Perform the inspection of the MAF meter while it is installed to the air cleaner case (installed to the vehicle).**
- **During the test, do not use the exhaust air duct to perform suction on the exhaust pipe.**

(1) Turn the ignition switch to ACC.

(2) Turn the ignition switch ON (do not run the engine).

(3) Turn the tester ON.

(4) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / MAF.

(5) Wait 30 seconds, and read the values on the intelligent tester.

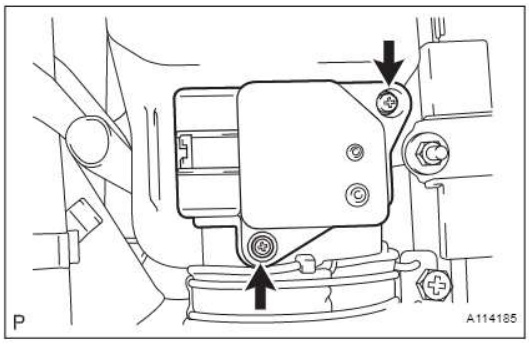
Standard condition:

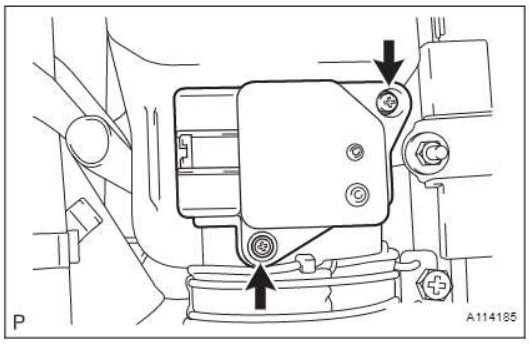
Less than 0.27g/s

- If the result is not as specified, replace the MAF meter.
- If the result is within the specified range, inspect the cause of the extremely rich or lean air fuel ratio (see page ES-149).

REMOVAL

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
2. **REMOVE MASS AIR FLOW METER**
   (a) Disconnect the MAF meter connector.
   (b) Remove the 2 screws and MAF meter.
   (c) Remove the O-ring from the MAF meter.





INSTALLATION

1. **INSTALL MASS AIR FLOW METER**
   (a) Install a new O-ring to the MAF meter.
   (b) Install the MAF meter with the 2 screws.
   (c) Connect the MAF connector.
2. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

DTC	P0116	Engine Coolant Temperature Circuit Range / Performance Problem

DESCRIPTION

Refer to DTC P0115 (see page ES-90).

DTC No.	DTC Detection Condition	Trouble Area
P0116	When one of following conditions is met (2 trip detection logic): • When cold engine is started and engine is warmed up, ECT sensor value does not change • When warmed up engine is started, driving does not change ECT sensor value • After a warmed up engine is started, if the ECT sensor value does not change when the engine is stopped and then the next cold engine start is performed, it is determined that a malfunction has occurred.	• Thermostat • Engine Coolant Temperature (ECT) sensor

ES

MONITOR DESCRIPTION

- When a cold engine start is performed and then the engine is warmed up, if the ECT sensor value does not change, it is determined that a malfunction has occurred. If this is detected in 2 consecutive driving cycles, the MIL is illuminated and a DTC is set.
- When a warmed up engine is started, if the ECT sensor value does not change during driving, it is determined that a malfunction has occurred. If this is detected in 2 consecutive driving cycles, the MIL is illuminated and a DTC is set.
- After a warmed up engine is started, if the ECT sensor value does not change when the engine is stopped and then the next cold engine start is performed, it is determined that a malfunction has occurred. If this is detected in 2 consecutive driving cycles, the MIL is illuminated and a DTC is set.

MONITOR STRATEGY

Related DTCs	P0116: Engine coolant temperature (ECT) sensor cold start monitor P0116: ECT sensor hot start monitor P0116: ECT sensor soak monitor
Required Sensors/Components (Main)	ECT sensor
Required Sensors/Components (Related)	None
Frequency of Operation	Once per driving cycle
Duration	180 seconds or more
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Engine Coolant Temperature (ECT) sensor cold start monitor:

This monitor will run whenever these DTCs are not present	P0100 to P0103: Mass air flow (MAF) meter P0110 to P0113: Intake air temperature (IAT) sensor
Battery voltage	10.5 V or more
Time after engine start	1 seconds or more
ECT at engine start	Less than 60°C (140°F)
IAT sensor circuit	OK
Soak time	5 hours or more
Accumulated MAF	900 g or more
Engine	Running
Fuel cut	OFF
Difference between ECT at engine start and IAT	Less than 40°C (72°F)

ECT sensor hot start monitor:

This monitor will run whenever these DTCs are not present	P0100 to P0103: MAF meter P0110 to P0113: IAT sensor
Battery voltage	10.5 V or more
MAF meter circuit	OK
ECT at engine start	Less than 60°C (140°F)
ECT at engine start	60 to 150°C (140 to 302°F)
Engine load change	10 times or more
Accumulated MAF	3,000 g or more

ECT sensor soak monitor:

This monitor will run whenever these DTCs are not present	P0100 to P0103: MAF meter P0110 to P0113: IAT sensor
Battery voltage	10.5 V or more
Engine	Running
Soak time	5 hours or more
Either (a) or (b) condition is met	-
(a) ECT	60°C (140°F) or more
(b) Accumulated MAF	5,000 g or more

ES

TYPICAL MALFUNCTION THRESHOLDS

Engine Coolant Temperature (ECT) sensor cold start monitor:

ECT sensor value change	Less than 5°C (9°F)

ECT sensor hot start monitor:

ECT sensor value change	Less than 5°C (9°F)

ECT sensor soak monitor:

Difference between current ECT sensor value and previous ECT sensor value when engine stopped	Less than 5°C (9°F)

COMPONENT OPERATING RANGE

Engine coolant temperature	ECT sensor value changes in accordance with actual ECT

WIRING DIAGRAM

Refer to DTC P0115 (see page ES-91).

INSPECTION PROCEDURE

HINT:

- If any of DTCs P0115, P0117, P0118 or P0125 are set simultaneously with DTC P0116, the ECT sensor may have an open or short circuit. Troubleshoot those DTCs first.
- Read freeze frame data using the intelligent tester. Freeze frame data records the engine conditions when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	CHECK INTELLIGENT TESTER

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.

(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read the DTC.

Result

Display (DTC output)	Proceed to
P0116	A
P0116 and other DTCs	B

B → GO TO DTC CHART

A

ES

2 INSPECT THERMOSTAT

(a) Remove the thermostat (see page CO-12).
(b) Check the valve opening temperature of the thermostat.
Standard:
80 to 84°C (176 to 183°F)
HINT:
In addition to the above check, confirm that the valve is completely closed when the temperature is below the standard.

NG → REPLACE THERMOSTAT

OK

REPLACE ENGINE COOLANT TEMPERATURE SENSOR

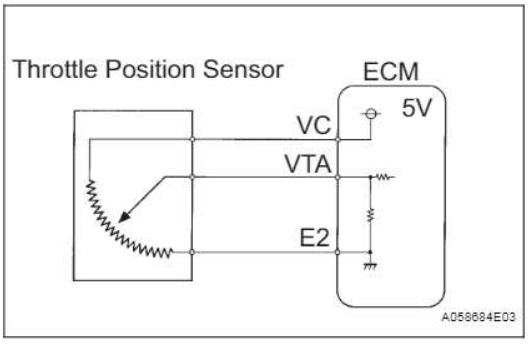
DTC	P0120	Throttle / Pedal Position Sensor / Switch "A" Circuit

DTC	P0122	Throttle / Pedal Position Sensor / Switch "A" Circuit Low Input

DTC	P0123	Throttle / Pedal Position Sensor / Switch "A" Circuit High Input

DESCRIPTION

ES



HINT:
These DTCs relate to the Throttle Position (TP) sensor.
The TP sensor is mounted on the throttle body and detects the throttle valve opening angle.
When the throttle valve is fully closed, the sensor transmits a signal voltage of approximately 0.3 to 1.0 V to terminal VTA of the ECM. This signal voltage increases in proportion to the opening angle of the throttle valve, reaching approximately 3.2 to 4.9 V when the throttle valve is fully open.
The ECM determines the vehicle driving conditions from these signals and uses this information in functions such as air-fuel ratio correction, power increase correction and fuel cut control.

DTC No.	DTC Detection Condition	Trouble Area
P0120	VTA less than 0.14 V, or VTA more than 4.91 V for 5 seconds or more (1 trip detection logic)	• Throttle Position (TP) sensor • ECM
P0122	VTA stays less than 0.14 V for 5 seconds or more (1 trip detection logic)	• TP sensor • Short in VTA circuit • Open in VC circuit • ECM
P0123	VTA stays more than 4.91 V for 5 seconds or more (1 trip detection logic)	• TP sensor • Open in VTA circuit • Open in E2 circuit • Short between VC and VTA circuits • ECM

HINT:
- Fail-safe mode: When any of these DTCs are set, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts fuel intermittently. Fail-safe mode continues until a pass condition is detected and the ignition switch is turned OFF.
- When any of these DTCs are set, check the throttle valve opening angle using the intelligent tester.

Throttle Valve Fully Closed	Throttle Valve Fully Open	Trouble Area
0%	0%	VC circuit open VTA circuit open or short
Approximately 100%	Approximately 100%	E2 circuit open

MONITOR DESCRIPTION

The resistance of the Throttle Position (TP) sensor varies in accordance with the throttle valve opening angle. The ECM transmits a standardized reference voltage to the VC terminal of the TP sensor and calculates the throttle valve opening angle based on the voltage received from the VTA terminal of the sensor. When the throttle valve is near the fully closed position, the output voltage of the TP sensor is low. When it is near the fully open position, the output voltage is high.
If the ECM detects that the output voltage of the TP sensor is outside the normal range, the ECM interprets this as a malfunction in the TP sensor and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0120: Throttle position sensor range check (fluctuating) P0122: Throttle position sensor range check (low voltage) P0123: Throttle position sensor range check (high voltage)
Required sensors/components (Main)	TP sensor
Required sensors/components (Related)	-
Frequency of operation	Continuous
Duration	5 seconds
MIL operation	Immediate
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever these DTCs not present	None

TYPICAL MALFUNCTION THRESHOLDS

P0120:

Throttle position sensor voltage	Less than 0.14 V or more than 4.91 V

P0122:

Throttle position sensor voltage	Less than 0.14 V

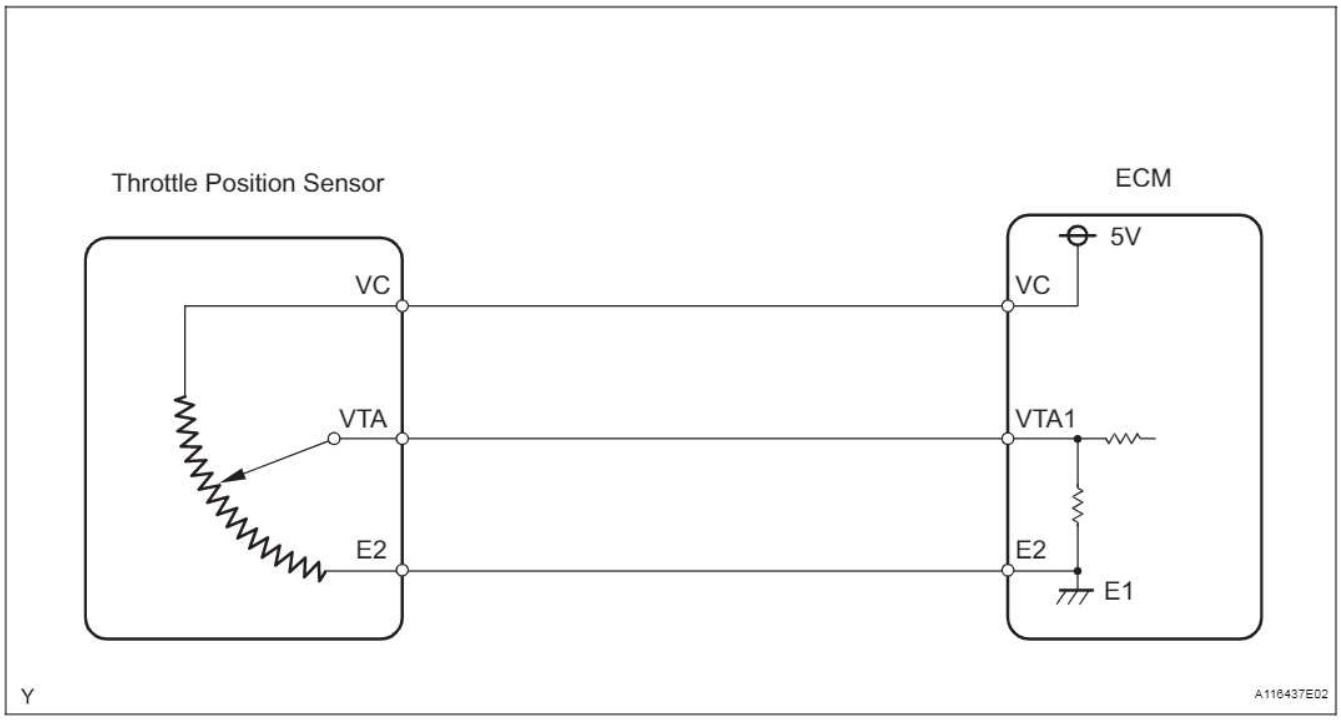
P0123:

Throttle position sensor voltage	More than 4.91 V

COMPONENT OPERATING RANGE

Throttle position sensor voltage	Between 0.14 V and 4.91 V

WIRING DIAGRAM



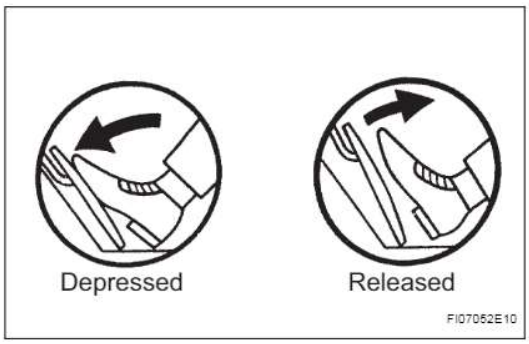
INSPECTION PROCEDURE

HINT:

- If other DTCs relating to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.
- Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	READ VALUE OF INTELLIGENT TESTER (THROTTLE VALVE OPENING PERCENTAGE)

(a) Connect the intelligent tester to the DLC3.
(b) Start the engine.
(c) On the tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ETCS / THROTTLE POS.
(d) Read its value displayed on the tester when the accelerator pedal is released and depressed.



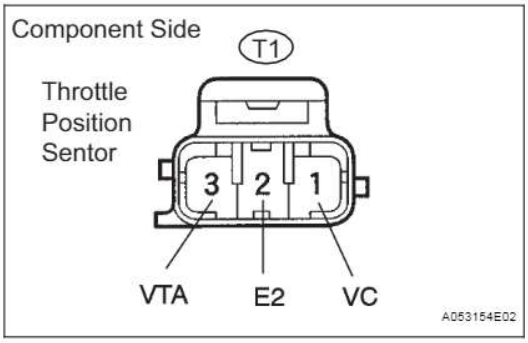
Result

Throttle Valve Opening Angle (%)	Proceed to
0	A
From approximately 0 to 75	B
Approximately 100	C

B	CHECK FOR INTERMITTENT PROBLEMS
C	Go to step 4

A

2 INSPECT THROTTLE POSITION SENSOR



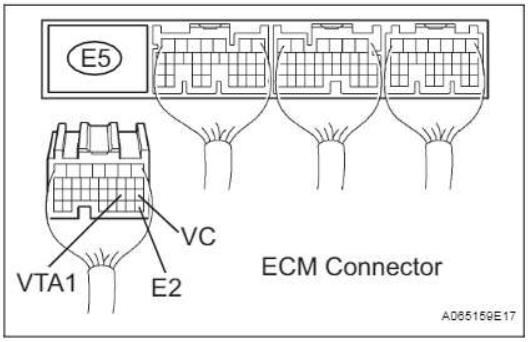
(a) Disconnect the T1 Throttle Position (TP) sensor connector.
(b) Measure the resistance of the TP sensor.
Standard resistance

Tester Connection	Throttle Valve Position	Specified Condition
VC (T1-1) - E2 (T1-2)	-	2.5 to 5.9 kΩ
VTA (T1-3) - E2 (T1-2)	Fully closed	0.2 to 5.7 kΩ
VTA (T1-3) - E2 (T1-2)	Fully open	2.0 to 10.2 kΩ

NG → REPLACE THROTTLE POSITION SENSOR

OK

3 CHECK HARNESS AND CONNECTOR (ECM - THROTTLE POSITION SENSOR)



(a) Disconnect the E5 ECM connector.
(b) Measure the resistance of the ECM connector.
Standard resistance

Tester Connection	Throttle Valve Position	Specified Condition
VC (E5-18) - E2 (E5-28)	-	2.5 to 5.9 kΩ
VTA1 (E5-20) - E2 (E5-28)	Fully closed	0.2 to 5.7 kΩ
VTA1 (E5-20) - E2 (E5-28)	Fully open	2.0 to 10.2 kΩ

Standard resistance (Check for short)

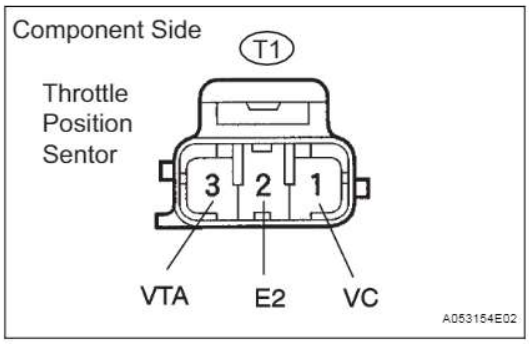
Tester Connection	Specified Condition
VC (E5-18) - Body ground	10 kΩ or higher
VTA1 (E5-20) - Body ground	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ECM

4 INSPECT THROTTLE POSITION SENSOR



(a) Disconnect the T1 TP sensor connector.
(b) Measure the resistance of the TP sensor.

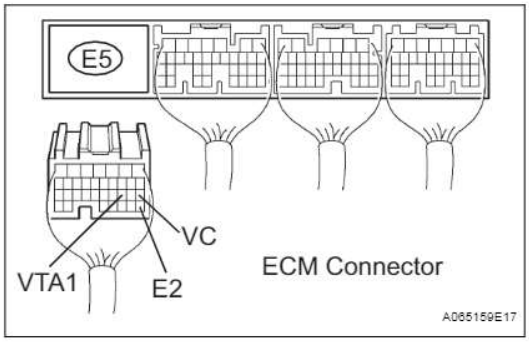
Standard resistance

Tester Connection	Throttle Valve Position	Specified Condition
VC (T1-1) - E2 (T1-2)	-	2.5 to 5.9 kΩ
VTA (T1-3) - E2 (T1-2)	Fully closed	0.2 to 5.7 kΩ
VTA (T1-3) - E2 (T1-2)	Fully open	2.0 to 10.2 kΩ

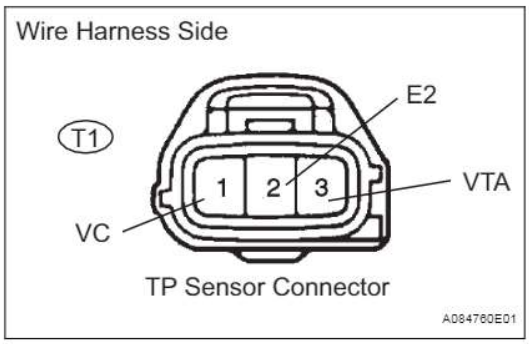
NG → REPLACE THROTTLE POSITION SENSOR

OK

5 CHECK HARNESS AND CONNECTOR (ECM - THROTTLE POSITION SENSOR)



(a) Disconnect the E5 ECM connector.



(b) Disconnect the T1 TP sensor connector.
(c) Measure the resistance of the wire harness side connectors.

Standard resistance (Check for open)

Tester Connection	Specified Condition
VC (T1-1) - VC (E5-18)	Below 1 Ω
VTA (T1-3) - VTA1 (E5-20)	Below 1 Ω
E2 (T1-2) - E2 (E5-28)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
VC (T1-1) or VC (E5-18) - Body ground	10 kΩ or higher
VTA (T1-3) or VTA1 (E5-20) - Body ground	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ECM

DTC	P0121	Throttle / Pedal Position Sensor / Switch "A" Circuit Range / Performance Problem

DESCRIPTION

HINT:
This DTC relates to the Throttle Position (TP) sensor.
Refer to DTC P0120 (see page ES-98).

DTC No.	DTC Detection Condition	Trouble Area
P0121	After vehicle speed exceeds 30 km/h (18.6 mph) once, Throttle Position (TP) sensor output voltage deviates from the standard range when throttle valve closed at 0 km/h (0 mph) on 4 occasions	Throttle Position (TP) sensor

ES

MONITOR DESCRIPTION

The resistance of the TP sensor varies in accordance with the throttle valve opening angle. The ECM transmits a standardized reference voltage to the VC terminal of the TP sensor and calculates the throttle valve opening angle based on the voltage received from the VTA terminal of the sensor.
When the throttle valve is near the fully closed position, the output voltage of the TP sensor is low. When it is near the fully open position, the output voltage is high.
The ECM monitors the indicated throttle valve opening angle during stop-and-go driving conditions. If the indicated angle (or voltage) in the closed throttle valve position is outside the specified range, the ECM interprets this as a malfunction in the TP sensor and sets the DTC.
HINT:
When this DTC is set, the ECM enters fail-safe mode. During fail-safe mode, the ECM cuts fuel intermittently. Fail-safe mode continues until a pass condition is detected and the ignition switch is turned OFF.

MONITOR STRATEGY

Related DTCs	P0121: TP sensor rationality
Required Sensors/Components (Main)	TP sensor
Required Sensors/Components (Related)	None
Frequency of Operation	Continuous
Duration	Stop and go is performed 4 times
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Stop and Go	4 times

Stop-and-go is defined as follows:
Stop indicates a vehicle speed of 0 km/h (0 mph). Go indicates a vehicle speed of 30 km/h (18.6 mph).

TYPICAL MALFUNCTION THRESHOLDS

Closed throttle position learning value	Lower than 0.298 or 1.05 V or higher

COMPONENT OPERATING RANGE

Closed throttle position learning value	0.298 to 1.05 V

INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0121)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed to
P0121 and other DTCs	A
P0121	B

HINT:
If any DTCs other than P0121 are output, troubleshoot those DTCs first.

B → REPLACE THROTTLE POSITION SENSOR

A → GO TO DTC CHART

DTC	P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control

DESCRIPTION

Refer to DTC P0115 (see page ES-90).

DTC No.	DTC Detection Condition	Trouble Area
P0125	• Case 1: ECT above 10°C (50°F) at engine start and following conditions met (2 trip detection logic): (a) 1 minute elapsed since engine start (b) ECT sensor value remains below closed loop fuel control enabling temperature • Case 2: ECT between -6.6 and 10°C (20 and 50°F) at engine start and following conditions met (2 trip detection logic): (a) 1.7 minutes elapsed since engine start (b) ECT sensor value remains below closed loop fuel control enabling temperature • Case 3: Engine Coolant Temperature (ECT) less than -6.6°C (20°F) at engine start and following conditions met (2 trip detection logic): (a) 19 minutes elapsed since engine start (b) ECT sensor value remains below closed loop fuel control enabling temperature	• Cooling system • Engine Coolant Temperature (ECT) sensor • Thermostat

ES

MONITOR DESCRIPTION

The resistance of the ECT sensor varies in proportion to the actual ECT. The ECM supplies a constant voltage to the sensor and monitors the signal output voltage of the sensor. The signal voltage output varies according to the changing resistance of the sensor. After the engine is started, the ECT is monitored through this signal. If the ECT sensor indicates that the engine is not yet warm enough for closed loop fuel control, despite a specified period of time having elapsed since the engine was started, the ECM interprets this as a malfunction in the sensor or cooling system and sets the DTC.
Example:
The ECT is 0°C (32°F) at engine start. After 5 minutes running time, the ECT sensor still indicates that the engine is not warm enough to begin closed loop fuel (air-fuel ratio feedback) control. The ECM interprets this as a malfunction in the sensor or cooling system and sets the DTC.

MONITOR STRATEGY

Related DTCs	P0125: Insufficient engine coolant temperature for closed loop (case 1) P0125: Insufficient engine coolant temperature for closed loop (case 2) P0125: Insufficient engine coolant temperature for closed loop (case 3)
Required sensors/components (Main)	Engine coolant temperature sensor
Required sensors/components (Related)	Cooling system
Frequency of operation	Continuous
Duration	Maximum 19 minutes (Varies with ECT at engine start)
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Insufficient engine coolant temperature for closed loop (case 1)

Monitor runs whenever following DTCs not present	P0100 - P0103 (MAF meter) P0110 - P0113 (IAT sensor) P0115 - P0118 (ECT sensor) P0128 (Thermostat)

ECT at engine start	10°C (50°F) or more

Insufficient engine coolant temperature for closed loop (case 2)

Monitor runs whenever following DTCs not present	P0100 - P0103 (MAF meter) P0110 - P0113 (IAT sensor) P0115 - P0118 (ECT sensor) P0128 (Thermostat)
ECT at engine start	-6.6 to 10°C (20 to 50°F)

Insufficient engine coolant temperature for closed loop (case 3)

Monitor runs whenever following DTCs not present	P0100 - P0103 (MAF meter) P0110 - P0113 (IAT sensor) P0115 - P0118 (ECT sensor) P0128 (Thermostat)
ECT at engine start	Less than -6.6°C (20°F)

ES

TYPICAL MALFUNCTION THRESHOLDS

Insufficient engine coolant temperature for closed loop (case 1)

ECT sensor value	Less than closed loop enabling temperature for 55 seconds

Insufficient engine coolant temperature for closed loop (case 2)

ECT sensor value	Less than closed loop enabling temperature for 103 seconds

Insufficient engine coolant temperature for closed loop (case 3)

ECT sensor value	Less than closed loop enabling temperature for 1144 seconds

COMPONENT OPERATING RANGE

ECT sensor value	Reaches 75°C (167°F) or more

WIRING DIAGRAM

Refer to DTC P0115 (see page ES-91).

INSPECTION PROCEDURE

HINT:

- If any of DTCs P0115, P0116, P0117 or P0118 are set simultaneously with DTC P0125, the Engine Coolant Temperature (ECT) sensor may have an open or short circuit. Troubleshoot those DTCs first.
- Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0125)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed to
P0125	A
P0125 and other DTCs	B

HINT:
If any DTCs other than P0125 are output, troubleshoot those DTCs first.

B → GO TO DTC CHART

A

2 INSPECT THERMOSTAT

(a) Remove the thermostat (see page CO-12).
(b) Check the valve opening temperature of the thermostat.
Standard:
80 to 84°C (176 to 183°F)
HINT:
In addition to the above check, confirm that the valve is completely closed when the temperature is below the standard.

NG → REPLACE THERMOSTAT

OK

3 CHECK COOLING SYSTEM

(a) Check for defects in the cooling system that might cause the system to be too cold, such as abnormal radiator fan operation or any modifications.

NG → REPAIR OR REPLACE COOLING SYSTEM

OK

REPLACE ENGINE COOLANT TEMPERATURE SENSOR

DTC	P0128	Thermostat Malfunction

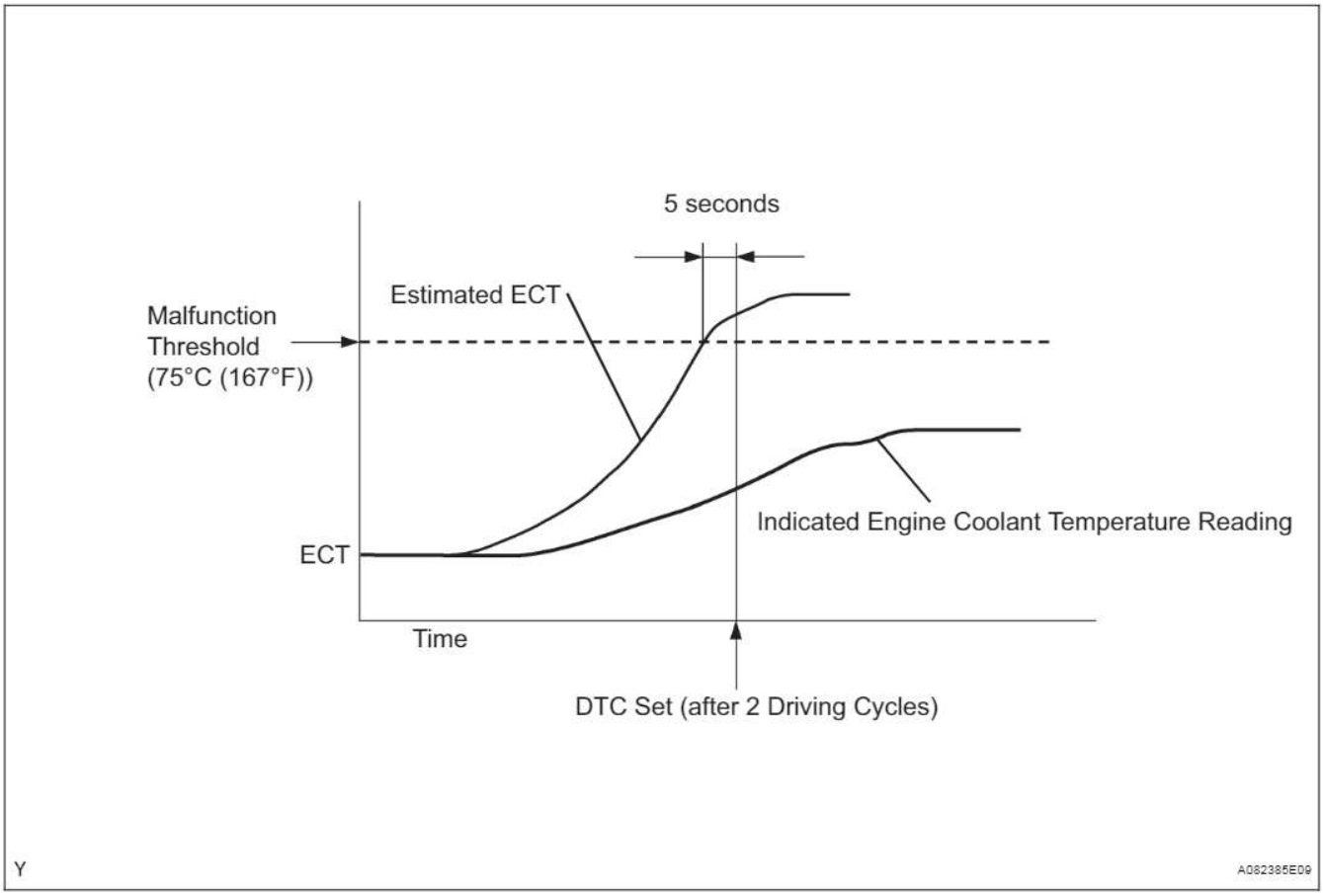
DESCRIPTION

HINT:
This DTC relates to the thermostat.
This DTC is set when the Engine Coolant Temperature (ECT) does not reach 75°C (167°F) despite sufficient engine warm-up time.

DTC No.	DTC Detection Condition	Trouble Area
P0128	Conditions (a), (b) and (c) met for 5 seconds (2 trip detection logic): (a) Cold start (b) Engine warmed up (c) ECT less than 75°C (167°F)	• Thermostat • Cooling system • Engine Coolant Temperature (ECT) sensor • ECM

ES

MONITOR DESCRIPTION



The ECM estimates the ECT based on starting temperature, engine loads, and engine speeds. The ECM then compares the estimated temperature with the actual ECT. When the estimated ECT reaches 75°C (167°F), the ECM checks the actual ECT. If the actual ECT is less than 75°C (167°F), the ECM will interpret this as a malfunction in the thermostat or the engine cooling system and sets the DTC.

MONITOR STRATEGY

Related DTCs	P0128: Coolant thermostat
Required sensors/components (Main)	Thermostat
Required sensors/components (Related)	Engine Coolant Temperature (ECT) sensor, Intake Air Temperature (IAT) sensor, Vehicle speed sensor

Frequency of operation	Once per driving cycle
Duration	400 seconds
MIL operation	2 driving cycles
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	P0010 (VVT OCV) P0011 (VVT system 1 - advance) P0012 (VVT system 1 - retard) P0031, P0032 (heated oxygen sensor 1) P0100 - P0103 (MAF meter) P0110 - P0113 (IAT sensor) P0115 - P0118 (ECT sensor) P0125 (insufficient ECT for closed loop) P0130 (heated oxygen sensor 1) P0134 (heated oxygen sensor 1) P0171, P0172 (fuel system) P0300 - P0304 (misfire) P0335 (crankshaft position sensor) P0340 (camshaft position sensor) P0351 - P0354 (igniter) P0441 - P0456 (EVAP system) P0500 (VSS)
Battery voltage	11 V or more
Intake air temperature at engine start (IAT)	-10°C (14°F) or more, and 35°C (95°F) or less
Engine coolant temperature at engine start (ECT)	-10°C (14°F) or more, and 35°C (95°F) or less
ECT at engine start - IAT at engine start	-15°C (-27°F) or more, and 7°C (12.6°F) or less
Accumulated time that vehicle speed is 128 km/h (80 mph) or more	Less than 20 seconds

TYPICAL MALFUNCTION THRESHOLDS

Duration that both conditions below are met:	5 seconds or more
Estimated engine coolant temperature	75°C (167°F) or more
ECT sensor output	Less than 75°C (167°F)

MONITOR RESULT

Refer to CHECKING MONITOR STATUS (see page ES-19).

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester. Freeze frame data records the engine conditions when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	CHECK OTHER DTC OUTPUT (IN ADDITION TO DTC P0128)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed to
P0128	A
P0128 and other DTCs	B

HINT:
If any DTCs other than P0128 are output, troubleshoot those DTCs first.

B → GO TO DTC CHART

A

2 CHECK COOLING SYSTEM

(a) Check for defects in the cooling system that might cause the system to be too cold, such as abnormal radiator fan operation or any modifications.

NG → REPAIR OR REPLACE COOLING SYSTEM

OK

3 INSPECT THERMOSTAT

(a) Remove the thermostat (see page CO-12).
(b) Check the valve opening temperature of the thermostat.
Standard:
80 to 84°C (176 to 183°F)
HINT:
In addition to the above check, confirm that the valve is completely closed when the temperature is below the standard.

NG → REPLACE THERMOSTAT

OK

REPLACE ECM

DTC	P0130	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 1)

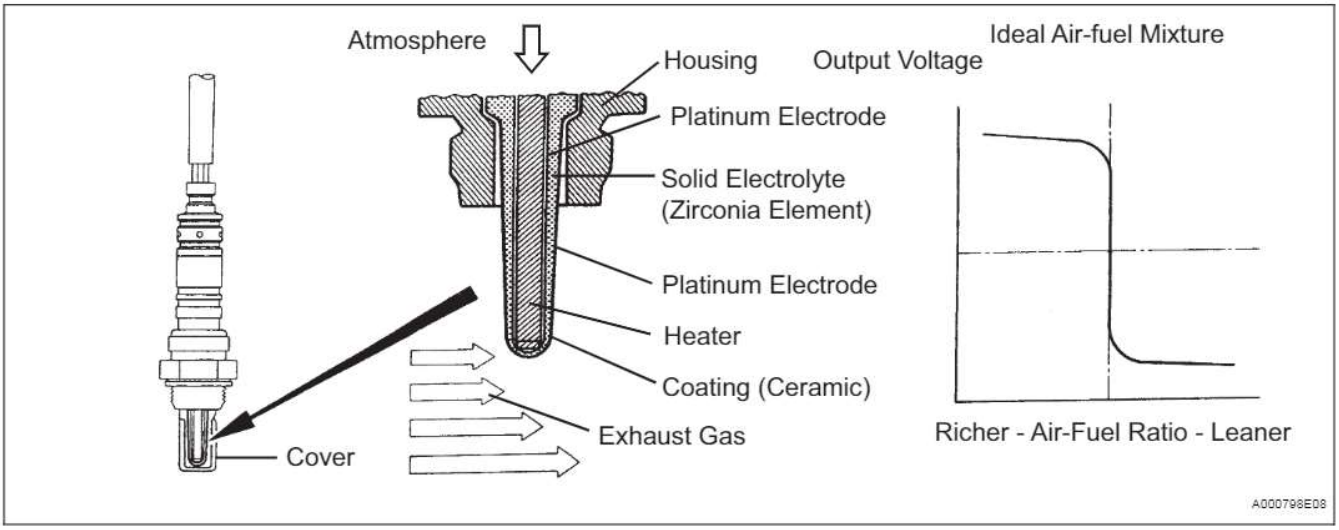
DTC	P2195	Oxygen Sensor Signal Stuck Lean (Bank 1 Sensor 1)

DTC	P2196	Oxygen Sensor Signal Stuck Rich (Bank 1 Sensor 1)

DESCRIPTION

ES

The Heated Oxygen (HO2) sensor (bank 1 sensor 1) monitors the oxygen concentration in the exhaust gas. For optimum TWC operation, the air-fuel mixture must be maintained as close as possible to the stoichiometric ratio. The HO2 sensor output voltage changes dramatically in the vicinity of the stoichiometric ratio. By making adjustments in accordance with these signal voltages, the ECM adjusts the fuel injection time so that the air-fuel ratio remains close to stoichiometric levels.
If the oxygen concentration in the exhaust gas increases, the air-fuel ratio is lean and the HO2 sensor output voltage to the ECM drops below 0.45 V. If the oxygen concentration in the exhaust gas decreases, the air-fuel ratio is rich and the HO2 sensor output voltage to the ECM increases to above 0.45 V.



DTC No.	DTC Detection Condition	Trouble Area
P0130	Output voltage of Heated Oxygen (HO2) sensor remains at 0.4 V or more, or 0.55 V or less, during idling after engine is warmed up (2 trip detection logic)	• Open or short in HO2 sensor (bank 1 sensor 1) circuit • HO2 sensor (bank 1 sensor 1) • HO2 sensor heater (bank 1 sensor 1) • EFI relay • Air induction system • Fuel pressure • Injector • ECM
P2195	Output voltage of HO2 sensor remains at 0.55 V or less during idling with warm engine (2 trip detection logic)	• Open or short in HO2 sensor (bank 1 sensor 1) circuit • HO2 sensor (bank 1 sensor 1) • HO2 sensor heater (bank 1 sensor 1) • EFI relay • Air induction system • Fuel pressure • Injector • ECM

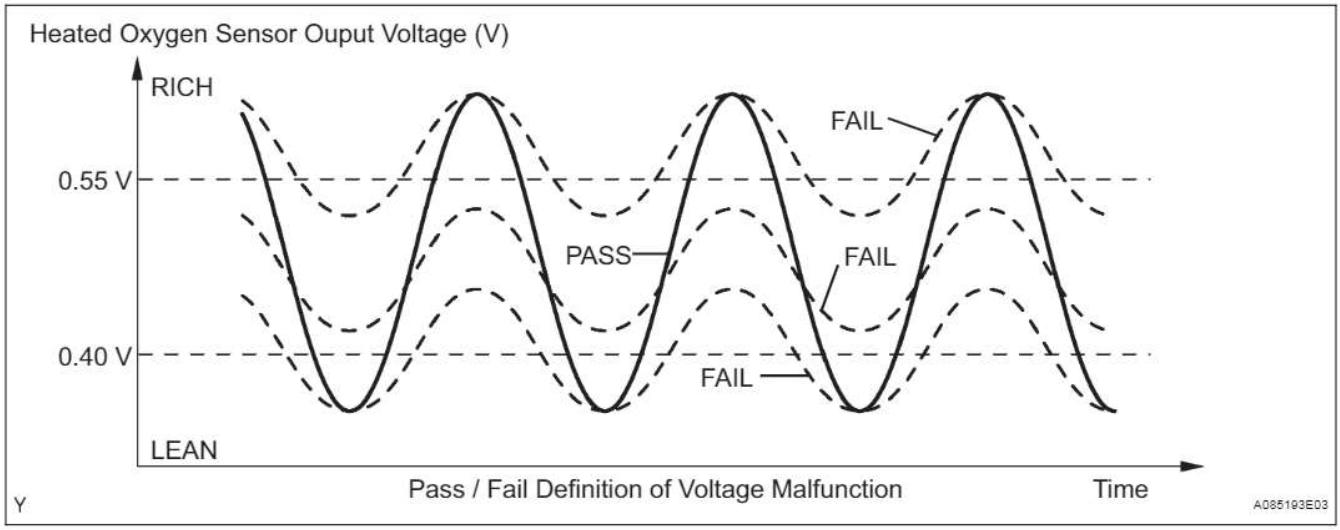
DTC No.	DTC Detection Condition	Trouble Area
P2196	Output voltage of HO2 sensor remains at 0.4 V or more during idling with warm engine (2 trip detection logic)	• Open or short in HO2 sensor (bank 1 sensor 1) circuit • HO2 sensor (bank 1 sensor 1) • HO2 sensor heater (bank 1 sensor 1) • EFI relay • Air induction system • Fuel pressure • Injector • ECM

HINT:

- Sensor 1 refers to the sensor mounted in front of the Three-Way Catalytic Converter (TWC), and located near the engine assembly.
- The output voltage of the HO2 sensor and the short-term fuel trim value can be read using the intelligent tester.

ES

MONITOR DESCRIPTION



MONITOR STRATEGY

Related DTCs	P0130: Heated Oxygen (HO2) sensor (bank 1 sensor 1) voltage P2195: Heated Oxygen (HO2) sensor (bank 1 sensor 1) voltage stuck Lean P2196: Heated Oxygen (HO2) sensor (bank 1 sensor 1) voltage stuck Rich
Required Sensors/Components (Main)	Front HO2 senor (sensor 1)
Required Sensors/Components (Related)	Crankshaft Position (CKP) sensor, Vehicle Speed Sensor (VSS)
Frequency of Operation	Once per driving cycle
Duration	20 to 36 seconds (3 times)
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever these DTCs not present	P0031, P0032 (heated oxygen sensor 1) P0100 - P0103 (MAF meter) P0110 - P0113 (IAT sensor) P0115 - P0118 (ECT sensor) P0120 - P0123 (TP sensor) P0125 (insufficient ECT for closed loop) P0134 (heated oxygen sensor 1) P0171, P0172 (fuel system) P0300 - P0304 (misfire) P0335 (crankshaft position sensor) P0340 (camshaft position sensor) P0441 - P0456 (EVAP system) P0500 (VSS)
Time after engine start	120 seconds
Idling	ON
Fuel system status	Closed Loop
Vehicle speed	Less than 5 km/h (3.125 mph)
Driving record for 20 seconds or more	40 km/h (25 mph) or more and 900 rpm or more

ES

TYPICAL MALFUNCTION THRESHOLDS

Heated oxygen sensor voltage (P0130):

Occasions either of following conditions is met	More than 2 times
Minimum HO2 sensor voltage	0.4 V or more for 25 seconds or more
Maximum HO2 sensor voltage	0.55 V or less for 25 seconds or more

Heated oxygen sensor voltage stuck Lean (P2195):

Occasions following condition is met	2 times
Maximum heated oxygen sensor voltage	0.55 V or less for 25 seconds or more

Heated oxygen sensor voltage stuck Rich (P2196):

Occasions following condition is met	2 times
Minimum heated oxygen sensor voltage	0.4 V or more for 25 seconds or more

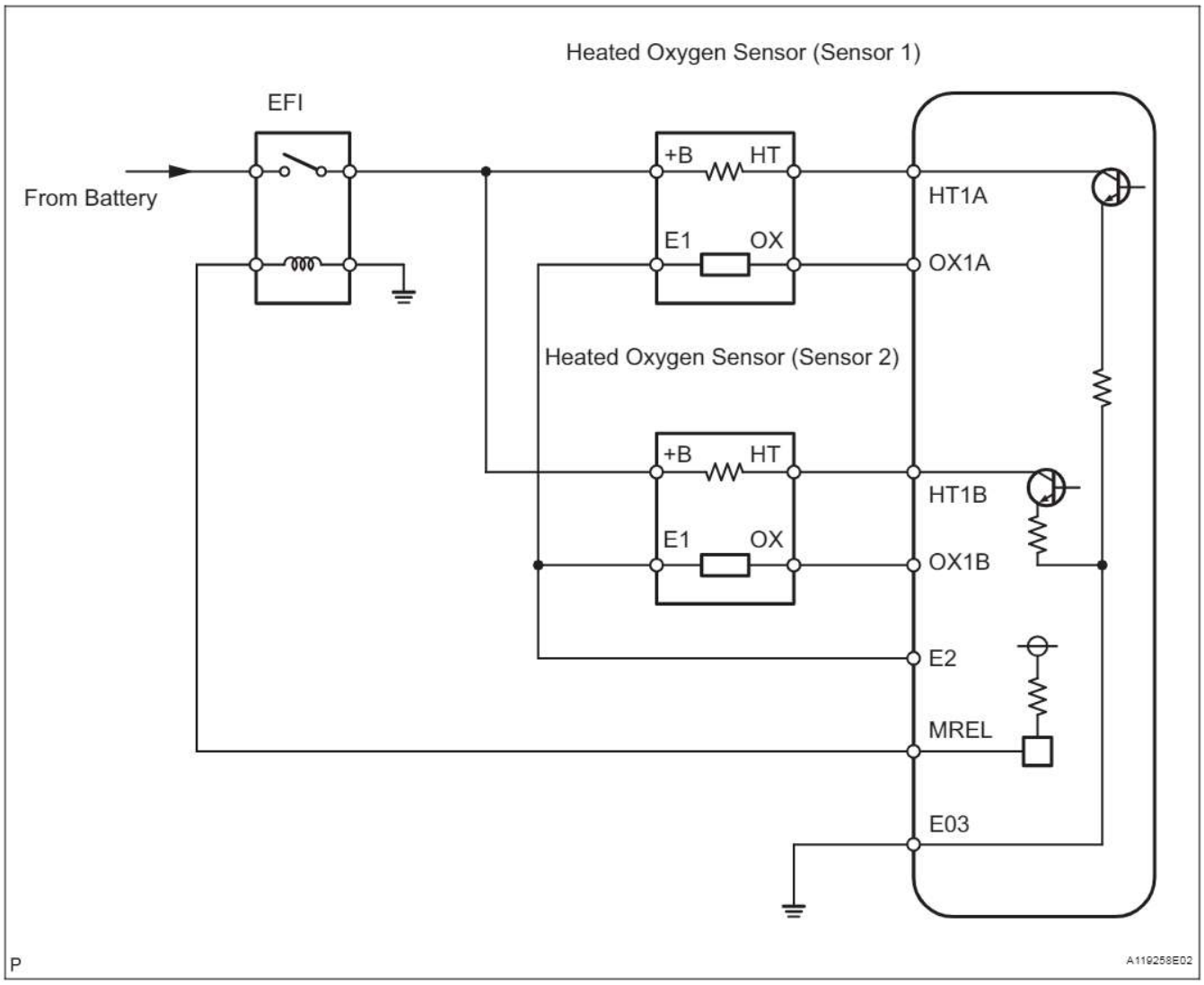
COMPONENT OPERATING RANGE

Heated Oxygen (HO2) sensor voltage	Fluctuates for a second

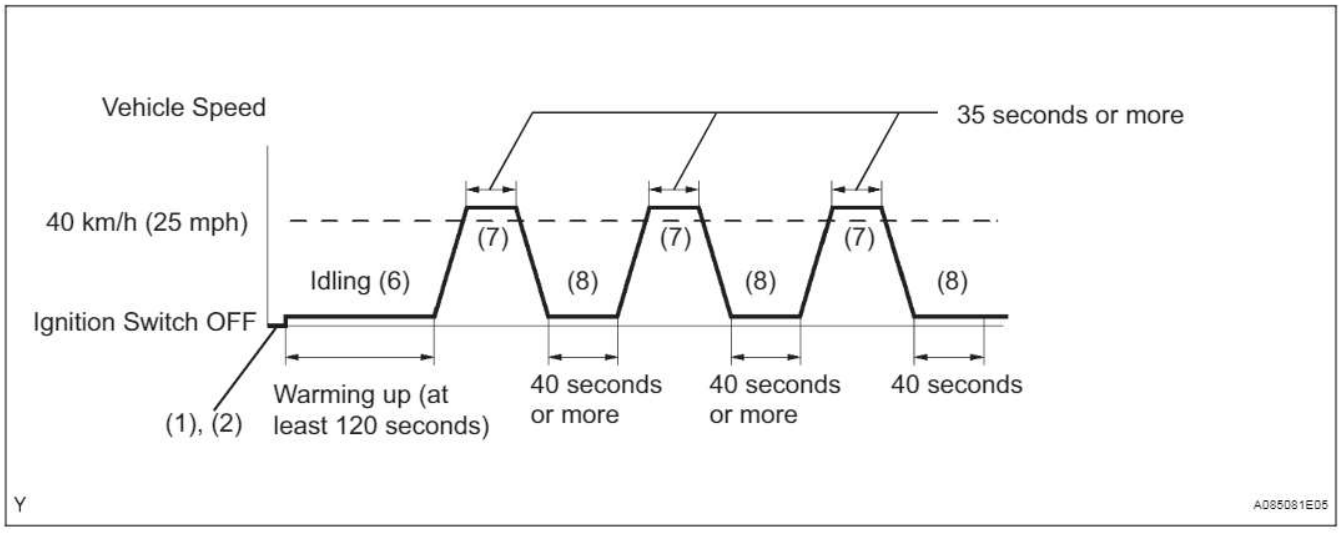
MONITOR RESULT

Refer to CHECKING MONITOR STATUS (see page ES-19).

WIRING DIAGRAM



CONFIRMATION DRIVING PATTERN



HINT:
This confirmation driving pattern is used in the "PERFORM CONFIRMATION DRIVING PATTERN" procedure of the following diagnostic troubleshooting procedure.
(1) Connect the intelligent tester to the DLC3.
(2) Turn the ignition switch ON and turn the tester ON.
(3) Clear DTCs (see page ES-37).
(4) If using the intelligent tester, switch the ECM from normal mode to check mode (see page ES-41).
(5) Start the engine.
(6) Allow the engine to idle until the engine coolant temperature reaches 75°C (167°F).
(7) Drive the vehicle at an engine speed of more than 40 km/h (25 mph) for 35 seconds or more.
(8) Allow the engine to idle for 40 seconds or more.
(9) Repeat steps (6) and (7) described above at least 3 times.
(10) Allow the engine to idle for 40 seconds or more.

HINT:
When using the intelligent tester: The MIL will be illuminated during step (10) if a malfunction still exists.
CAUTION:
If the conditions in this test are not strictly followed, malfunctions may not be detected.

INSPECTION PROCEDURE

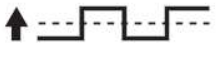
HINT:
Malfunctioning areas can be identified by performing the A/F CONTROL function provided in the ACTIVE TEST. The A/F CONTROL function can help to determine whether the Heated Oxygen (HO2) sensors and other potential trouble areas are malfunctioning.
The following instructions describe how to conduct the A/F CONTROL operation using the intelligent tester.

1. Connect the intelligent tester to the DLC3.
2. Start the engine and turn the tester ON.
3. Warm up the engine at an engine speed of 2,500 rpm for approximately 90 seconds.
4. Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL.
5. Perform the A/F CONTROL operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume).
6. Monitor the voltage outputs of the HO2 sensors (O2S B1S1 and O2S B1S2) displayed on the tester.
   HINT:
   - The A/F CONTROL operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
   - Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

Standard

Tester Display (Sensor)	Injection Volume	Status	Voltage
O2S B1S1 (Front HO2 Sensor)	+25%	Rich	More than 0.55
O2S B1S1 (Front HO2 Sensor)	-12.5%	Lean	Less than 0.4
O2S B1S2 (Rear HO2 Sensor)	+25%	Rich	More than 0.5
O2S B1S2 (Rear HO2 Sensor)	-12.5%	Lean	Less than 0.4

NOTICE:
The front HO2 sensor has an output delay of a few seconds and the rear HO2 sensor has a maximum output delay of approximately 20 seconds.

Case	Front HO2 Sensor (Sensor 1) Output Voltage		Rear HO2 Sensor (Sensor 2) Output Voltage		Main Suspected Trouble Area
1	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		-
	Output Voltage More than 0.55 V Less than 0.4 V		Output Voltage More than 0.55 V Less than 0.4 V		
2	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		• Front HO2 sensor • Front HO2 sensor heater • Front HO2 sensor circuit
	Output Voltage Almost no reaction		Output Voltage More than 0.55 V Less than 0.4 V		
3	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		• Rear HO2 sensor • Rear HO2 sensor heater • Rear HO2 sensor circuit
	Output Voltage More than 0.55 V Less than 0.4 V		Output Voltage Almost no reaction		
4	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		• Injector • Fuel pressure • Gas leakage from exhaust system (Air-fuel ratio extremely rich or lean)
	Output Voltage Almost no reaction		Output Voltage Almost no reaction		

- Following the A/F CONTROL procedure enables technicians to check and graph the voltage outputs of both the front and rear HO2 sensors.
- To display the graph, enter the following menus on the tester: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST/ A/F CONTROL / USER DATA / O2S B1S1 and O2S B1S2; the press the YES button and then the ENTER button followed by the F4 button.

NOTICE:

If the vehicle is short of fuel, the air-fuel ratio becomes lean, HO2 sensor DTCs are recorded, and the ECM illuminates the MIL.

HINT:

- If other DTCs relating to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.
- Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- A high HO2 sensor (sensor 1) voltage (0.55 V or more) could be caused by a rich air-fuel mixture. Check for conditions that would cause the engine to run rich.
- A low HO2 sensor (sensor 1) voltage (0.4 V or less) could be caused by a lean air-fuel mixture. Check for conditions that would cause the engine to run lean.

1	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO HEATED OXYGEN SENSOR DTCS)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.

(c) On the tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read DTCs.

Result

Display (DTC output)	Proceed to
P0130, P2195 and/or P2196	A
P0130, P2195 and/or P2196 and other DTCs	B

HINT:
If any DTCs other than P0130, P2195 and/or P2196 are output, troubleshoot those DTCs first.

B → **GO TO DTC CHART**

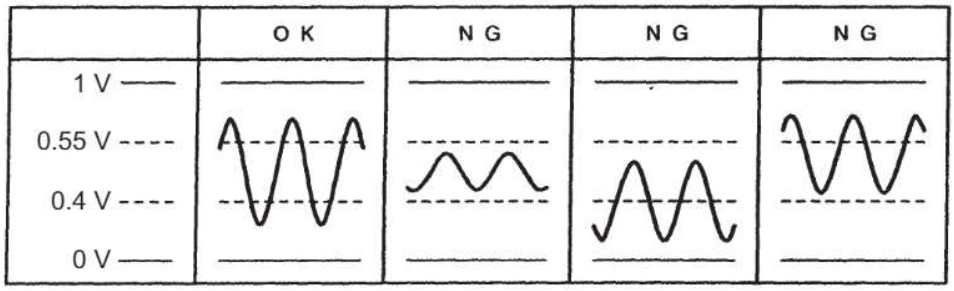
ES

A

2 READ VALUE OF INTELLIGENT TESTER (OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Start the engine.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / O2S B1S1.
(e) Warm up the Heated Oxygen (HO2) sensor at an engine speed of 2,500 rpm for approximately 90 seconds.
(f) Read the voltage output of the front HO2 sensor displayed on the tester while the engine is idling.

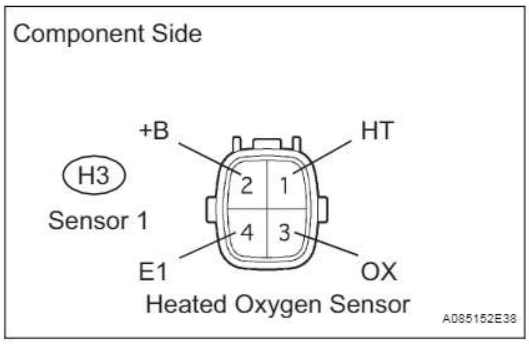
Standard voltage:
Fluctuates between less than 0.4 V and more than 0.55 V (refer to table below).



OK → **Go to step 9**

NG

3 INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)



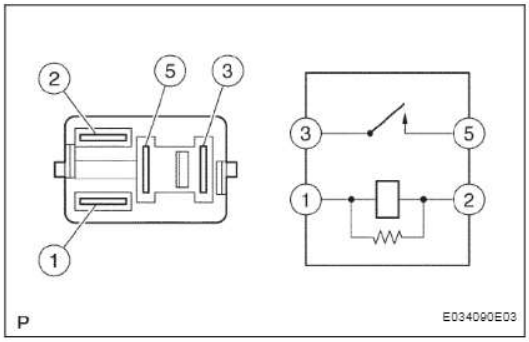
(a) Disconnect the H3 HO2 sensor connector.
(b) Measure the resistance of the HO2 sensor connector.
Standard resistance

Tester Connection	Specified Condition
HT (H3-1) - +B (H3-2)	11 to 16 Ω at 20°C (68°F)
HT (H3-1) - E1 (H3-4)	10 kΩ or higher

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

4 INSPECT EFI RELAY (Marking: EFI)



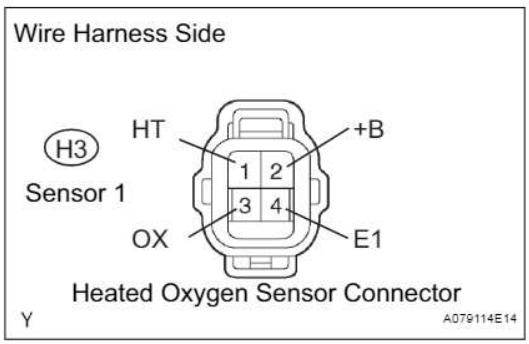
(a) Remove the EFI relay from the engine room relay block.
(b) Measure the resistance of the EFI relay.
Standard resistance

Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (When battery voltage is applied to terminals 1 and 2)

NG → **REPLACE EFI RELAY**

OK

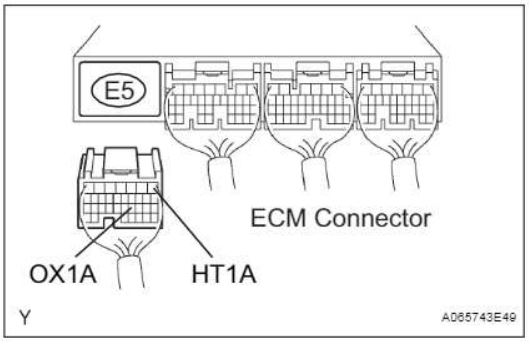
5 CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - ECM)



(a) Disconnect the H3 HO2 sensor connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage between the +B terminal of the H3 HO2 sensor connector and body ground.
Standard voltage

Tester Connection	Specified Condition
+B (H3-2) - Body ground	9 to 14 V

(d) Turn the ignition switch OFF.
(e) Disconnect the E5 ECM connector.



(f) Measure the resistance of the wire harness side connectors.

Standard resistance (Check for open)

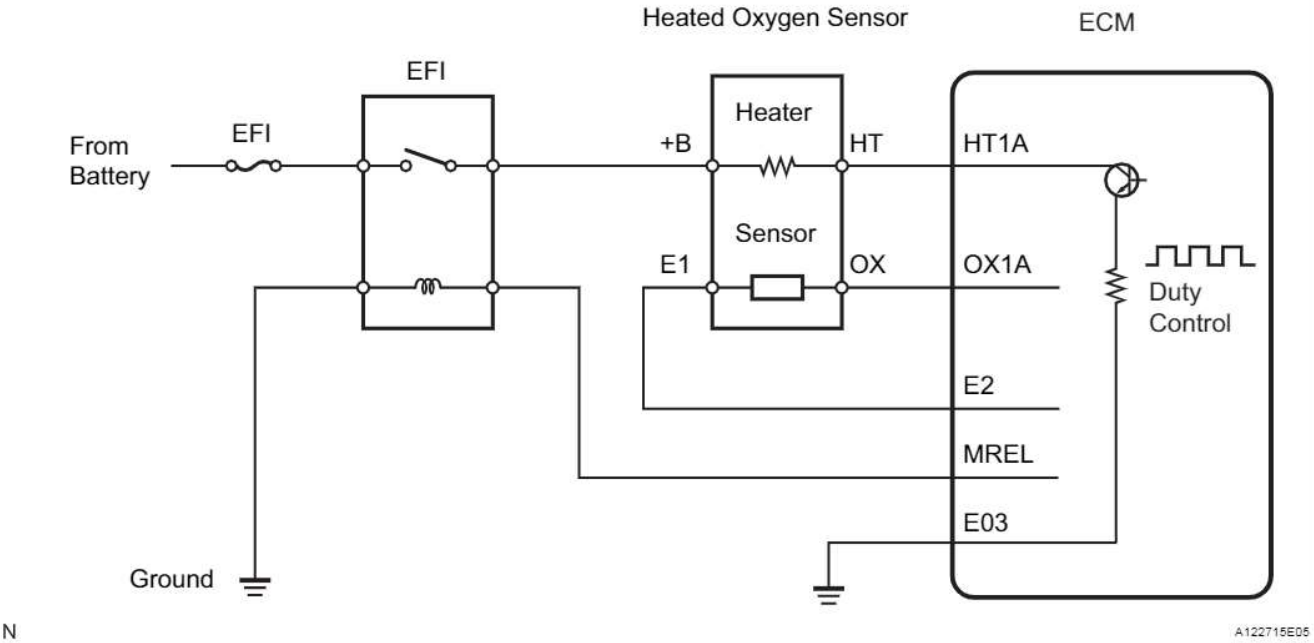
Tester Connection	Specified Condition
HT (H3-1) - HT1A (E5-1)	Below 1 Ω
OX (H3-3) - OX1A (E5-21)	Below 1 Ω
E1 (H3-4) - Body ground	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
HT (H3-1) or HT1A (E5-1) - Body ground	10 kΩ or higher
OX (H3-3) or OX1A (E5-21) - Body ground	10 kΩ or higher

ES

Reference (System Diagram of Bank 1 Sensor 1)



NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

6	CHECK AIR INDUCTION SYSTEM

(a) Check the air induction system for vacuum leaks.

OK:

No leakage from air induction system.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

7	CHECK FUEL PRESSURE

(a) Check the fuel pressure (high or low pressure) (see page FU-7).

NG → REPAIR OR REPLACE FUEL SYSTEM

OK

8	INSPECT FUEL INJECTOR

(a) Check the injector injection and volume (see page FU-13).

NG → REPLACE FUEL INJECTOR

OK

REPLACE HEATED OXYGEN SENSOR

9	PERFORM CONFIRMATION DRIVING PATTERN

NEXT

10	CHECK WHETHER DTC OUTPUT RECURS (HEATED OXYGEN SENSOR DTCS)

(a) Read DTCs using the intelligent tester.
(b) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
Result

Display (DTC output)	Proceed to
P0130, P2195 and/or P2196	A
No output	B

B → CHECK FOR INTERMITTENT PROBLEMS

A

REPLACE HEATED OXYGEN SENSOR

DTC	P0133	Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 1)

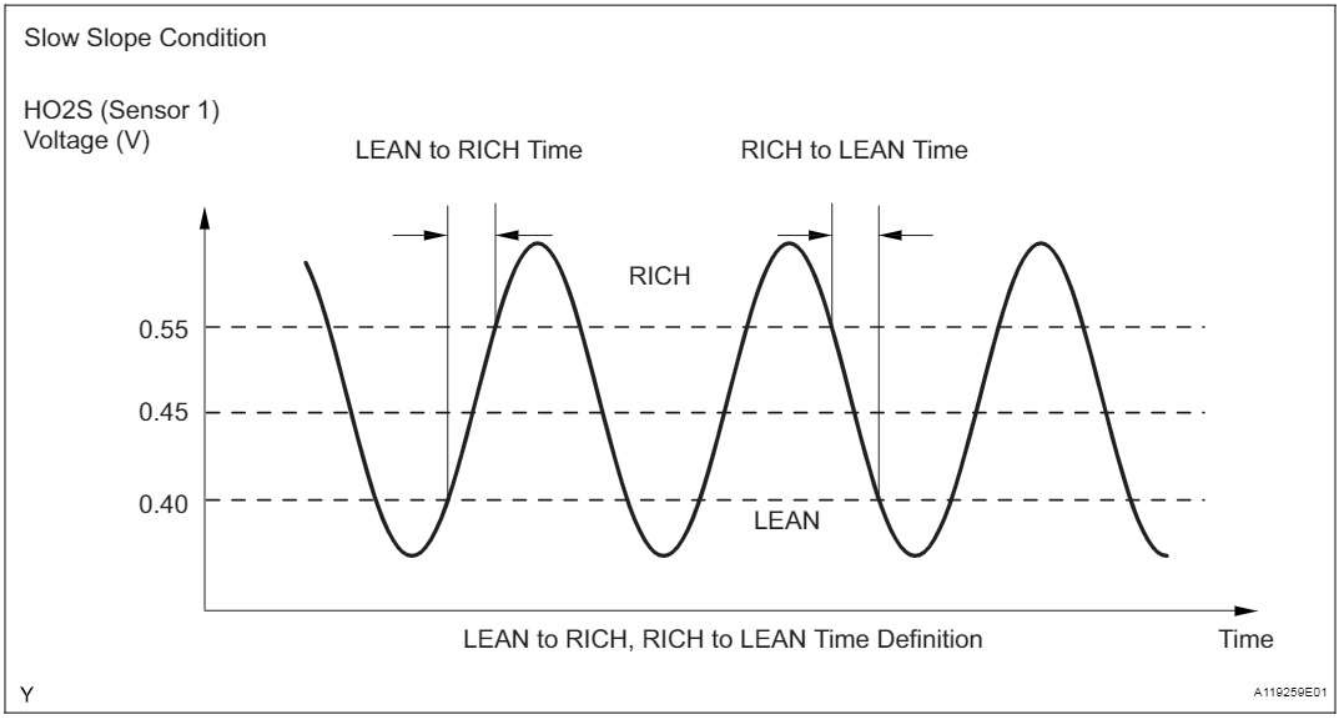
DESCRIPTION

HINT:
Sensor 1 refers to the sensor mounted in front of the Three-Way Catalytic Converter (TWC) and located near the engine assembly.
Refer to DTC P0130 (see page ES-111).

DTC No.	DTC Detection Condition	Trouble Area
P0133	• While idling with warm engine, response time for voltage output of Heated Oxygen (HO2) sensor to change from rich to lean or from lean to rich is 0.9 seconds or more (2 trip detection logic) • While idling, response time of HO2 sensor output voltage in 1 rich-lean cycle is 9 seconds or more (2 trip detection logic)	• Open or short in Heated Oxygen (HO2) sensor (bank 1 sensor 1) circuit • HO2 sensor (bank 1 sensor 1) • HO2 sensor heater (bank 1 sensor 1) • EFI relay • Air induction system • Fuel pressure • Injector • ECM

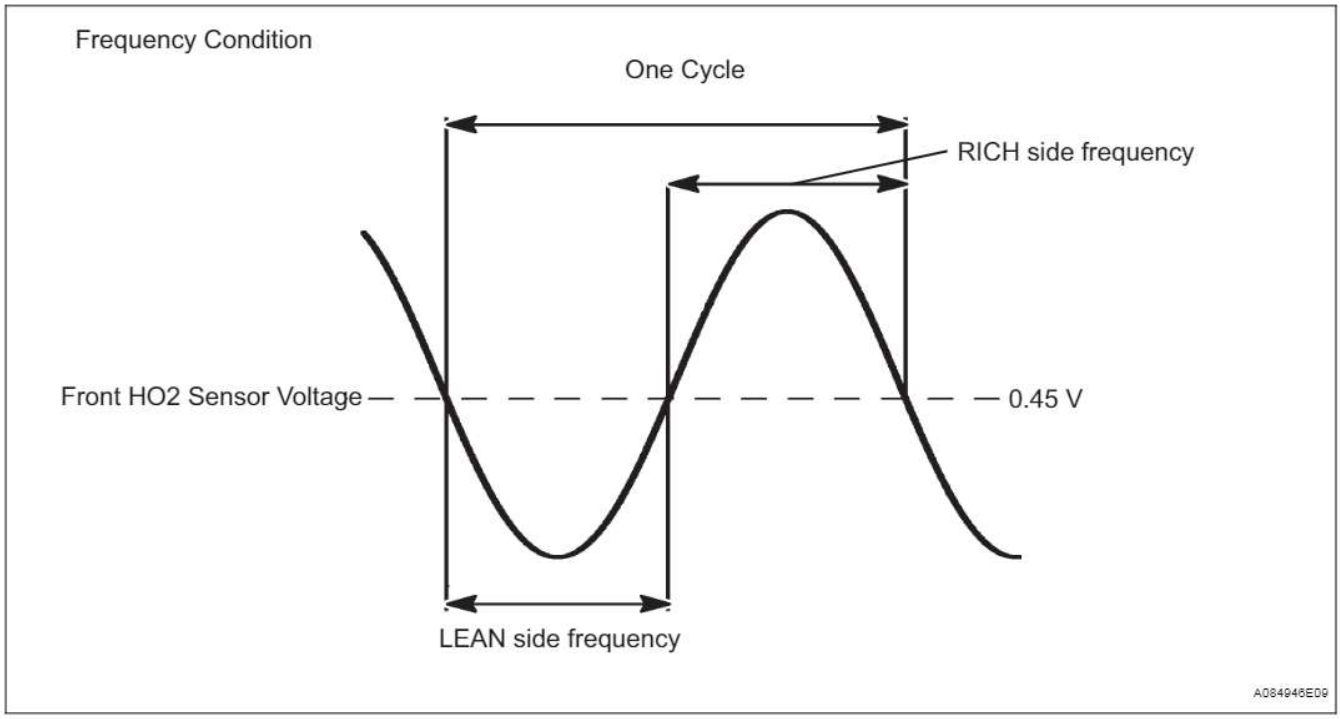
ES

MONITOR DESCRIPTION



The Heated Oxygen (HO2) sensor detects the oxygen levels in the exhaust gas and transmits this information to the ECM, which uses it to maintain the air-fuel ratio as close as possible to stoichiometric levels. This optimizes the three-way catalytic converter's ability to purify the exhaust gases.
The sensor element is made of platinum electrode and solid electrolyte (zirconia element), and includes an integrated heating element. The inner surface of the sensor element is exposed to the outside air and the outer surface is exposed to the exhaust gases.
The HO2 sensor generates a waveform voltage signal that oscillates between 0.1 V and 0.9 V in accordance with the oxygen concentration in the exhaust gas. The HO2 sensor has a characteristic whereby this output voltage changes dramatically in the vicinity of the stoichiometric air-fuel ratio.
When the output voltage of the HO2 sensor is 0.55 V or more, the ECM determines that the air-fuel ratio is rich. When it is 0.40 V or less, the ECM determines that the air-fuel ratio is lean.

The ECM also monitors the response of the HO2 sensor. If the response time of the output changes from rich to lean or vice versa becomes longer than preset thresholds, the ECM interprets this as a malfunction in the HO2 sensor, illuminates the MIL and sets the DTC (2 trip detection logic).



MONITOR STRATEGY

Related DTCs	P0133: Heated Oxygen (HO2) sensor (bank 1 sensor 1) responsibility P0133: HO2 sensor (bank 1 sensor 1) frequency at idle P0133: HO2 sensor (bank 1 sensor 1) frequency at driving
Required Sensors/Components (Main)	HO2 sensor (sensor 1)
Required Sensors/Components (Related)	None
Frequency of Operation	Continuous
Duration	60 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

HO2 sensor bank 1 sensor 1 responsibility

This monitor will run whenever these DTCs are not present	P0031, P0032 (heated oxygen sensor 1) P0100 - P0103 (MAF meter) P0110 - P0113 (IAT sensor) P0115 - P0118 (ECT sensor) P0120 - P0123 (TP sensor) P0125 (insufficient ECT for closed loop) P0134 (heated oxygen sensor 1) P0171, P0172 (fuel system) P0300 - P0304 (misfire) P0335 (crankshaft position sensor) P0340 (camshaft position sensor) P0441 - P0456 (EVAP system) P0500 (VSS)
Driving record for 20 seconds or more	40 km/h (25 mph) or more and 900 rpm or more
Time after engine start	120 seconds or more
Idle	ON
Fuel system	Closed loop

Vehicle speed	Less than 5 km/h (3 mph)
ECT	40°C (104°F) or more

HO2 sensor bank 1 sensor 1 frequency at idle

This monitor will run whenever these DTCs are not present	P0031, P0032 (heated oxygen sensor 1) P0100 - P0103 (MAF meter) P0110 - P0113 (IAT sensor) P0115 - P0118 (ECT sensor) P0120 - P0123 (TP sensor) P0125 (insufficient ECT for closed loop) P0134 (heated oxygen sensor 1) P0171, P0172 (fuel system) P0300 - P0304 (misfire) P0335 (crankshaft position sensor) P0340 (camshaft position sensor) P0441 - P0456 (EVAP system) P0500 (VSS)
Driving record for 20 seconds or more	40 km/h (25 mph) or more and 900 rpm or more
Time after engine start	120 seconds or more
Idle	ON
Fuel system	Closed loop
Vehicle speed	Less than 5 km/h (3 mph)
ECT	40°C (104°F) or more

HO2 sensor bank 1 sensor 1 frequency at driving

This monitor will run whenever these DTCs are not present	P0031, P0032 (heated oxygen sensor 1) P0100 - P0103 (MAF meter) P0110 - P0113 (IAT sensor) P0115 - P0118 (ECT sensor) P0120 - P0123 (TP sensor) P0125 (insufficient ECT for closed loop) P0134 (heated oxygen sensor 1) P0171, P0172 (fuel system) P0300 - P0304 (misfire) P0335 (crankshaft position sensor) P0340 (camshaft position sensor) P0441 - P0456 (EVAP system) P0500 (VSS)
Driving record for 20 seconds or more	40 km/h (25 mph) or more and 900 rpm or more
Time after engine start	120 seconds or more
Idle	OFF
MAF	4.2 to 20 g/sec.
Fuel system	Closed loop
Engine rpm	1,000 to 3,500 rpm
Fuel cut	OFF
ECT	70°C (158°F) or more

TYPICAL MALFUNCTION THRESHOLDS

HO2 sensor (bank 1 sensor 1) responsibility

Rich (0.55 V) to Lean (0.4 V) switch time	0.9 seconds or more
Lean (0.4 V) to Rich (0.55 V) switch time	0.9 seconds or more

HO2 sensor (bank 1 sensor 1) frequency at idle

HO2 sensor frequency in 1 period	9 seconds or more

HO2 sensor (bank 1 sensor 1) frequency at driving

HO2 sensor frequency in 1 period	Malfunction threshold or more

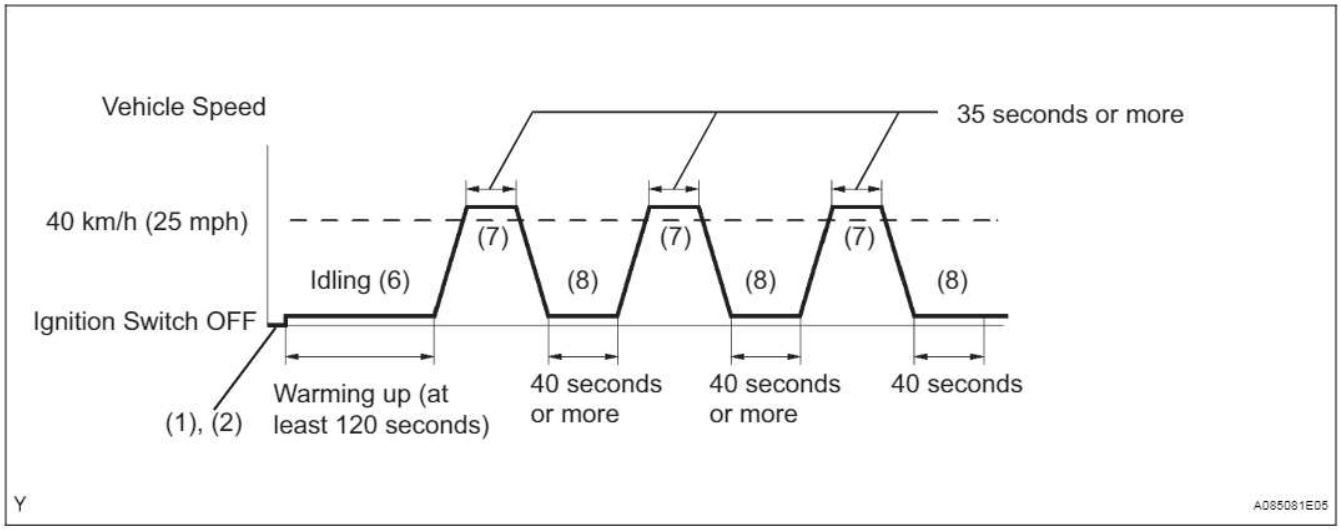
COMPONENT OPERATING RANGE

HO2 sensor voltage	Fluctuates for a second

MONITOR RESULT

Refer to CHECKING MONITOR STATUS (see page ES-19).

CONFIRMATION DRIVING PATTERN



HINT:
This confirmation driving pattern is used in the "PERFORM CONFIRMATION DRIVING PATTERN" procedure of the following diagnostic troubleshooting procedure.
(1) Connect the intelligent tester to the DLC3.
(2) Turn the ignition switch ON and turn the tester ON.
(3) Clear DTCs (see page ES-37).
(4) If using the intelligent tester, switch the ECM from normal mode to check mode (see page ES-41).
(5) Start the engine.
(6) Allow the engine to idle until the engine coolant temperature reaches 75°C (167°F).
(7) Drive the vehicle at an engine speed of more than 40 km/h (25 mph) for 35 seconds or more.
(8) Allow the engine to idle for 40 seconds or more.
(9) Repeat steps (6) and (7) described above at least 3 times.
(10) Allow the engine to idle for 40 seconds or more.
HINT:
When using the intelligent tester: The MIL will be illuminated during step (10) if a malfunction still exists.
CAUTION:
If the conditions in this test are not strictly followed, malfunctions may not be detected.

WIRING DIAGRAM

Refer to DTC P0130 (see page ES-114).

INSPECTION PROCEDURE

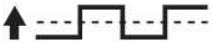
HINT:
Malfunctioning areas can be identified by performing the A/F CONTROL function provided in the ACTIVE TEST. The A/F CONTROL function can help to determine whether the Heated Oxygen (HO2) sensors and other potential trouble areas are malfunctioning.
The following instructions describe how to conduct the A/F CONTROL operation using the intelligent tester.
1. Connect the intelligent tester to the DLC3.

2. Start the engine and turn the tester ON.
3. Warm up the engine at an engine speed of 2,500 rpm for approximately 90 seconds.
4. Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL.
5. Perform the A/F CONTROL operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume).
6. Monitor the voltage output of the HO2 sensors (O2S B1S1 and O2S B1S2) displayed on the tester.
   HINT:
   - The A/F CONTROL operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
   - Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

Standard

Tester Display (Sensor)	Injection Volumes	Status	Voltages
O2S B1S1 (Front HO2 Sensor)	+25%	Rich	More than 0.55
O2S B1S1 (Front HO2 Sensor)	-12.5%	Lean	Less than 0.4
O2S B1S2 (Rear HO2 Sensor)	+25%	Rich	More than 0.5
O2S B1S2 (Rear HO2 Sensor)	-12.5%	Lean	Less than 0.4

NOTICE:
The front HO2 sensor has an output delay of a few seconds and the rear HO2 sensor has a maximum output delay of approximately 20 seconds.

Case	Front HO2 Sensor (Sensor 1) Output Voltage		Rear HO2 Sensor (Sensor 2) Output Voltage		Main Suspected Trouble Area
1	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		-
	Output Voltage More than 0.55 V Less than 0.4 V		Output Voltage More than 0.55 V Less than 0.4 V		
2	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		• Front HO2 sensor • Front HO2 sensor heater • Front HO2 sensor circuit
	Output Voltage Almost no reaction		Output Voltage More than 0.55 V Less than 0.4 V		
3	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		• Rear HO2 sensor • Rear HO2 sensor heater • Rear HO2 sensor circuit
	Output Voltage More than 0.55 V Less than 0.4 V		Output Voltage Almost no reaction		
4	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		• Injector • Fuel pressure • Gas leakage from exhaust system (Air-fuel ratio extremely rich or lean)
	Output Voltage Almost no reaction		Output Voltage Almost no reaction		

- Following the A/F CONTROL procedure enables technicians to check and graph the voltage outputs of both the front and rear HO2 sensors.

- To display the graph, enter the following menus on the tester: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST/ A/F CONTROL / USER DATA / O2S B1S1 and O2S B1S2; then press the YES button and ENTER button followed by the F4 button.

NOTICE:

If the vehicle is short of fuel, the air-fuel ratio becomes lean and HO2 sensor DTCs are recorded, and the ECM illuminates the MIL.

HINT:

- If other DTCs relating to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.
- Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- A high HO2 sensor (sensor 1) voltage (0.55 V or more) could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A low HO2 sensor (sensor 1) voltage (0.4 V or less) could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.

ES

1	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0133)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed to
P0133	A
P0133 and other DTCs	B

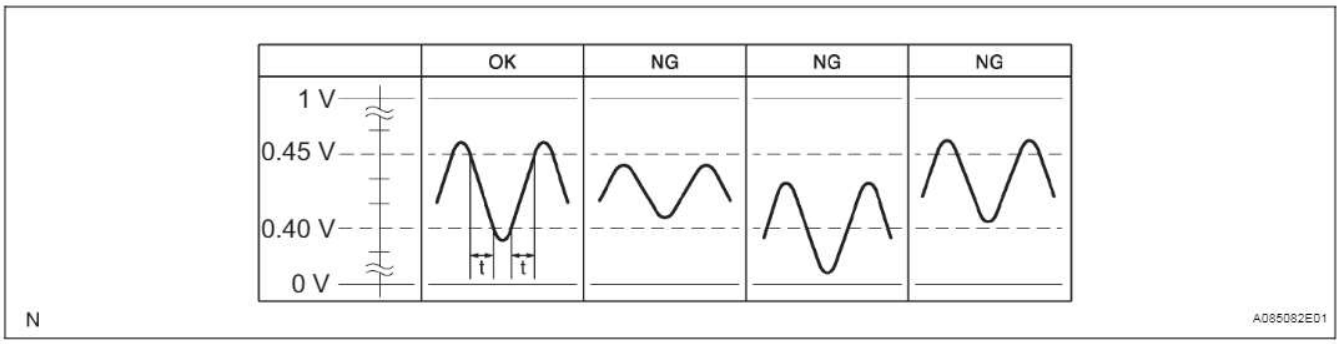
HINT:
If any DTCs other than P0133 are output, troubleshoot those DTCs first.

B → GO TO DTC CHART

A

2	READ VALUE OF INTELLIGENT TESTER (HEATED OXYGEN SENSOR DURING IDLING)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Start the engine.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / O2S B1S1.
(e) Warm up the Heated Oxygen (HO2) sensor at an engine speed of 2,500 rpm for approximately 90 seconds.
(f) Read the voltage output of the front HO2 sensor displayed on the tester, while the engine is idling.
Standard:
Fluctuates between less than 0.40 V and more than 0.45 V, and period "t" must be less than 0.6 seconds (refer to table below).

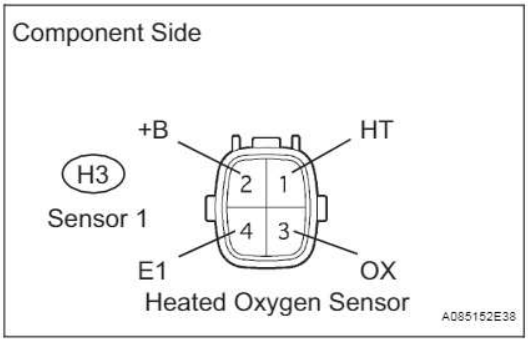


OK → Go to step 9

ES

NG

3 INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)



(a) Disconnect the H3 HO2 sensor connector.
(b) Measure the resistance between the terminals of the HO2 sensor connector.
Standard resistance

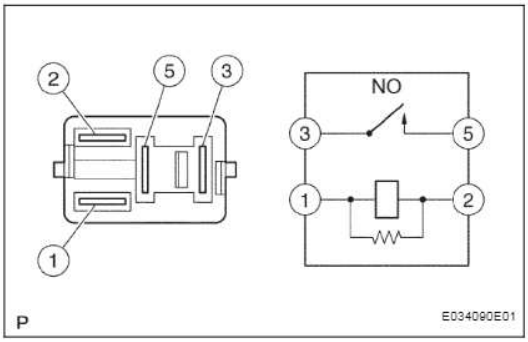
Tester Connection	Specified Condition
HT (H3-1) - +B (H3-2)	11 to 16 Ω at 20°C (68°F)
HT (H3-1) - E1 (H3-4)	10 kΩ or higher

(c) Reconnect the HO2 sensor connector.

NG → REPLACE HEATED OXYGEN SENSOR

OK

4 INSPECT EFI RELAY (Marking: EFI)



(a) Remove the EFI relay from the engine room relay block.
(b) Measure the resistance of the EFI relay.
Standard resistance

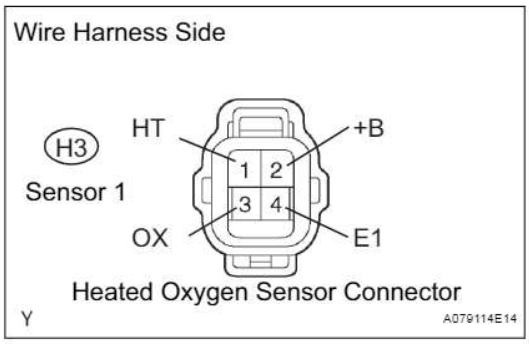
Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (When battery voltage applied to terminals 1 and 2)

(c) Reinstall the EFI relay.

NG → REPLACE EFI RELAY

OK

5 CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - ECM)

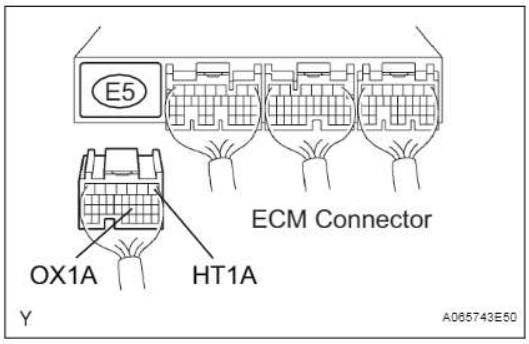


(a) Disconnect the H3 HO2 sensor connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage between the +B terminal of the H3 HO2 sensor connector and body ground.

Standard voltage

Tester Connection	Specified Condition
+B (H3-2) - Body ground	9 to 14 V

(d) Turn the ignition switch OFF.



(e) Disconnect the E5 ECM connector.
(f) Measure the resistance of the wire harness side connectors.

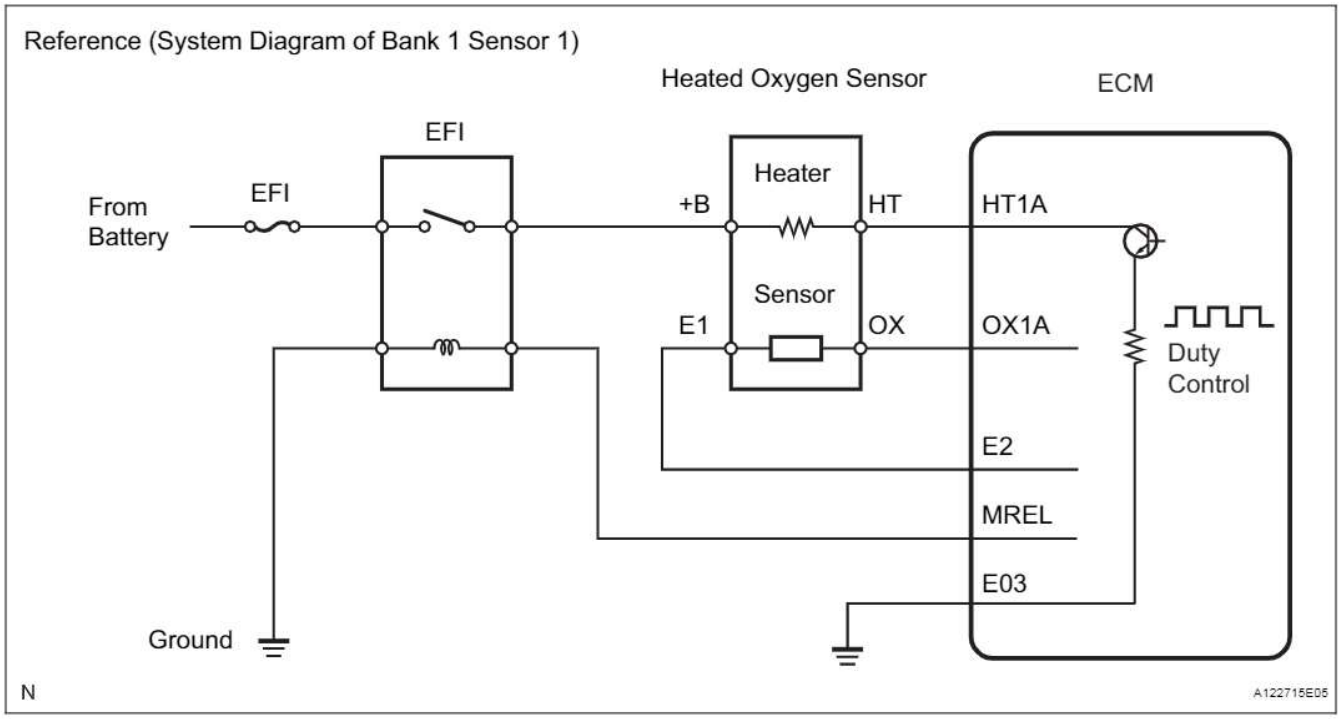
Standard resistance (Check for open)

Tester Connection	Specified Condition
HT (H3-1) - HT1A (E5-1)	Below 1 Ω
OX (H3-3) - OX1A (E5-21)	Below 1 Ω
E1 (H3-4) - Body ground	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
HT (H3-1) or HT1A (E5-1) - Body ground	10 kΩ or higher
OX (H3-3) or OX1A (E5-21) - Body ground	10 kΩ or higher

Reference (System Diagram of Bank 1 Sensor 1)



NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

6	CHECK AIR INDUCTION SYSTEM

(a) Check the air induction system for vacuum leaks.
OK:
No leakage from air induction system.

NG → **REPAIR OR REPLACE AIR INDUCTION SYSTEM**

OK

ES

7	CHECK FUEL PRESSURE

(a) Check the fuel pressure (high or low pressure) (see page FU-7).

NG → **REPAIR OR REPLACE FUEL SYSTEM**

OK

8	INSPECT FUEL INJECTOR (INJECTION AND VOLUME)

(a) Check the injector injection and volume (see page FU-13).

NG → **REPLACE FUEL INJECTOR**

OK

REPLACE HEATED OXYGEN SENSOR

9	PERFORM CONFIRMATION DRIVING PATTERN

NEXT

10	CHECK WHETHER DTC OUTPUT RECURS (DTC P0133)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the intelligent tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed to
P0133	A
No output	B

B → CHECK FOR INTERMITTENT PROBLEMS

A

REPLACE HEATED OXYGEN SENSOR

DTC	P0134	Oxygen Sensor Circuit No Activity Detected (Bank 1 Sensor 1)

DESCRIPTION

The heated oxygen sensor (HO2S) located on the front of the catalyst converter is used to control the fuel trim.
Refer to the description of DTC P0130 for detailed information (see page ES-111).

DTC No.	DTC Detecting Condition	Trouble Area
P0134	(a) HO2S voltage (bank 1 sensor 1) does not exceed 0.45 V while intrusive closed loop with short-term fuel trim is 18% or more for 15 seconds (2 trip detection logic) Intrusive closed loop runs when all of the following conditions are met for 20 seconds: • Driving at 40 km/h (25 mph) or more • Not idle • HO2S voltage is less than 0.45 V	• HO2S (bank 1 sensor 1) • Fuel pressure • Air induction system • Ventilation hose • Ventilation valve • Injector • Exhaust gas leakage
	(b) With warm engine, Heated Oxygen (HO2) sensor (bank 1 sensor 1) output does not indicate rich (more than 0.45 V) even once when conditions (1), (2), (3), (4), (5) and (6) continue for 30 seconds or more (2 trip detection logic) (1) After detection condition (a) is determined to be normal (2) Engine running (3) Engine coolant temperature more than 75°C (167°F) (4) Throttle valve not fully closed (5) Fuel system status is closed loop (6) Short-term fuel trim is 18% or more	

HINT:
If this DTC is set, check the output voltage of the HO2 sensor (bank 1 sensor 1) by entering the following menus on the intelligent tester: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / O2S B1S1.

MONITOR DESCRIPTION

To monitor the heated oxygen sensor (HO2S) activity, the ECM (PCM) performs the intrusive closed loop if the HO2S voltage does not exceed 0.45 V while the vehicle is running under the closed loop. In the intrusive closed loop, the ECM (PCM) varies the fuel trim and checks whether the HO2S voltage exceeds 0.45V or not.
Then, the HO2S voltage varies between 0.1 and 0.9 V when the HO2S functions. If the HO2S voltage does not exceed 0.45 V, the ECM (PCM) interprets this as a malfunction. The ECM (PCM) illuminates the MIL and sets the DTC (2 trip detection logic).

MONITOR STRATEGY

Related DTCs	P0134: Excessive time to enter closed loop for HO2S (bank 1 sensor 1)
Required Sensors/Components (Main)	HO2 sensor (bank 1 sensor 1)
Required Sensors/Components (Related)	None
Frequency of Operation	Once per driving cycle
Duration	110 seconds
MIL Operation	2 driving cycle
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Intrusive closed loop

Monitor runs whenever these DTCs not present	P0031, P0032 (heated oxygen sensor 1) P0100 - P0103 (MAF meter) P0110 - P0113 (IAT sensor) P0115 - P0118 (ECT sensor) P0120 - P0123 (TP sensor) P0125 (insufficient ECT for closed loop) P0130 (heated oxygen sensor - sensor 1) P0171, P0172 (fuel system) P0300 - P0304 (misfire) P0335 (crankshaft position sensor) P0340 (camshaft position sensor) P0441 - P0456 (EVAP system) P0500 (VSS)
Intrusive closed loop	Running
Intrusive closed loop runs when following conditions are met for:	20 seconds or more
ECT	ECT to enable closed loop or more
Engine rpm	900 rpm or more
Vehicle speed	40 km/h (25 mph) or more
Idle	OFF
HO2S voltage	Less than 0.45 V
Battery voltage	11 V or higher

ES

Others

Engine	Running
ECT	75°C (167°F) or more
Fuel system status	Closed loop
Idle	OFF

TYPICAL MALFUNCTION THRESHOLDS

Intrusive closed loop

HO2S voltage in intrusive closed loop	Less than 0.45 V for 15 seconds with short-term fuel trim 18% or more

Others

HO2S voltage	Less than 0.45 V for 30 seconds with short-term fuel trim 18% or more

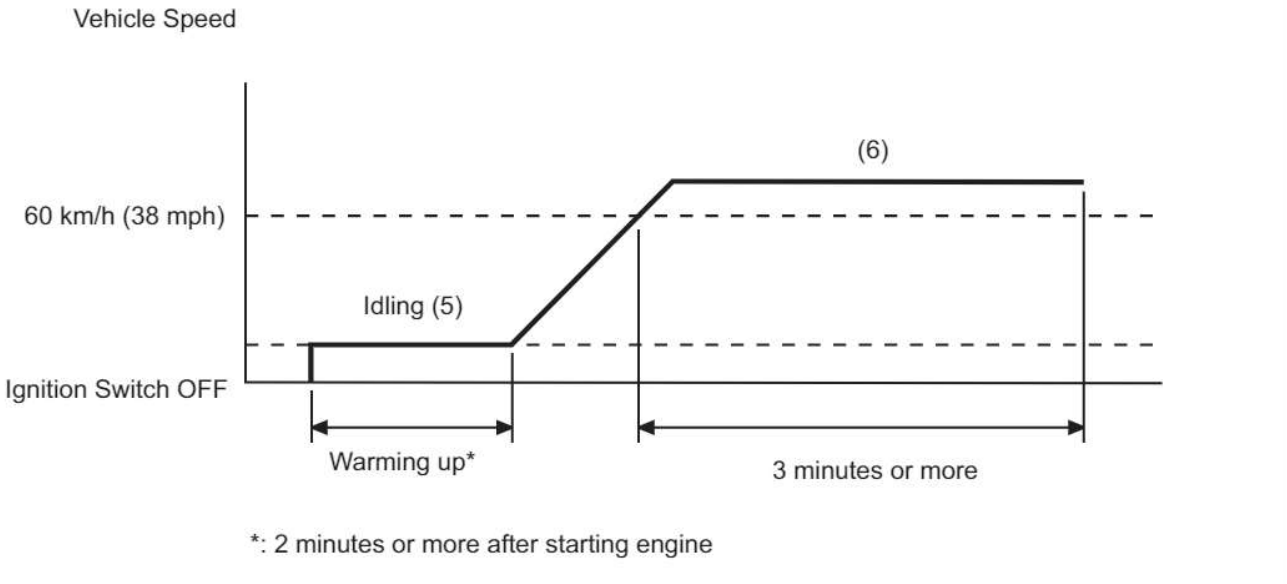
COMPONENT OPERATING RANGE

HO2S voltage in closed loop	Switching between 0.1 and 0.9 V

WIRING DIAGRAM

Refer to DTC P0130 (see page ES-114).

CONFIRMATION DRIVING PATTERN



HINT:
This confirmation driving pattern is used in the "PERFORM CONFIRMATION DRIVING PATTERN" procedure of the following diagnostic troubleshooting procedure.
(1) Connect the intelligent tester to the DLC3.
(2) Turn the ignition switch ON and turn the tester ON.
(3) Clear DTCs (see page ES-37).
(4) Start the engine.
(5) Allow the engine to idle until the engine coolant temperature reaches 40°C (104°F).
Drive the vehicle at a speed of more than 60 km/h (38 mph) for 3 minutes or more.
NOTICE:
If the conditions in this test are not strictly followed, malfunctions may not be detected.

INSPECTION PROCEDURE

HINT:
Malfunctioning areas can be identified by performing the A/F CONTROL function provided in the ACTIVE TEST. The A/F CONTROL function can help to determine whether the Heated Oxygen (HO2) sensors and other potential trouble areas are malfunctioning.
The following instructions describe how to conduct the A/F CONTROL operation using the intelligent tester.

1. Connect the intelligent tester to the DLC3.
2. Start the engine and turn the tester ON.
3. Warm up the engine at an engine speed of 2,500 rpm for approximately 90 seconds.
4. Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL.
5. Perform the A/F CONTROL operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume).
6. Monitor the voltage output of the HO2 sensors (O2S B1S1 and O2S B1S2) displayed on the tester.
   HINT:
   - The A/F CONTROL operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
   - Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

Standard

Tester Display (Sensor)	Injection Volumes	Status	Voltages
O2S B1S1 (Front HO2 Sensor)	+25%	Rich	More than 0.55
O2S B1S1 (Front HO2 Sensor)	-12.5%	Lean	Less than 0.4
O2S B1S2 (Rear HO2 Sensor)	+25%	Rich	More than 0.5
O2S B1S2 (Rear HO2 Sensor)	-12.5%	Lean	Less than 0.4

NOTICE:
The front HO2 sensor has an output delay of a few seconds and the rear HO2 sensor has a maximum output delay of approximately 20 seconds.

ES

Case	Front HO2 Sensor (Sensor 1) Output Voltage		Rear HO2 Sensor (Sensor 2) Output Voltage		Main Suspected Trouble Area
1	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		-
	Output Voltage More than 0.55 V Less than 0.4 V		Output Voltage More than 0.55 V Less than 0.4 V		
2	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		• Front HO2 sensor • Front HO2 sensor heater • Front HO2 sensor circuit
	Output Voltage Almost no reaction		Output Voltage More than 0.55 V Less than 0.4 V		
3	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		• Rear HO2 sensor • Rear HO2 sensor heater • Rear HO2 sensor circuit
	Output Voltage More than 0.55 V Less than 0.4 V		Output Voltage Almost no reaction		
4	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		• Injector • Fuel pressure • Gas leakage from exhaust system (Air-fuel ratio extremely rich or lean)
	Output Voltage Almost no reaction		Output Voltage Almost no reaction		

- Following the A/F CONTROL procedure enables technicians to check and graph the voltage outputs of both the front and rear HO2 sensors.
- To display the graph, enter the following menus on the tester: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST/ A/F CONTROL / USER DATA / O2S B1S1 and O2S B1S2; then press the YES button and ENTER button followed by the F4 button.

NOTICE:
If the vehicle is short of fuel, the air-fuel ratio becomes lean, HO2 sensor DTCs are recorded, and the ECM illuminates the MIL.

HINT:

- If other DTCs relating to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.

- Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- A high HO2 sensor (sensor 1) voltage (0.55 V or more) could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A low HO2 sensor (sensor 1) voltage (0.4 V or less) could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.

1	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0134)

ES

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed to
P0134	A
P0134 and other DTCs	B

HINT:
If any DTCs other than P0134 are output, troubleshoot those DTCs first.

B → GO TO DTC CHART

A

2	READ VALUE OF INTELLIGENT TESTER (OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Start the engine.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / O2S B1S1 and ENGINE SPD.
(e) Warm up the engine until the engine coolant temperature reaches more than 75°C (169°F).
(f) Rev the engine up to 4,000 rpm 3 times using the accelerator pedal.
(g) Read the output voltage of the front Heated Oxygen (HO2) sensor displayed on the tester when the engine speed is suddenly increased.
Standard:
HO2 sensor voltage output indicates 0.45 V or more (rich signal) at least once.

OK → Go to step 12

NG

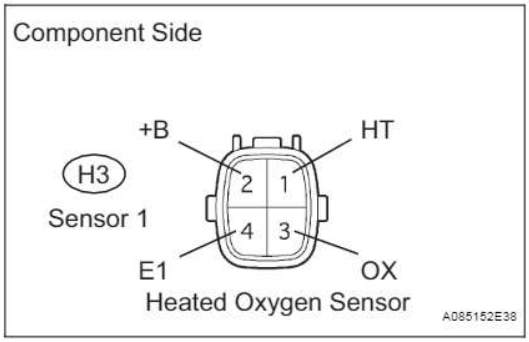
3	CHECK VENTILATION HOSE CONNECTIONS

OK:
Ventilation hose is connected correctly and is not damaged.

NG → **REPAIR OR REPLACE VENTILATION HOSE**

OK

4	INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)



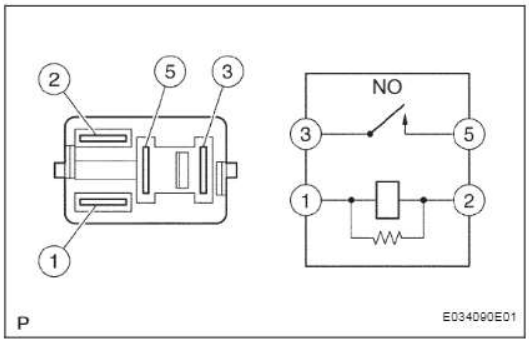
(a) Disconnect the H3 HO2 sensor connector.
(b) Measure the resistance of the HO2 sensor connector.
Standard resistance

Tester Connection	Specified Condition
HT (H3-1) - +B (H3-2)	11 to 16 Ω at 20°C (68°F)
HT (H3-1) - E1 (H3-4)	10 kΩ or higher

NG → **REPLACE HEATED OXYGEN SENSOR**

OK

5	INSPECT EFI RELAY (Marking: EFI)



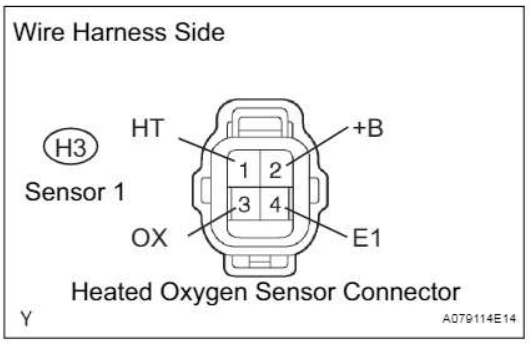
(a) Remove the EFI relay from the engine room relay block.
(b) Measure the resistance of the EFI relay.
Standard resistance

Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (When battery voltage applied to terminals 1 and 2)

NG → **REPLACE EFI RELAY**

OK

6 CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - ECM)

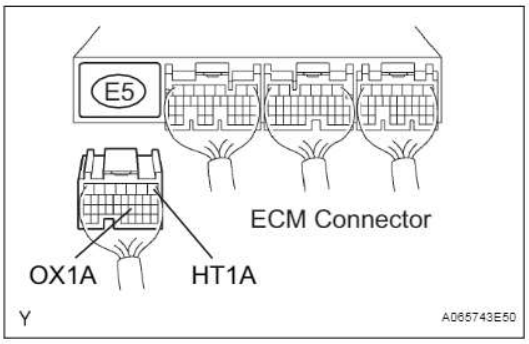


(a) Disconnect the H3 HO2 sensor connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage between the +B terminal of the H3 HO2 sensor connector and body ground.

Standard voltage

Tester Connection	Specified Condition
+B (H3-2) - Body ground	9 to 14 V

(d) Turn the ignition switch OFF.



(e) Disconnect the E5 ECM connector.
(f) Measure the resistance of the wire harness side connectors.

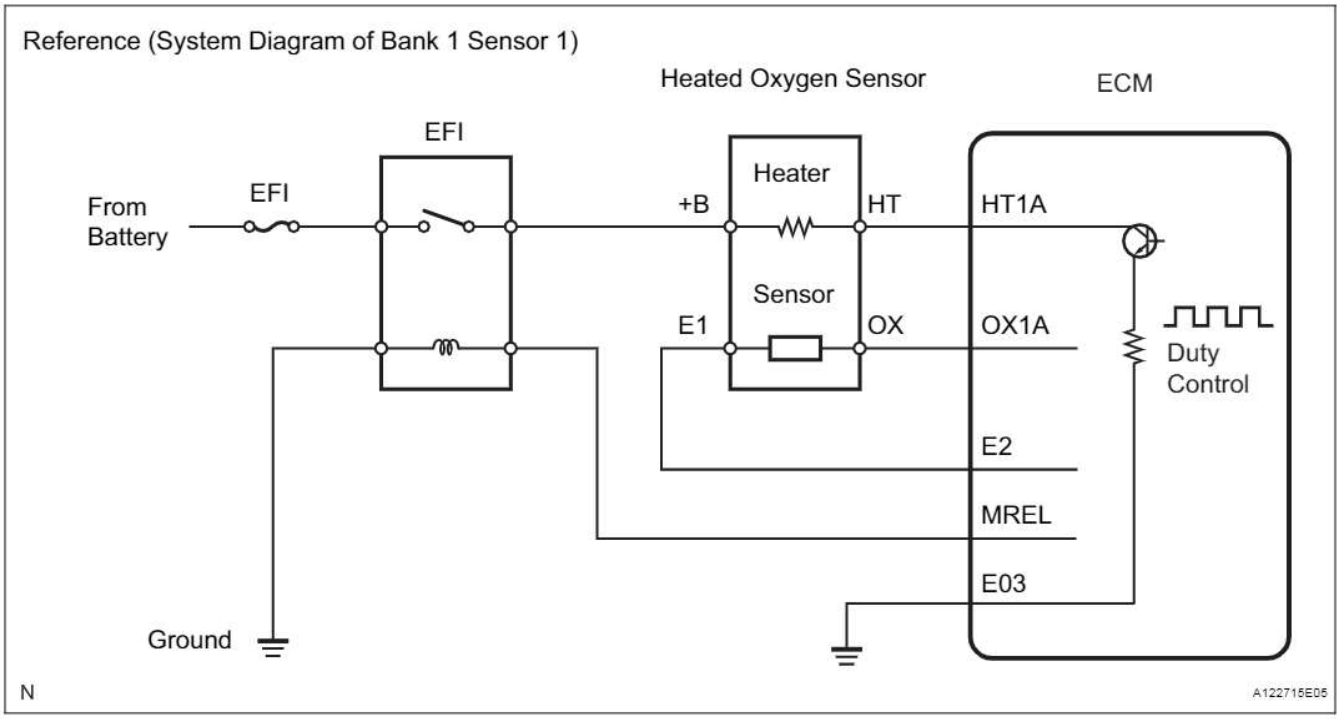
Standard resistance (Check for open)

Tester Connection	Specified Condition
HT (H3-1) - HT1A (E5-1)	Below 1 Ω
OX (H3-3) - OX1A (E5-21)	Below 1 Ω
E1 (H3-4) - Body ground	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
HT (H3-1) or HT1A (E5-1) - Body ground	10 kΩ or higher
OX (H3-3) or OX1A (E5-21) - Body ground	10 kΩ or higher

Reference (System Diagram of Bank 1 Sensor 1)



NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

7	CHECK WHETHER MISFIRE OCCURS BY MONITORING DTC AND DATA LIST

NG → TROUBLESHOOT MISFIRE

OK

8	CHECK AIR INDUCTION SYSTEM

(a) Check the air induction system for vacuum leaks.
OK:
No leakage from air induction system.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

9	CHECK FUEL PRESSURE

(a) Check the fuel pressure (see page FU-7).

NG → REPAIR OR REPLACE FUEL SYSTEM

OK

10	INSPECT FUEL INJECTOR (INJECTION AND VOLUME)

(a) Check the injector injection and volume (see page FU-13).

NG → REPLACE FUEL INJECTOR

OK

11	CHECK FOR EXHAUST GAS LEAKS

NG → REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT

OK

REPLACE HEATED OXYGEN SENSOR

12	PERFORM CONFIRMATION DRIVING PATTERN

NEXT

13	CHECK WHETHER DTC OUTPUT RECURS (DTC P0134)

(a) Read DTCs using the intelligent tester.
(b) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.

Result

Display (DTC Output)	Proceed to
No output	A
P0134	B

B → REPLACE ECM

A

14	CONFIRM WHETHER VEHICLE HAS RUN OUT OF FUEL IN PAST

NO → CHECK FOR INTERMITTENT PROBLEMS

YES

DTC CAUSED BY RUNNING OUT OF FUEL

CHECK FOR INTERMITTENT PROBLEMS

HINT:
Inspect the vehicle's ECM using check mode. Intermittent problems are easier to detect with the intelligent tester when the ECM is in check mode. In check mode, the ECM uses 1 trip detection logic, which is more sensitive to malfunctions than normal mode (default), which uses 2 trip detection logic.

1. Clear the DTCs (see page ES-37).
2. Switch the ECM from normal mode to check mode using the intelligent tester (see page ES-41).
3. Perform a simulation test (see page IN-21).
4. Check and wiggle the harness(es), connector(s) and terminal(s) (see page IN-29).

BASIC INSPECTION

When the malfunction is not confirmed by the DTC check, troubleshooting should be carried out in all circuits considered to be possible causes of the problem. In many cases, by carrying out the basic engine check shown in the following flowchart, the location of the problem can be found quickly and efficiently. Therefore, using this check is essential when engine troubleshooting.

ES

1 CHECK BATTERY VOLTAGE

NOTICE:
Perform this check with the engine stopped and ignition switch OFF.

Result	Proceed to
11 V or more	OK
Below 11 V	NG

NG → **CHARGE OR REPLACE BATTERY**

OK ↓

2 CHECK WHETHER ENGINE WILL CRANK

NG → **PROCEED TO PROBLEM SYMPTOMS TABLE**

OK ↓

3 CHECK WHETHER ENGINE STARTS

NG → **GO TO STEP 6**

OK ↓

4 CHECK AIR FILTER

(a) Visually check that the air filter is not excessively contaminated with dirt or oil.

NG → **REPLACE AIR FILTER**

OK ↓

5 CHECK IDLING SPEED

NG → **PROCEED TO PROBLEM SYMPTOMS TABLE**

OK

6	CHECK FUEL PRESSURE

NG → PROCEED TO TROUBLESHOOTING

OK

7	CHECK FOR SPARK

NG → PROCEED TO TROUBLESHOOTING

OK

PROCEED TO PROBLEM SYMPTOMS TABLE

DTC	P0136	Oxygen Sensor Circuit Malfunction (Bank 1 Sensor 2)

DTC	P0138	Heated Oxygen Sensor Circuit High Voltage (Bank 1 Sensor 2)

DTC	P0139	Oxygen Sensor Circuit Slow Response (Bank 1 Sensor 2)

DESCRIPTION

The rear Heated Oxygen (HO2) sensor (bank 1 sensor 2) is located behind the Three-Way Catalytic Converter (TWC), and detects the oxygen concentration in the exhaust gas. For optimum TWC operation, the air fuel mixture must be maintained as close as possible to the stoichiometric ratio. The HO2 sensor output voltage changes dramatically in the vicinity of the stoichiometric ratio. By making adjustments in accordance with these signal voltage changes, the ECM adjusts the fuel injection time so that the air-fuel ratio remains as close as possible to stoichiometric levels.

The rear HO2 sensor generates a voltage that ranges from 0.1 V to 0.9 V according to the oxygen concentration in the exhaust gas. When the oxygen concentration in the exhaust gas increases, the HO2 sensor voltage drops below 0.45 V. The ECM interprets this as the air-fuel ratio being lean. Alternatively, the sensor voltage rises to more than 0.45 V when there is no oxygen in the exhaust gas. The ECM interprets this as the air-fuel ratio being rich.

DTC No	DTC Detection Condition	Trouble Area
P0136	Either of following conditions (a) or (b) met: (a) Rear Heated Oxygen (HO2) sensor voltage remains below 0.4 V (lean) or above 0.5 V (rich) while vehicle repeatedly accelerated and decelerated for 5 minutes or more (b) Rear HO2 sensor voltage remains below 0.05 V for long time period	• Open or short in Heated Oxygen (HO2) sensor (sensor 2) circuit • HO2 sensor (sensor 2) • HO2 sensor (sensor 2) heater • EFI relay
P0138	Rear HO2 sensor output voltage 1.2 V or more for 10 seconds	• HO2 sensor (sensor 2) • Short in HO2 sensor (sensor 2) circuit
P0139	When either condition below is met: • After fuel cut starting, time until rear HO2 sensor (sensor 2) voltage drops to below 0.2 V is 7 seconds or more • During fuel cut, duration that rear oxygen sensor voltage drops from 0.35 V to 0.2 V is 1 second or more	• HO2 sensor (sensor 2) • Short in HO2 sensor (sensor 2) circuit

MONITOR DESCRIPTION

The ECM monitors the HO2 sensor (bank 1 sensor 2) to check for the following malfunctions. If any one of the malfunctions is detected, the ECM illuminates the MIL and sets a DTC:

- The HO2 sensor output voltage remains above 0.5 V (rich) or below 0.4 V (lean) while the vehicle is accelerated and decelerated for 4 to 8 minutes.
- The HO2 sensor output voltage remains extremely low, below 0.05 V for a long time period of time while the vehicle is driven.
- The HO2 sensor output voltage remains extremely low, below 0.2 V (extremely lean condition) soon after fuel cut is performed while the vehicle is decelerated. The ECM interprets this as the sensor response having deteriorated.
- The HO2 sensor output voltage exceeds more than 1.2 V for 10 seconds.

MONITOR STRATEGY

Related DTCs	P0136: HO2 sensor (bank 1 sensor 2) voltage P0138: HO2 sensor (bank 1 sensor 2) voltage high P0139: HO2 sensor (bank 1 sensor 2) fuel cut

Required Sensors/Components (Main)	HO2 sensor (sensor 2)
Required Sensors/Components (Related)	Engine Coolant Temperature (ECT) sensor, Mass Air Flow (MAF) meter, Vehicle speed sensor (VSS)
Frequency of Operation	Continuous
Duration	Within 6 minutes: P0136 10 seconds: P0138 7 seconds: P0139
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

All:

ES

Monitor runs whenever these DTCs not present	P0031, P0032 (heated oxygen sensor 1) P0037, P0038 (heated oxygen sensor 2) P0100 - P0103 (MAF meter) P0110 - P0113 (IAT sensor) P0115 - P0118 (ECT sensor) P0120 - P0123 (TP sensor) P0125 (insufficient ECT for closed loop) P0130 (heated oxygen sensor 1) P0134 (heated oxygen sensor 1) P0171, P0172 (fuel system) P0300 - P0304 (misfire) P0335 (crankshaft position sensor) P0340 (camshaft position sensor) P0441 - P0456 (EVAP system) P0500 (VSS)

P0136 HO2 sensor voltage:

Engine	Running
Fuel system status	Closed loop
Idle	OFF
Cumulative time while oxygen sensor heater is operating	22 seconds or more

P0136 HO2 sensor element:

Engine	Running
Vehicle speed	3 km/h (2 mph) or more
Idle	OFF
Fuel cut	OFF
Intake air amount per revolution	0.16 g/rev or more

P0138 HO2 sensor voltage:

Engine	Running

P0139 HO2 sensor voltage (during fuel cut):

HO2 sensor (sensor 2) voltage before fuel cut	0.2 V or more
Three-way catalytic converter condition	400°C (752°F) or more
ECT	70°C (158°F) or more
Fuel cut	Operating

TYPICAL MALFUNCTION THRESHOLDS

P0136 HO2 sensor voltage:

Lean/Rich switching count	None
Lean	Heated Oxygen (HO2) sensor (sensor 2) voltage less than 0.4 V
Rich	HO2 sensor (sensor 2) voltage 0.5 V or more
Cumulative rear oxygen sensor monitor time	300 seconds or more

P0136 HO2 sensor element:

Cumulative rear HO2 sensor (sensor 2) monitor time	210 seconds or more
Cumulative time when HO2 sensor (sensor 2) voltage less than 0.05 V	126 seconds or more
Cumulative time when HO2 sensor (sensor 2) voltage 0.70 V or more	Less than 42 seconds
Cumulative time when HO2 sensor (sensor 2) voltage more than 0.45 V	Less than 84 seconds
Maximum rear HO2 sensor (sensor 2) rich time: Rear HO2 sensor voltage 0.45 V or more	Less than 20 seconds

P0138 HO2 sensor voltage:

Time while HO2 sensor output voltage 1.2 V or more	10 seconds or more

P0139 HO2 sensor voltage (during fuel cut):

Time until HO2 sensor (sensor 2) voltage drops to below 0.2 V after fuel cut starting	7 seconds or more
Duration that rear oxygen sensor voltage drops from 0.35 V to 0.2 V during fuel cut	1 second or more

ES

COMPONENT OPERATING RANGE

HO2 sensor (sensor 2) voltage	Alternates between 0 V and 1 V

MONITOR RESULT

Refer to CHECKING MONITOR STATUS (see page ES-19).

WIRING DIAGRAM

Refer to DTC P0130 (see page ES-114).

CONFIRMATION DRIVING PATTERN

This confirmation driving pattern is used in the "PERFORM CONFIRMATION DRIVING PATTERN" procedure of the following diagnostic troubleshooting procedure.

CAUTION:

Strictly observe posted speed limits, traffic laws, and road conditions when performing the driving pattern below.

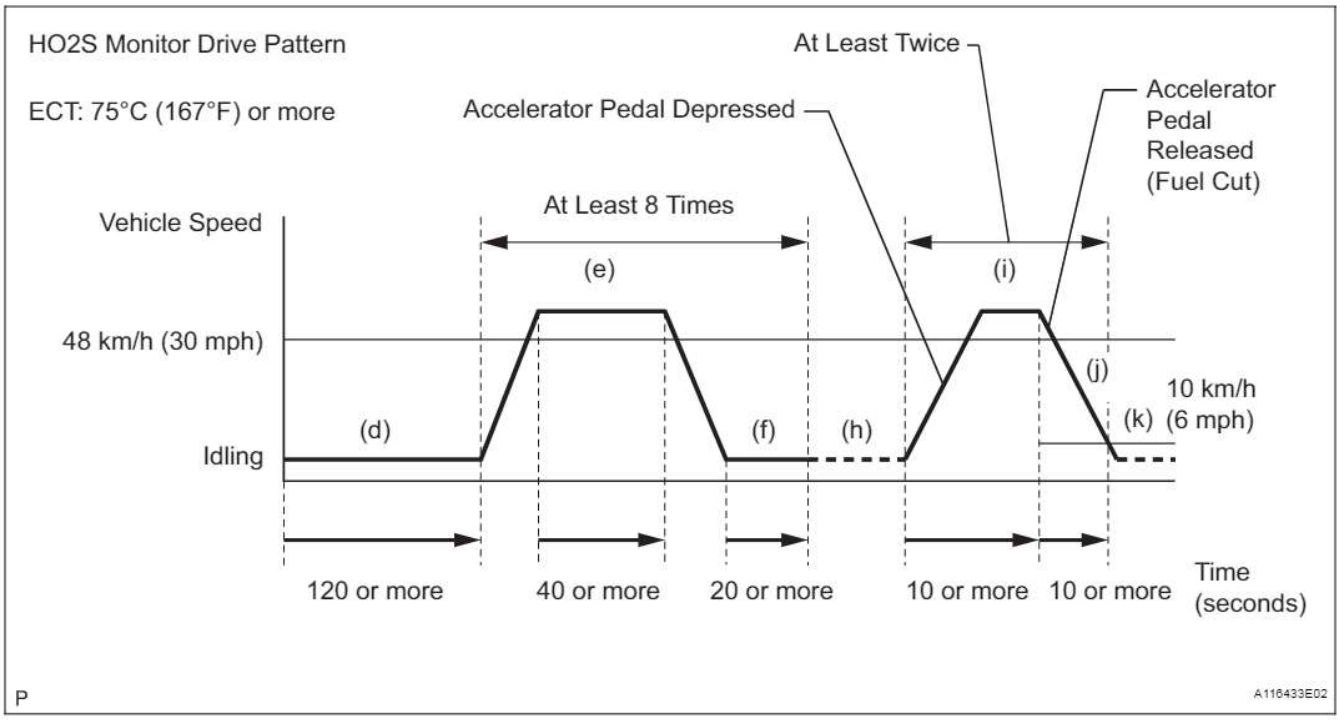
1. **Preconditions**

   The Heated Oxygen (HO2) sensor monitor will not run unless:
   - 2 minutes or more have elapsed since the engine was started.
   - The Engine Coolant Temperature (ETC) is 75°C (167°F) or more.
   - Cumulative driving time at a vehicle speed of 48 km/h (30 mph) or more exceeds 6 minutes.
   - Air-fuel ratio feedback control is performed.
   - Fuel cut control is performed for 8 seconds or more (for the rear HO2 sensor).

2. **Driving Patterns**

   (a) Connect the intelligent tester to the DLC3.
   (b) Turn the ignition switch ON and turn the tester ON.
   (c) Clear DTCs (see page ES-37).
   (d) Start the engine and warm it up until the ETC reaches 75°C (167°F) or higher.
   (e) Drive the vehicle at 48 km/h (30 mph) or more for at least 40 seconds.
   (f) Allow the engine to idle for 20 seconds or more.
   (g) Repeat steps (e) and (f) described above at least 8 times in 1 driving cycle.
   (h) Change the transmission to 2nd gear.
   (i) Accelerate the vehicle to 48 km/h (30 mph) or more by depressing the accelerator pedal for at least 10 seconds.

(j) Soon after performing step (i) above, release the accelerator pedal for at least 10 seconds without depressing the brake pedal in order to execute fuel cut control.
(k) Allow the vehicle to decelerate to less than 10 km/h (6 mph).
(l) Repeat steps from (i) through (k) described above at least twice in 1 driving cycle.



INSPECTION PROCEDURE

HINT:
Malfunctioning areas can be identified by performing the A/F CONTROL function provided in the ACTIVE TEST. The A/F CONTROL function can help to determine whether the Heated Oxygen (HO2) sensors and other potential trouble areas are malfunctioning.
The following instructions describe how to conduct the A/F CONTROL operation using the intelligent tester.

1. Connect the intelligent tester to the DLC3.
2. Start the engine and turn the tester ON.
3. Warm up the engine at an engine speed of 2,500 rpm for approximately 90 seconds.
4. Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL.
5. Perform the A/F CONTROL operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume).
6. Monitor the voltage output of the HO2 sensors (O2S B1S1 and O2S B1S2) displayed on the tester.
   HINT:
   - The A/F CONTROL operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
   - Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

Standard

Tester Display (Sensor)	Injection Volumes	Status	Voltages
O2S B1S1 (Front HO2 Sensor)	+25%	Rich	More than 0.55
O2S B1S1 (Front HO2 Sensor)	-12.5%	Lean	Less than 0.4
O2S B1S2 (Rear HO2 Sensor)	+25%	Rich	More than 0.5
O2S B1S2 (Rear HO2 Sensor)	-12.5%	Lean	Less than 0.4

NOTICE:
The front HO2 sensor has an output delay of a few seconds and the rear HO2 sensor has a maximum output delay of approximately 20 seconds.

Case	Front HO2 Sensor (Sensor 1) Output Voltage		Rear HO2 Sensor (Sensor 2) Output Voltage		Main Suspected Trouble Area
1	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		-
	Output Voltage More than 0.55 V Less than 0.4 V		Output Voltage More than 0.55 V Less than 0.4 V		
2	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		• Front HO2 sensor • Front HO2 sensor heater • Front HO2 sensor circuit
	Output Voltage Almost no reaction		Output Voltage More than 0.55 V Less than 0.4 V		
3	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		• Rear HO2 sensor • Rear HO2 sensor heater • Rear HO2 sensor circuit
	Output Voltage More than 0.55 V Less than 0.4 V		Output Voltage Almost no reaction		
4	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		• Injector • Fuel pressure • Gas leakage from exhaust system (Air-fuel ratio extremely rich or lean)
	Output Voltage Almost no reaction		Output Voltage Almost no reaction		

- Following the A/F CONTROL procedure enables technicians to check and graph the voltage outputs of both the front and rear HO2 sensors.
- To display the graph, enter the following menus on the tester: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST/ A/F CONTROL / USER DATA / O2S B1S1 and O2S B1S2; then press the YES button and ENTER button followed by the F4 button.
  NOTICE:
  If the vehicle is short of fuel, the air-fuel ratio becomes lean, HO2 sensor DTCs are recorded, and the ECM illuminates the MIL.

HINT:

- If other DTCs relating to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.
- Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- A high HO2 sensor (sensor 1) voltage (0.55 V or more) could be caused by a rich air fuel mixture. Check for conditions that would cause the engine to run rich.
- A low HO2 sensor (sensor 1) voltage (0.4 V or less) could be caused by a lean air fuel mixture. Check for conditions that would cause the engine to run lean.

1	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0136, P0138 AND/OR P0139)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read DTCs.

Result

Display (DTC output)	Proceed to
P0136, P0138 and/or P0139	A
P0136, P0138 and/or P0139, and other DTCs	B

ES

HINT:
If any DTCs other than P0136, P0138 and/or P0139 are output, troubleshoot those DTCs first.

B → GO TO DTC CHART

A

2	READ VALUE OF INTELLIGENT TESTER (OUTPUT VOLTAGE OF HEATED OXYGEN SENSOR)

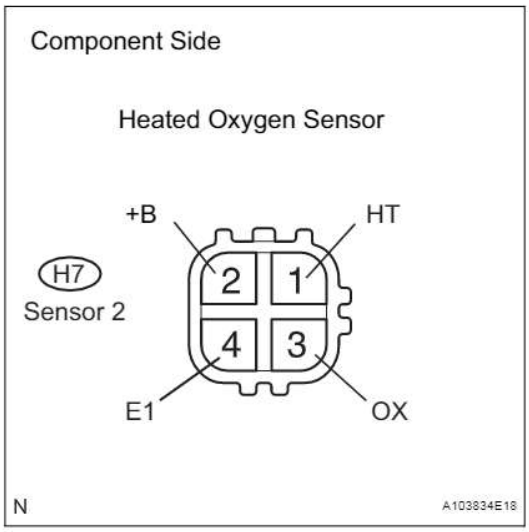
(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Start the engine.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / O2S B1S2 and ENGINE SPD.
(e) Warm up the engine.
(f) Run the engine at an engine speed of 2,500 rpm for 3 minutes.
(g) Rev the engine up to 4,000 rpm 3 times using the accelerator pedal.
(h) Read the output voltage of the rear Heated Oxygen (HO2) sensor displayed on the tester when the engine speed is suddenly increased.

Standard voltage:
Rear HO2 sensor voltage output fluctuates between less than 0.4 V and more than 0.55 V.

OK → Go to step 6

NG

3 INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)



(a) Disconnect the H7 HO2 sensor connector.
(b) Measure the resistance of the HO2 sensor connector.
Standard resistance

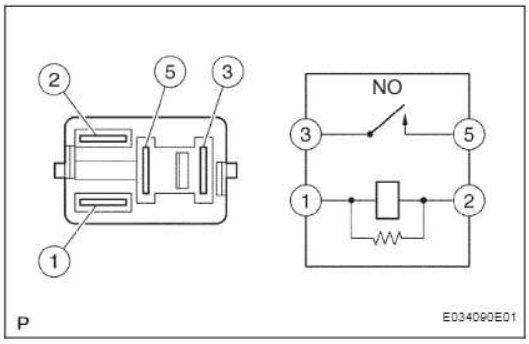
Tester Connection	Specified Condition
HT (H7-1) - +B (H7-2)	11 to 16 Ω at 20 °C (68 °F)
HT (H7-1) - E1 (H7-4)	10 kΩ or higher

NG → REPLACE HEATED OXYGEN SENSOR

ES

OK

4 INSPECT EFI RELAY (Marking EFI)



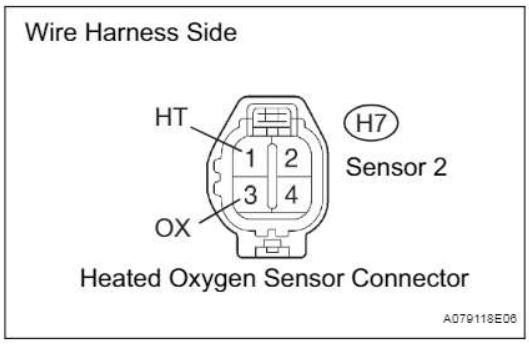
(a) Remove the EFI relay from the engine room relay block.
(b) Measure the resistance of the EFI relay.
Standard resistance

Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (When battery voltage is applied to terminals 1 and 2)

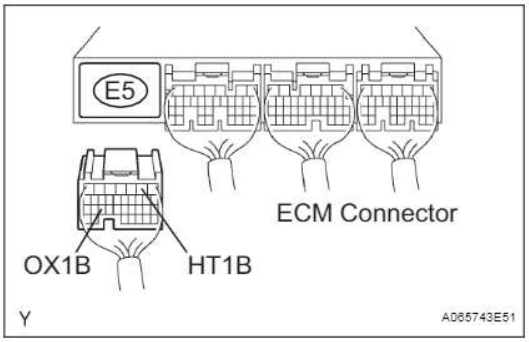
NG → REPLACE EFI RELAY

OK

5 CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR - ECM)



(a) Disconnect the H7 HO2 sensor connector.



(b) Disconnect the E5 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard resistance (Check for open)

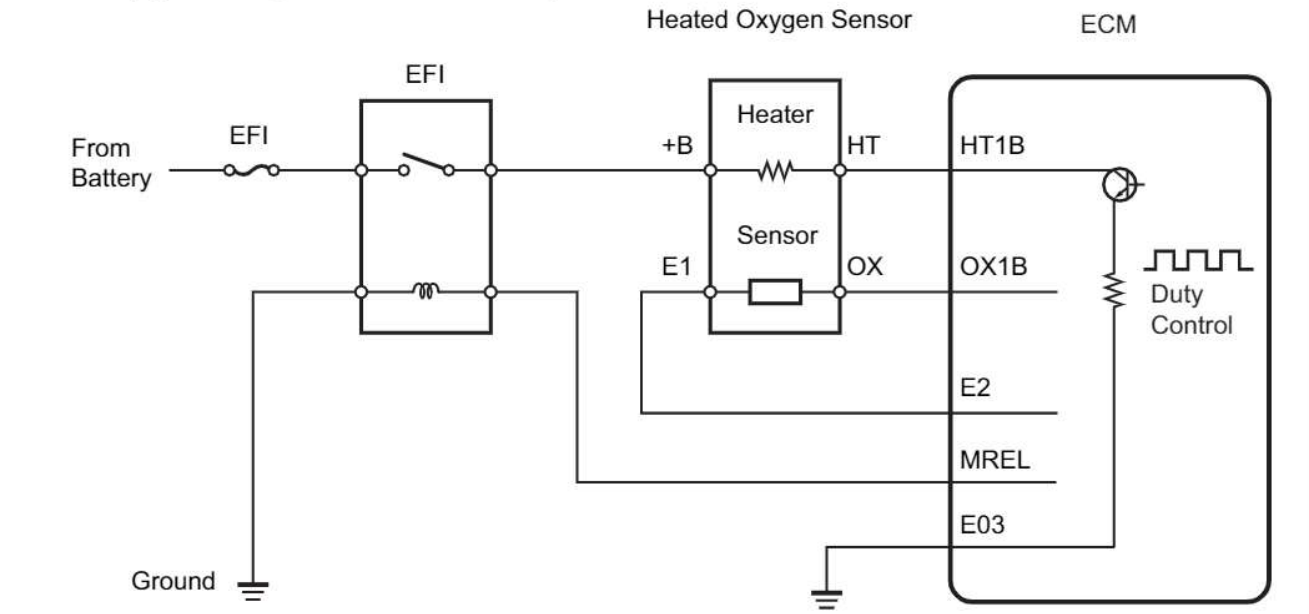
Tester Connection	Specified Condition
HT (H7-1) - HT1B (E5-2)	Below 1 Ω
OX (H7-3) - OX1B (E5-25)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
HT (H7-1) or HT1B (E5-2) - Body ground	10 kΩ or higher
OX (H7-3) or OX1B (E5-25) - Body ground	10 kΩ or higher

ES

Reference (System Diagram of Bank 1 Sensor 2)



NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE HEATED OXYGEN SENSOR

6	PERFORM CONFIRMATION DRIVING PATTERN

NEXT

7	CHECK WHETHER DTC OUTPUT RECURS (DTC P0136, P0138 AND/OR P0139)

(a) Read DTCs using the intelligent tester.

(b) If using the intelligent tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.

Result

Display (DTC output)	Proceed to
P0136, P0138 and/or P0139	A
No output	B

B → CHECK FOR INTERMITTENT PROBLEMS

A → REPLACE HEATED OXYGEN SENSOR

ES

DTC	P0171	System Too Lean (Bank 1)

DTC	P0172	System Too Rich (Bank 1)

DESCRIPTION

The fuel trim is related to the feedback compensation value, not to the basic injection time. The fuel trim consists of both the short-term and long-term fuel trims.

The short-term fuel trim is fuel compensation that is used to constantly maintain the air-fuel ratio at stoichiometric levels. The signal from the front Heated Oxygen (HO2) sensor indicates whether the air-fuel ratio is rich or lean compared to the stoichiometric ratio. This triggers a reduction in the fuel injection volume if the air-fuel ratio is rich and an increase in the fuel injection volume if it is lean.

ES

Factors such as individual engine differences, wear over time and changes in operating environment cause short-term fuel trim to vary from the central value. The long-term fuel trim, which controls overall fuel compensation, compensates for long-term deviations in the fuel trim from the central value caused by the short-term fuel trim compensation.

If both the short-term and long-term fuel trims are lean or rich beyond predetermined values, it is interpreted as a malfunction, and the ECM illuminates the MIL and sets a DTC.

DTC No.	DTC Detection Condition	Trouble Area
P0171	With warm engine and stable air-fuel ratio feedback, fuel trim considerably in error to lean side (2 trip detection logic)	• Air induction system • Injector blockage • Mass Air Flow (MAF) meter • Engine Coolant Temperature (ECT) sensor • Fuel pressure • Gas leakage from exhaust system • Open or short in Heated Oxygen (HO2) sensor (bank 1 sensor 1) circuit • HO2 sensor (bank 1 sensor 1) • HO2 sensor heater (bank 1 sensor 1) • EFI relay • Ventilation valve and hose • Ventilation hose connections • ECM
P0172	With warm engine and stable air-fuel ratio feedback, fuel trim considerably in error to rich side (2 trip detection logic)	• Injector leakage or blockage • MAF meter • ECT sensor • Ignition system • Fuel pressure • Gas leakage from exhaust system • Open or short in HO2 sensor (bank 1 sensor 1) circuit • HO2 sensor (bank 1 sensor 1) • HO2 sensor heater (bank 1 sensor 1) • EFI relay • ECM

HINT:

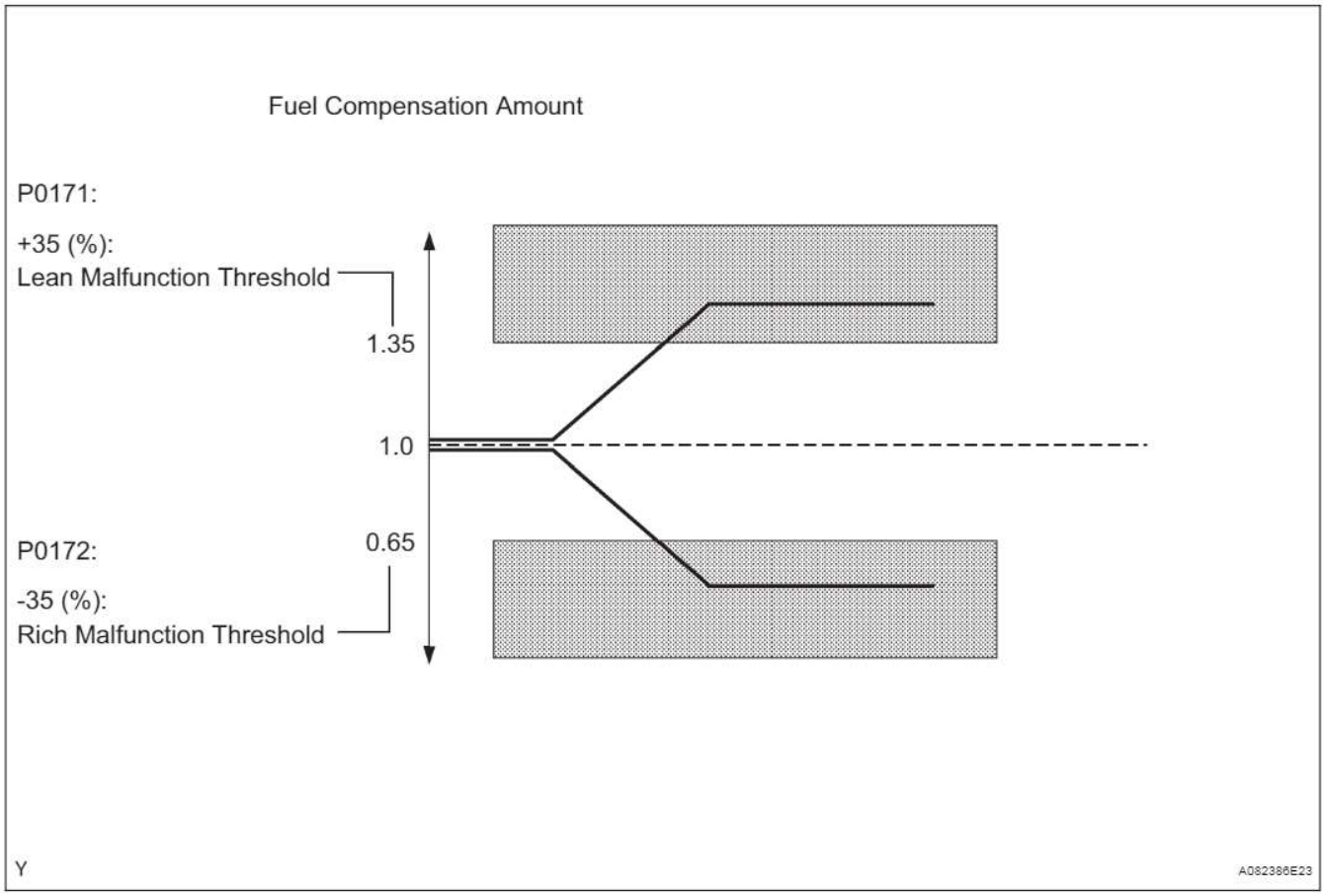
- When DTC P0171 is set, the actual air-fuel ratio is on the lean side. When DTC P0172 is set, the actual air-fuel ratio is on the rich side.
- If the vehicle runs out of fuel, the air-fuel ratio is lean and DTC P0171 may be set. The MIL is then illuminated.
- When the total of the short-term and long-term fuel trim values is within the malfunction threshold (and the engine coolant temperature is more than 75°C [167°F]), the system is functioning normally.

MONITOR DESCRIPTION

Under closed loop fuel control, fuel injection volumes that deviate from those estimated by the ECM cause changes in the long-term fuel trim compensation value. The long-term fuel trim is adjusted when there are persistent deviations in the short-term fuel trim values. Deviations from the ECM's estimated fuel injection volumes also affect the average fuel trim learning value, which is a combination of the average short-term fuel trim (fuel feedback compensation value) and the average long-term fuel trim (learning value of the air-fuel ratio). If the average fuel trim learning value exceeds the malfunction thresholds, the ECM interprets this as a fault in the fuel system and sets a DTC.

Example:

When the average fuel trim leaning value is more than +35% or less than -35%, the ECM interprets this as a fuel system malfunction.



MONITOR STRATEGY

Related DTCs	P0171: Fuel trim Lean (bank 1) P0172: Fuel trim Rich (bank 1)
Required Sensors/Components (Main)	Fuel system
Required Sensors/Components (Related)	Heated oxygen sensor (sensor 1), Mass air flow meter, Crankshaft position sensor
Frequency of Operation	Continuous
Duration	Within 10 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever these DTCs not present	P0010 (VVT OCV 1) P0011 (VVT system 1 - advance) P0012 (VVT system 1 - retard) P0031, P0032 (heated oxygen sensor 1) P0100 - P0103 (MAF meter) P0115 - P0118 (ECT sensor) P0120 - P0123 (TP sensor) P0125 (insufficient ECT for closed loop) P0130 (heated oxygen sensor 1) P0134 (heated oxygen sensor 1) P0171, P0172 (fuel system) P0300 - P0304 (misfire) P0335 (crankshaft position sensor) P0441 - P0456 (EVAP system) P0500 (VSS)
Battery voltage	11 V or more
Fuel system	Closed loop (for more than 13 seconds)
Either of following conditions (a) or (b) met:	-
(a) Engine RPM	Less than 1,100 rpm
(b) Intake air amount per revolution	0.15 g/rev or more

ES

TYPICAL MALFUNCTION THRESHOLDS

All:

EVAP purge-cut	Executing

Fuel trim Lean:

Average fuel trim learning value	35% or more (varies with engine coolant temperature [ECT])

Fuel trim Rich:

Average fuel trim learning value	-35% or less (varies with ECT)

WIRING DIAGRAM

Refer to DTC P0130 (see page ES-114).

INSPECTION PROCEDURE

HINT:

Malfunctioning areas can be identified by performing the A/F CONTROL function provided in the ACTIVE TEST. The A/F CONTROL function can help to determine whether the Heated Oxygen (HO2) sensors and other potential trouble areas are malfunctioning.

The following instructions describe how to conduct the A/F CONTROL operation using the intelligent tester.

1. Connect the intelligent tester to the DLC3.
2. Start the engine and turn the tester ON.
3. Warm up the engine at an engine speed of 2,500 rpm for approximately 90 seconds.
4. On the tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL.
5. Perform the A/F CONTROL operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume).
6. Monitor the voltage outputs of the HO2 sensors (O2S B1S1 and O2S B1S2) displayed on the tester.

   HINT:

   - The A/F CONTROL operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
   - Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

Standard

Tester Display (Sensor)	Injection Volumes	Status	Voltages
O2S B1S1 (Front HO2 Sensor)	+25%	Rich	More than 0.55
O2S B1S1 (Front HO2 Sensor)	-12.5%	Lean	Less than 0.4
O2S B1S2 (Rear HO2 Sensor)	+25%	Rich	More than 0.5
O2S B1S2 (Rear HO2 Sensor)	-12.5%	Lean	Less than 0.4

NOTICE:
The front HO2 sensor has an output delay of a few seconds and the rear HO2 sensor has a maximum output delay of approximately 20 seconds.

ES

Case	Front HO2 Sensor (Sensor 1) Output Voltage		Rear HO2 Sensor (Sensor 2) Output Voltage		Main Suspected Trouble Area
1	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		-
	Output Voltage More than 0.55 V Less than 0.4 V		Output Voltage More than 0.55 V Less than 0.4 V		
2	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		• Front HO2 sensor • Front HO2 sensor heater • Front HO2 sensor circuit
	Output Voltage Almost no reaction		Output Voltage More than 0.55 V Less than 0.4 V		
3	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		• Rear HO2 sensor • Rear HO2 sensor heater • Rear HO2 sensor circuit
	Output Voltage More than 0.55 V Less than 0.4 V		Output Voltage Almost no reaction		
4	Injection Volume +25% -12.5%		Injection Volume +25% -12.5%		• Injector • Fuel pressure • Gas leakage from exhaust system (Air-fuel ratio extremely rich or lean)
	Output Voltage Almost no reaction		Output Voltage Almost no reaction		

- Following the A/F CONTROL procedure enables technicians to check and graph the voltage outputs of both the front and rear HO2 sensors.
- To display the graph, enter the following menus on the tester: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST/ A/F CONTROL / USER DATA / O2S B1S1 and O2S B1S2; then press the YES button and ENTER button followed by the F4 button.
  NOTICE:
  If the vehicle is short of fuel, the air-fuel ratio becomes lean, HO2 sensor DTCs are recorded, and the ECM illuminates the MIL.

HINT:

- If other DTCs relating to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.

- Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- A high HO2 sensor (sensor 1) voltage (0.55 V or more) could be caused by a rich air-fuel mixture. Check for conditions that would cause the engine to run rich.
- A low HO2 sensor (sensor 1) voltage (0.4 V or less) could be caused by a lean air-fuel mixture. Check for conditions that would cause the engine to run lean.

ES

1 CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0171 OR P0172)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed to
P0171 or P0172	A
P0171 or P0172 and other DTCs	B

HINT:
If any DTCs other than P0171 or P0172 are output, troubleshoot those DTCs first.

B → **GO TO DTC CHART**

A

2 CHECK VENTILATION HOSE CONNECTIONS

OK:
Ventilation hose is connected correctly, and is not damaged.

NG → **REPAIR OR REPLACE VENTILATION HOSE**

OK

3 CHECK AIR INDUCTION SYSTEM

(a) Check the air induction system for vacuum leakage.

OK:
No leakage from air induction system.

NG → **REPAIR OR REPLACE AIR INDUCTION SYSTEM**

OK

4 PERFORM ACTIVE TEST BY INTELLIGENT TESTER (A/F CONTROL)

(a) Connect the intelligent tester to the DLC3.

(b) Start the engine and turn the tester ON.
(c) Warm up the engine at an engine speed of 2,500 rpm for approximately 90 seconds.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL.
(e) Perform the A/F CONTROL operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume).
(f) Monitor the voltage output of the Heated Oxygen (HO2) sensors (O2S B1S1 and O2S B1S2) displayed on the tester.
HINT:
- The A/F CONTROL operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

ES

Standard

Tester Display (Sensor)	Injection Volumes	Status	Voltages
O2S B1S1 (Front HO2 Sensor)	+25%	Rich	More than 0.55
O2S B1S1 (Front HO2 Sensor)	-12.5%	Lean	Less than 0.4
O2S B1S2 (Rear HO2 Sensor)	+25%	Rich	More than 0.5
O2S B1S2 (Rear HO2 Sensor)	-12.5%	Lean	Less than 0.4

Result

Status O2S B1S1	Status O2S B1S2	A/F Condition and HO2 Sensor Condition	Misfires	Suspected Trouble Areas	Proceed to
Lean/Rich	Lean/Rich	Normal	-	-	C
Lean	Lean	Actual air-fuel ratio lean	May occur	• Ventilation valve and hose • Ventilation hose connections • Injector blockage • Gas leakage from exhaust system • Air induction system • Fuel pressure • Mass Air Flow (MAF) meter • Engine Coolant Temperature (ECT) sensor	A
Rich	Rich	Actual air-fuel ratio rich	-	• Injector leakage or blockage • Gas leakage from exhaust system • Ignition system • Fuel pressure • MAF meter • ECT sensor	A
Lean	Lean/Rich	HO2 sensor malfunction	-	• HO2 sensor	B

Status O2S B1S1	Status O2S B1S2	A/F Condition and HO2 Sensor Condition	Misfires	Suspected Trouble Areas	Proceed to
Rich	Lean/Rich	HO2 sensor malfunction	-	• HO2 sensor	B

Lean: During A/F CONTROL, both the front and rear HO2 sensor output voltages (O2S) are consistently less than 0.4 V.
Rich: During A/F CONTROL, both of the O2S voltages are consistently more than 0.55 V.

B → Go to step 11

C → Go to step 15

ES

A

5 READ VALUE OF INTELLIGENT TESTER (COOLANT TEMP)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / COOLANT TEMP.
(d) Read the COOLANT TEMP twice, when the engine is cold and also when warmed up.
Standard:
With cold engine: Same as ambient air temperature.
With warm engine: 75°C to 95°C (167°F to 203°F)

NG → **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK

6 READ VALUE OF INTELLIGENT TESTER (MAF)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / MAF and COOLANT TEMP.
(d) Allow the engine to idle until the COOLANT TEMP reaches 75°C (167°F).
(e) Read the MAF with the engine in an idling condition and at an engine speed of 2,500 rpm.
Standard:
MAF while engine idling: 1.4 g/sec. to 2.3 g/sec. (A/C: OFF).
MAF at engine speed of 2,500 rpm: 5.4 g/sec. to 7.9 g/sec. (A/C: OFF).

NG → **REPLACE MASS AIR FLOW METER**

OK

7	CHECK FUEL PRESSURE

(a) Check the fuel pressure (high or low pressure) (see page FU-7).

NG → REPAIR OR REPLACE FUEL SYSTEM

OK

8	CHECK FOR EXHAUST GAS LEAKAGE

OK:
No gas leakage.

NG → REPAIR OR REPLACE EXHAUST SYSTEM

OK

9	CHECK FOR SPARKS AND IGNITION

HINT:
If the spark plugs or ignition system malfunctions, engine misfire may occur. The misfire count can be read using the intelligent tester. Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / MISFIRE / CYL #1 (to CYL #4).

NG → REPAIR OR REPLACE IGNITION SYSTEM

OK

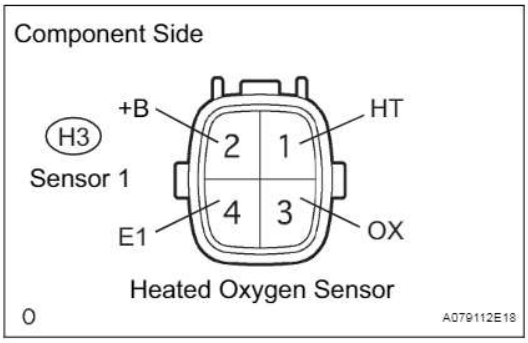
10	INSPECT FUEL INJECTOR (INJECTION AND VOLUME)

HINT:
If the injectors malfunction, engine misfire may occur. The misfire count can be read using the intelligent tester. Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / MISFIRE / CYL #1 (to CYL #4).

NG → REPLACE FUEL INJECTOR

OK

11 INSPECT HEATED OXYGEN SENSOR (HEATER RESISTANCE)



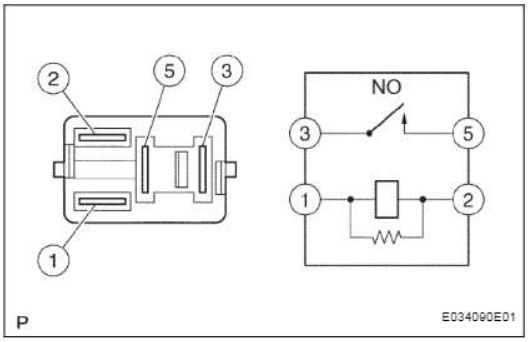
(a) Disconnect the H3 HO2 sensor connector.
(b) Measure the resistance of the HO2 sensor connector.
Standard resistance

Tester Connection	Specified Condition
HT (H3-1) - +B (H3-2)	11 to 16 Ω at 20°C (68°F)
HT (H3-1) - E1 (H3-4)	10 kΩ or higher

NG → REPLACE HEATED OXYGEN SENSOR

OK

12 INSPECT EFI RELAY (Marking: EFI)



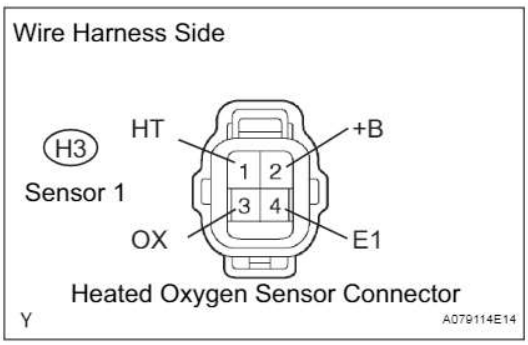
(a) Remove the EFI relay from the engine room relay block.
(b) Measure the resistance of the EFI relay.
Standard resistance

Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (When battery voltage is applied to terminals 1 and 2)

NG → REPLACE EFI RELAY

OK

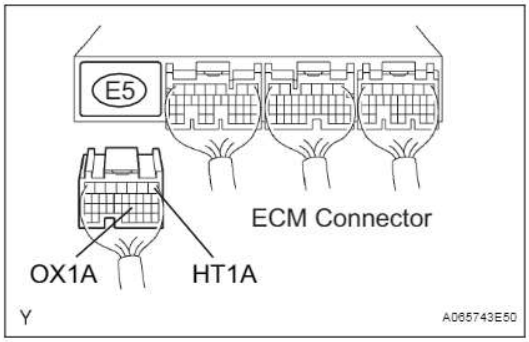
13 CHECK HARNESS AND CONNECTOR (HEATED OXYGEN SENSOR (SENSOR 1) - ECM)



(a) Disconnect the H3 HO2 sensor connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage between the +B terminal of the H3 HO2 sensor connector and body ground.
Standard voltage

Tester Connection	Specified Condition
+B (H3-2) - Body ground	9 to 14 V

(d) Turn the ignition switch OFF.



(e) Disconnect the E5 ECM connector.
(f) Measure the resistance of the wire harness side connectors.

Standard resistance (Check for open)

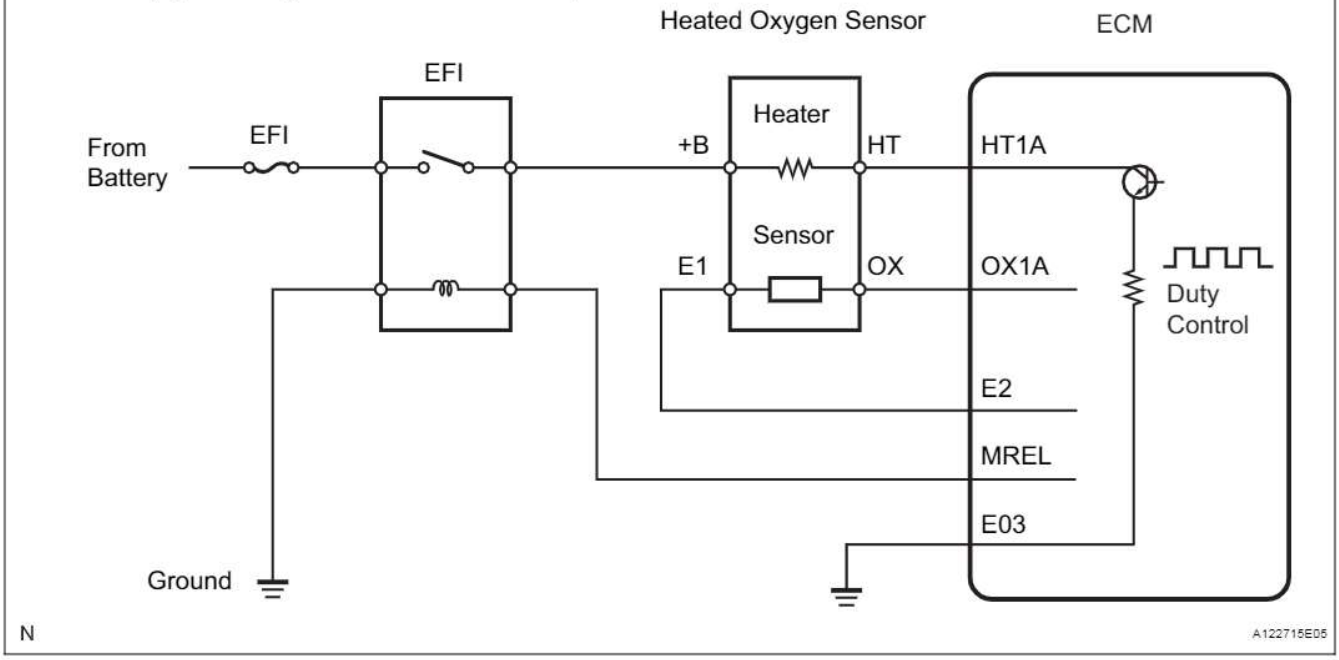
Tester Connection	Specified Condition
HT (H3-1) - HT1A (E5-1)	Below 1 Ω
OX (H3-3) - OX1A (E5-21)	Below 1 Ω
E1 (H3-4) - Body ground	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
HT (H3-1) or HT1A (E5-1) - Body ground	10 kΩ or higher
OX (H3-3) or OX1A (E5-21) - Body ground	10 kΩ or higher

ES

Reference (System Diagram of Bank 1 Sensor 1)



NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

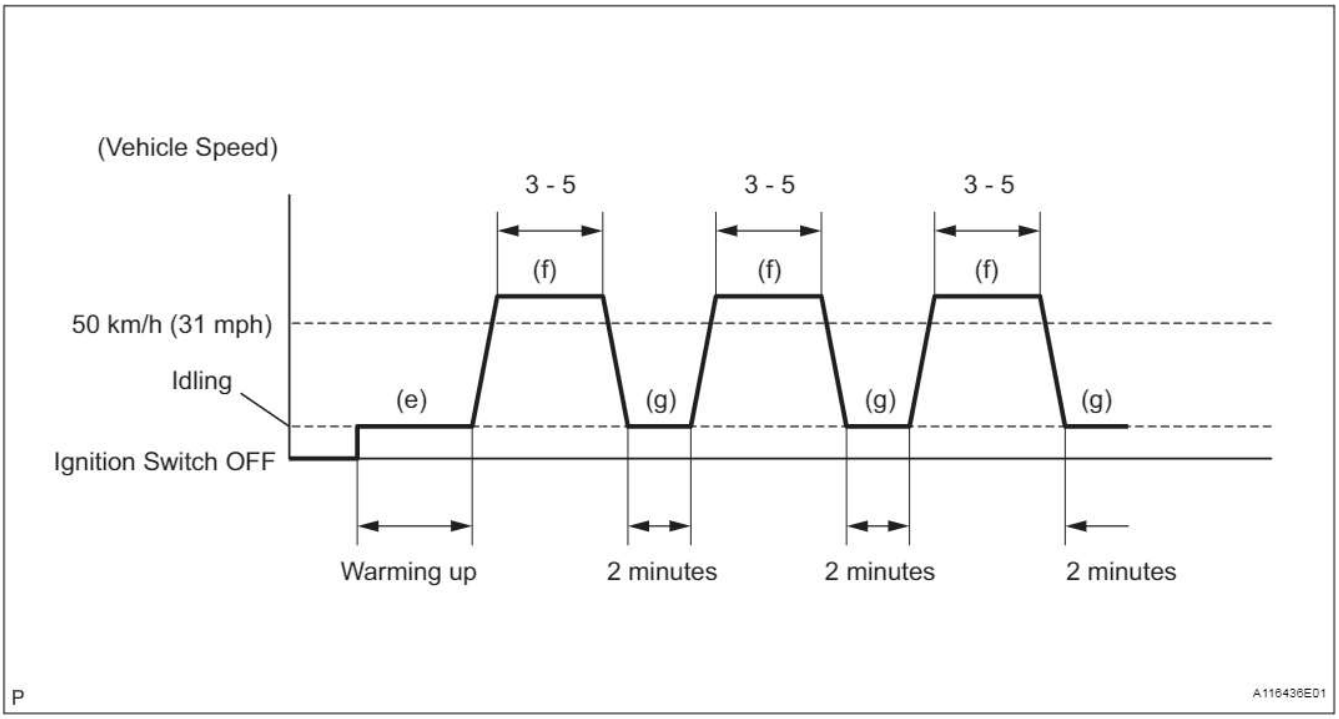
OK

14	REPLACE HEATED OXYGEN SENSOR (SENSOR 1)

(a) Replace the HO2 sensor (see page EC-20).

NEXT

15	PERFORM CONFIRMATION DRIVING PATTERN



(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Clear DTCs (see page ES-37).
(d) Switch the ECM from normal mode to check mode using the tester (see page ES-41).
(e) Start the engine and warm it up with all accessories switched OFF.
(f) Drive the vehicle at 50 km/h (31 mph) or more for 3 to 5 minutes.
(g) Allow the engine to idle for 2 minutes.
(h) Perform steps (f) and (g) at least 3 times.

NEXT

16	CHECK WHETHER DTC OUTPUT RECURS (DTC P0171 OR P0172)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read DTCs (see page ES-48).

Result

Display (DTC Output)	Proceed to
No output	A
P0171 or P0172	B

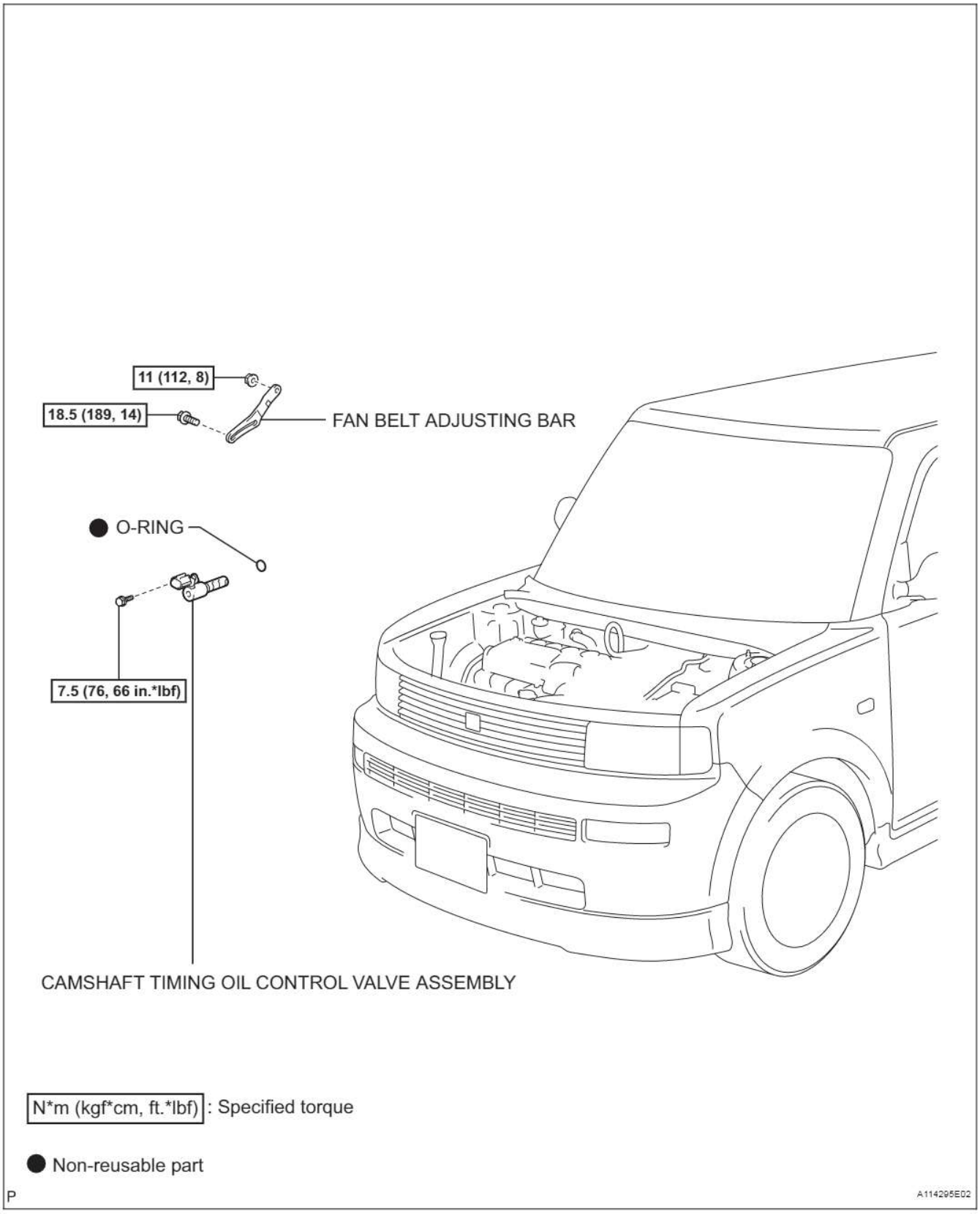
B → Go to step 5

A

END

CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

COMPONENTS

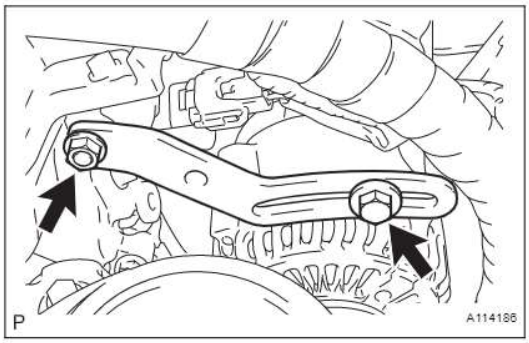


REMOVAL

1. DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL

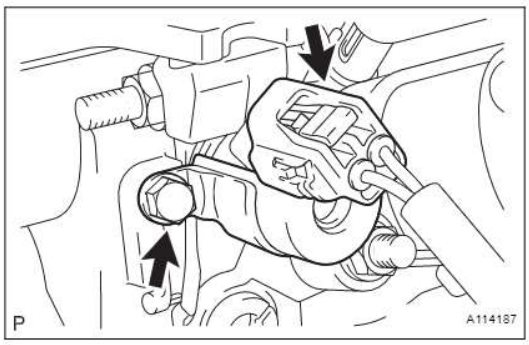
CAUTION:

Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.



2. REMOVE FAN BELT ADJUSTING BAR

(a) Remove the bolt, nut and adjusting bar.



3. REMOVE CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

(a) Disconnect the oil control valve connector.

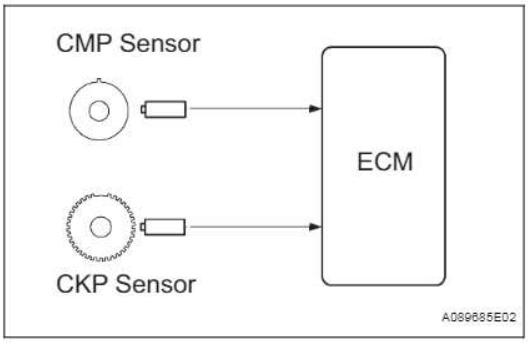
(b) Remove the bolt and oil control valve.

(c) Remove the O-ring from the oil control valve.

DTC	P0300	Random / Multiple Cylinder Misfire Detected
DTC	P0301	Cylinder 1 Misfire Detected
DTC	P0302	Cylinder 2 Misfire Detected
DTC	P0303	Cylinder 3 Misfire Detected
DTC	P0304	Cylinder 4 Misfire Detected

ES

DESCRIPTION



When the engine misfires, high concentrations of hydrocarbons (HC) enter the exhaust gas. Extremely high HC concentration levels can cause increases in exhaust emission levels. High concentrations of HC can also cause increases in the Three-Way Catalytic Converter (TWC) temperature, which may cause damage to the TWC. To prevent these increases in emissions and to limit the possibility of thermal damage, the ECM monitors the misfire rate. When the temperature of the TWC reaches the point of thermal degradation, the ECM blinks the MIL. To monitor misfires, the ECM uses both the Camshaft Position (CMP) sensor and the Crankshaft Position (CKP) sensor. The CMP sensor is used to identify any misfiring cylinders and the CKP sensor is used to measure variations in the crankshaft rotation speed. Misfires are counted when the crankshaft rotation speed variations exceed predetermined thresholds. If the misfire exceeds the threshold levels, and could cause emission deterioration, the ECM illuminates the MIL and sets a DTC.

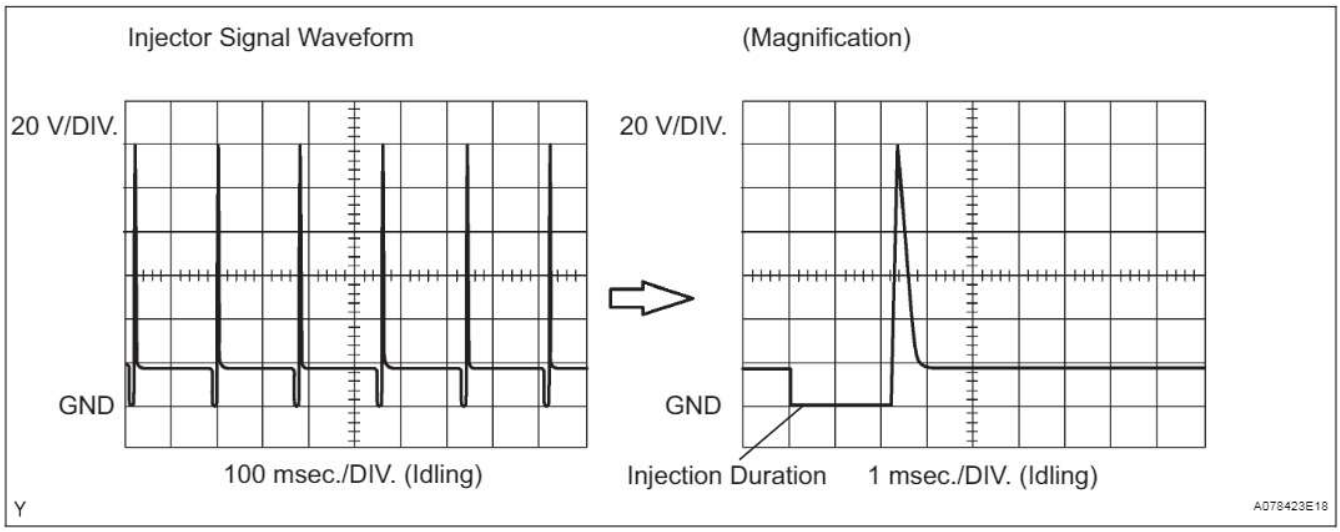
DTC No.	DTC Detection Condition	Trouble Area
P0300	Misfiring of random cylinders is detected (2 trip detection logic)	• Open or short in engine wire harness • Connector connections • Vacuum hose connections • Ignition system • Injector • Fuel pressure • Mass air flow meter • Engine coolant temperature sensor • Compression pressure • Valve clearance • Valve timing • Ventilation hose connections • Ventilation valve and hose • ECM
P0301 P0302 P0303 P0304	Misfiring of each cylinder is detected (2 trip detection logic)	

HINT:
When the DTCs for misfiring cylinders are recorded repeatedly but no random misfire DTC is recorded, it indicates that the misfires have been set and recorded at different times. Random misfire codes are recorded only when several misfires occur at the same time.
Reference: Inspection using the oscilloscope

With the engine idling, check the waveform between terminals #10 to #40 and E01 of the ECM connectors.

Item	Content
Terminals	#10 to #40 - E01
Equipment Settings	20 V/DIV., 100 or 1 ms/DIV.
Conditions	Idling

HINT:
The correct waveform is as shown.



MONITOR DESCRIPTION

The ECM illuminates the MIL and sets a DTC when either one of the following conditions, which could cause emission deterioration, is detected. (2 trip detection logic.)

- Within the first 1,000 crankshaft revolutions of the engine starting, an excessive misfiring rate (approximately 20 to 50 misfires per 1,000 crankshaft revolutions) occurs once.
- After the first 1,000 crankshaft revolutions, an excessive misfiring rate (approximately 20 to 60 misfires per 1,000 crankshaft revolutions) occurs 4 times in sequential crankshaft revolutions.

The ECM flashes the MIL and sets a DTC when either one of the following conditions, which could cause the Three-Way Catalytic Converter (TWC) damage, is detected (2 trip detection logic).

- In every 200 crankshaft revolutions at a high engine rpm, the threshold misfiring percentage is recorded once.
- In every 200 crankshaft revolutions at a normal engine rpm, the threshold misfiring percentage is recorded 3 times.

MONITOR STRATEGY

Related DTCs	P0300: Multiple cylinder misfire P0301: No. 1 cylinder misfire P0302: No. 2 cylinder misfire P0303: No. 3 cylinder misfire P0304: No. 4 cylinder misfire
Required sensors/ components (Main)	Injector, Ignition coil, Spark plug
Required sensors / components (Related)	Crankshaft, Camshaft, Engine coolant temperature, Intake air temperature sensors and Mass air flow meter
Frequency of operation	Continuous
Duration	1,000 to 4,000 crankshaft revolutions: Emission related misfire 200 to 600 crankshaft revolutions: Catalyst damaged misfire
MIL operation	2 driving cycles: Emission related misfire MIL flashes immediately: Catalyst damage misfire

Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	P0100 - P0103 (MAF meter) P0110 - P0113 (IAT sensor) P0115 - P0118 (ECT sensor) P0120 - P0123 (TP sensor) P0125 (insufficient ECT for closed loop) P0327 - P0328 (knock sensor) P0335 (crankshaft position sensor) P0340 (camshaft position sensor) P0500 (VSS)
Battery voltage	8 V or more
Engine RPM	450 rpm to 6,600 rpm
Both of following 1 and 2 met	-
1. Engine coolant temperature	-10°C (14°F) or more
2. Either of following conditions (a) or (b) met	-
(a) Engine coolant temperature at engine start	More than -7°C (19°F)
(b) Engine coolant temperature	More than 20°C (68°F)

Throttle position learning	Completed
VVT system	Not operated by scan tool
Fuel cut	OFF

Monitor period of emission-related misfire:

First 1,000 revolutions after engine start, or Check Mode	Crankshaft 1,000 revolutions
Except above	Crankshaft 1,000 revolutions x 4

Monitor period of emission-related misfire:

Except above	Crankshaft 200 revolutions x 3
All of following conditions 1, 2 and 3 are met	Crankshaft 200 revolutions
1. Driving cycles	1st
2. Check Mode	OFF
3. RPM	Less that 3,800 revolutions

TYPICAL MALFUNCTION THRESHOLDS

P0301 to P0304:

With conditions of either emission related misfire or catalyst damaged misfire met, specific misfiring cylinder DTCs set when misfire counts of those cylinders exceed threshold	7 or more per 1,000 revolutions

Emission-related-misfire:

Misfire rate	1.63% or more

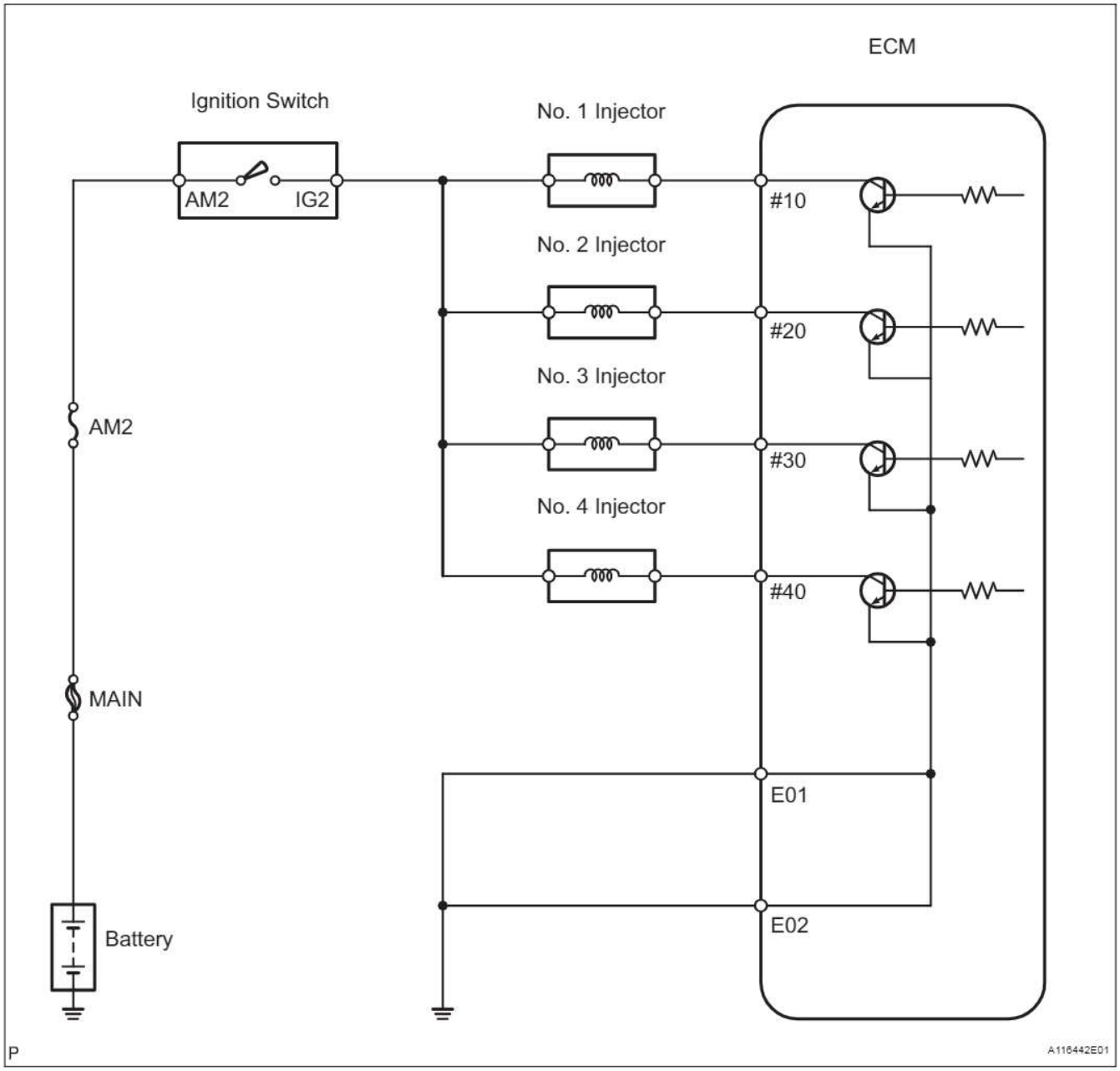
Catalyst-damage-misfire (MIL flashes immediately):

Misfire counts	136 or more* per 200 revolutions (at intake air amount: 0.3 g/rev and engine RPM: 1,600 rpm)

HINT:
*:The threshold value varies with the intake air amount and the engine RPM.

WIRING DIAGRAM

Refer to DTC P0351 (see page ES-189).



CONFIRMATION DRIVING PATTERN

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Record the DTC(s) and freeze frame data.
(d) Using the tester, switch the ECM from normal mode to check mode (see page ES-41).
(e) Read the misfire counts of each cylinder (CYL #1 to #4) with the engine in an idling condition. If any misfire count is displayed, skip the following confirmation driving pattern.
(f) Drive the vehicle several times with the conditions, such as engine rpm and engine load, shown in MISFIRE RPM, MISFIRE LOAD in the DATA LIST.
HINT:
In order to store misfire DTCs, it is necessary to drive the vehicle for the period of time shown in the table below, with the MISFIRE RPM and MISFIRE LOAD in the DATA LIST.

Engine RPM	Duration
Idling	3.5 minutes or more

Engine RPM	Duration
1,000 rpm	3 minutes or more
2,000 rpm	1.5 minutes or more
3,000 rpm	1 minute or more

(g) Check whether misfires have occurred by checking DTCs and freeze frame data.
HINT:
Do not turn the ignition switch OFF until the stored DTC(s) and freeze frame data have been recorded. When the ECM returns to normal mode (default), the stored DTC(s), freeze frame data and other data will be erased.
(h) Record the DTC(s), freeze frame data and misfire counts.
(i) Turn the ignition switch OFF and wait for at least 5 seconds.

ES

INSPECTION PROCEDURE

HINT:

- If any DTCs other than the misfire DTCs are output, troubleshoot those DTCs first.
- Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.
- If the misfire does not recur when the vehicle is brought to the workshop, reproduce the conditions stored in the freeze frame data.
- If the misfire still cannot be reproduced even though the conditions stored in the freeze frame data have been duplicated, one of the following factors is considered to be a possible cause of the problem:
  (a) The in the fuel tank is low.
  (b) Improper fuel is used.
  (c) The ignition plugs have been contaminated.
  (d) The problem is complex.
- After finishing repairs, check the misfire counts of the cylinders (CYL #1, #2, #3 and #4).
- Be sure to confirm that no misfiring cylinder DTCs are set again by conducting the confirmation driving pattern after repairs.
- For 6 and 8 cylinder engines, the ECM intentionally does not set the specific misfiring cylinder DTCs at high engine RPM. If misfires occur only in high engine RPM areas, only DTC P0300 is set.
  In the event of DTC P0300 being present, perform the following operations:
  (a) Clear the DTC (see page ES-37).
  (b) Start the engine and conduct the confirmation driving pattern.
  (c) Read the misfiring rates of each cylinder or DTC(s) using the tester.
  (d) Repair the cylinder(s) that has a high misfiring rate or is indicated by the DTC.
  (e) After finishing repairs, conduct the confirmation driving pattern again in order to verify that DTC P0300 is not set.
- When one of SHORT FT #1, LONG FT #1 in the freeze frame data is outside the range of +-20%, the air-fuel ratio may be rich (-20% or less) or lean (+20% or more).
- When the COOLANT TEMP in the freeze frame data is less than 75°C (167°F), the misfires have occurred only while warming up the engine.

1	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO MISFIRE DTCS)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read DTCs (see page ES-48).

Result

Display (DTC Output)	Proceed to
P0300, P0301, P0302, P0303 and/or P0304	A
P0300, P0301, P0302, P0303 and/or P0304 and other DTCs	B

HINT:
If any other DTCs besides P0300, P0301, P0302, P0303 and P0304 are output, perform troubleshooting for those DTCs first.

B → GO TO DTC CHART

A

ES

2 READ VALUE OF INTELLIGENT TESTER (MISFIRE RPM, MISFIRE LOAD)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / MISFIRE / MISFIRE RPM and MISFIRE LOAD.
(d) Read and note the MISFIRE RPM and the MISFIRE LOAD (engine load) values.
HINT:
The MISFIRE RPM and MISFIRE LOAD indicate the vehicle conditions under which the misfire occurred.

NEXT

3 CHECK VENTILATION HOSE CONNECTIONS

OK:
Ventilation hose is connected correctly, and is not damaged.

NG → REPAIR OR REPLACE VENTILATION HOSE

OK

4 CHECK MISFIRE COUNT (CYL #1, #2, #3, #4)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Clear DTC (see page ES-37).
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / MISFIRE / CYL #1, #2, #3 and #4.
(e) Allow the engine to idle.
(f) Read each value of CYL #1 to #4 displayed on the tester. If no misfire counts occur in any cylinders, perform the following operations:
(1) Move the gear selector lever to the D position.
(2) Repeat steps (c) and (d) above.
(3) Check the CYL #1 to #4.

(4) If misfire counts are still not displayed, repeat (e) and then check the misfire counts again.

(g) Drive the vehicle with the MISFIRE RPM and MISFIRE LOAD noted in step 2.

(h) Read the CYL #1 to #4 or DTCs displayed on the tester.

Result

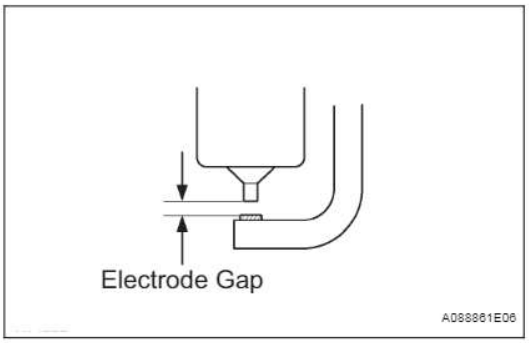
Misfire Count	Proceed to
1 or 2 cylinders have misfire counts	A
3 cylinders or more have misfire counts	B

B → **Go to step 13**

ES

A

5 CHECK SPARK PLUG



(a) Remove the No. 2 cylinder head cover (see page EM-40).

(b) Remove the ignition coil and the spark plug of misfire cylinder.

(c) Measure the spark plug electrode gap.

Standard gap:
0.7 to 0.8 mm (0.028 to 0.032 in.)
Maximum electrode gap:
1.16 mm (0.046 in.)

(d) Check the electrode for carbon deposits.

Recommended spark plug

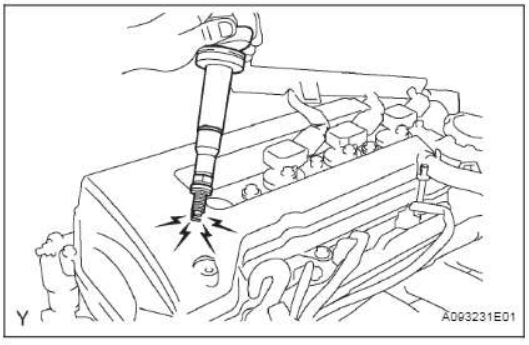
Manufacturer	Product
DENSO	K16R-U
NGK	BKR5EYA

NOTICE:
If the electrode gap is larger than the standard, replace the spark plug. Do not adjust the electrode gap.

NG → **REPLACE SPARK PLUG**

OK

6 CHECK SPARK AND IGNITION



(a) Disconnect the injector connectors to prevent the engine starting.

(b) Install the spark plug to the ignition coil.

(c) Attach the spark plug to the cylinder head cover.

(d) Crank the engine within 2 seconds and check the spark.

OK:
Spark jumps across electrode gap.

NG → **Go to step 8**

OK

7	CHECK CYLINDER COMPRESSION PRESSURE OF MISFIRING CYLINDER

(a) Measure the cylinder compression pressure of the misfiring cylinder.

OK → Go to step 9

NG

REPAIR OR REPLACE MALFUNCTIONING PARTS

ES

8	CHANGE TO NORMAL SPARK PLUG AND CHECK SPARK OF MISFIRING CYLINDER

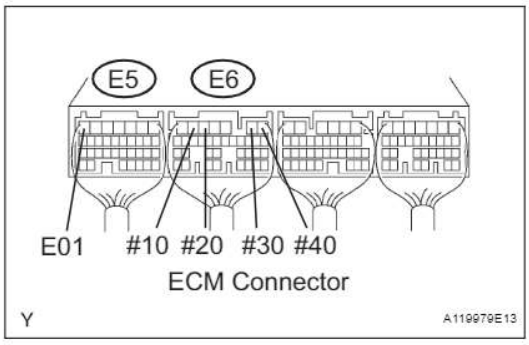
(a) Change to a normal spark plug.
(b) Perform a spark test.
CAUTION:
Always disconnect each injector connector.
NOTICE:
Do not crank the engine for more than 2 seconds.
(1) Install the spark plug to the ignition coil and connect the ignition coil connector.
(2) Disconnect the injector connector.
(3) Ground the spark plug.
(4) Check if sparks occur while the engine is being cranked.
OK:
Spark jumps across electrode gap.

NG → REPLACE IGNITION COIL, THEN CONFIRM THAT THERE IS NO MISFIRE

OK

REPLACE SPARK PLUG

9	INSPECT ECM TERMINAL OF MISFIRING CYLINDER (#10, #20, #30 AND/OR #40 VOLTAGE)



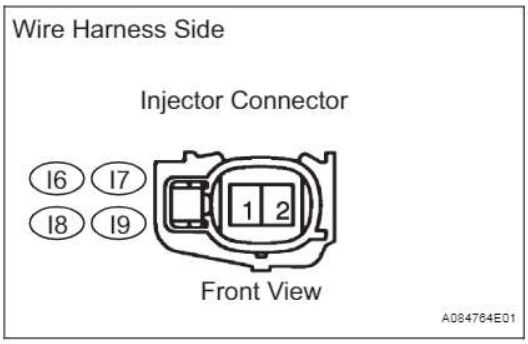
(a) Turn the ignition switch ON.
(b) Measure the voltage of the E5 and E6 ECM connectors.
Standard voltage

Tester Connection	Specified Condition
#10 (E6-6) - E01 (E5-7)	9 to 14 V
#20 (E6-5) - E01 (E5-7)	9 to 14 V
#30 (E6-2) - E01 (E5-7)	9 to 14 V
#40 (E6-1) - E01 (E5-7)	9 to 14 V

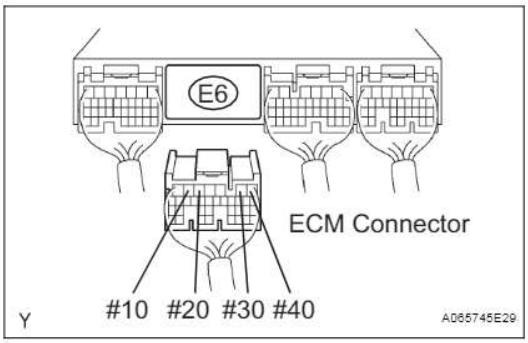
OK → Go to step 11

NG

10 CHECK HARNESS AND CONNECTOR (INJECTOR - ECM)



(a) Disconnect the injector connector (of the misfire cylinder).



(b) Disconnect the E6 ECM connector.
(c) Turn the ignition switch ON.
(d) Measure the resistance and voltage between the injector and the ECM connector terminals.

Standard voltage

Tester Connection	Specified Condition
I6-1 - Body ground	11 to 14 V
I7-1 - Body ground	11 to 14 V
I8-1 - Body ground	11 to 14 V
I9-1 - Body ground	11 to 14 V

(e) Measure the resistance of the wire harness side connectors.

Standard resistance

Cylinder	Tester Connection	Specified Condition
No. 1	I6-2 - Body ground	10 kΩ or higher
No. 1	I6-2 - #10 (E6-6)	Below 1 Ω
No. 2	I7-2 - Body ground	10 kΩ or higher
No. 2	I7-2 - #20 (E6-5)	Below 1 Ω
No. 3	I8-2 - Body ground	10 kΩ or higher
No. 3	I8-2 - #30 (E6-2)	Below 1 Ω
No. 4	I9-2 - Body ground	10 kΩ or higher
No. 4	I9-2 - #40 (E6-1)	Below 1 Ω

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

11 CHECK FUEL INJECTOR OF MISFIRING CYLINDER

(a) Check the injector injection (whether fuel volume is high or low, and whether injection pattern is poor).

NG → REPLACE FUEL INJECTOR

OK

12	CHECK VALVE CLEARANCE OF MISFIRING CYLINDER

NG → ADJUST VALVE CLEARANCE

OK

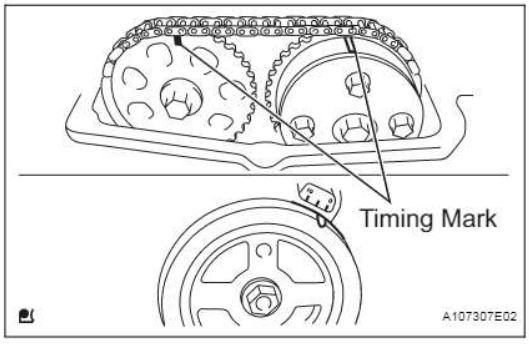
13	CHECK AIR INDUCTION SYSTEM

(a) Check the air induction system for vacuum leaks.
OK:
No leakage from air induction system.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

14	CHECK VALVE TIMING



(a) Remove the cylinder head cover (see page EM-25).
(b) Turn the crankshaft pulley, then align its groove with the timing mark "0" of the timing chain cover.
(c) Check that both timing marks on the camshaft timing sprocket and camshaft timing gear are facing upward as shown in the illustration.
If not, turn the crankshaft 1 revolution (360°), then align the marks as above.
OK:
Timing marks on camshaft timing gears are aligned with timing chain cover surface.

NG → ADJUST VALVE TIMING

OK

15	CHECK FUEL PRESSURE

(a) Check the fuel pressure (see page FU-7).

NG → CHECK AND REPLACE FUEL PUMP, PRESSURE REGULATOR, FUEL PIPE LINE AND FILTER

OK

16	READ VALUE OF INTELLIGENT TESTER (COOLANT TEMP)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.

(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / COOLANT TEMP.
(d) Read the COOLANT TEMP twice when the engine is both cold and warmed up.
Standard:
With cold engine: Same as ambient air temperature.
With warm engine: 75°C to 95°C (167°F to 203°F).

NG → **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK

ES

17	READ VALUE OF INTELLIGENT TESTER (MAF)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / MAF and COOLANT TEMP.
(d) Allow the engine to idle until the COOLANT TEMP reaches 75°C (167°F) or more.
(e) Read the MAF with the engine in an idling condition and at an engine speed of 2,500 rpm.
Standard:
MAF while engine idling: Between 1.4 g/sec. and 2.3 g/sec. (shift position: N; A/C: OFF).
MAF at engine speed of 2,500 rpm: 5.4 g/sec. to 7.9 g/sec. (shift position: N; A/C: OFF).

NG → **REPLACE MASS AIR FLOW METER**

OK

CHECK FOR INTERMITTENT PROBLEMS

DTC	P0327	Knock Sensor 1 Circuit Low Input (Bank 1 or Single Sensor)

DTC	P0328	Knock Sensor 1 Circuit High Input (Bank 1 or Single Sensor)

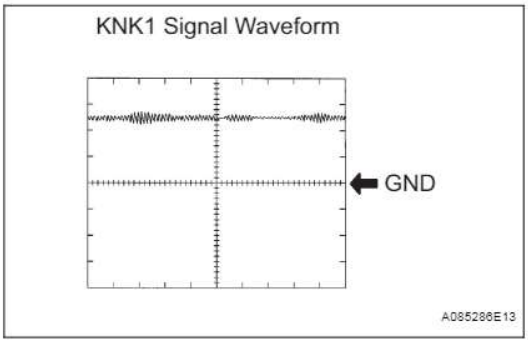
DESCRIPTION

A flat type knock sensor (non-resonant type) has a structure that can detect vibrations between approximately 6 kHz and 15 kHz.
Knock sensors are fitted onto the engine block to detect engine knocking.
The knock sensor contains a piezoelectric element which generates a voltage when it becomes deformed. The voltage is generated when the engine block vibrates due to knocking. Any occurrence of engine knocking can be suppressed by delaying the ignition timing.

ES

DTC No.	DTC Detection Condition	Trouble Area
P0327	Output voltage of knock sensor 0.5 V or less (1 trip detection logic)	• Short in knock sensor circuit • Knock sensor • ECM
P0328	Output voltage of knock sensor 4.5 V or more (1 trip detection logic)	• Open in knock sensor circuit • Knock sensor • ECM

HINT:
When any of DTCs P0327 and P0328 are set, the ECM enters fail-safe mode. During fail-safe mode, the ignition timing is delayed to its maximum retardation. Fail-safe mode continues until the ignition switch is turned OFF.



Reference: Inspection using an oscilloscope.
The correct waveform is as shown.

Items	Contents
Terminals	KNK1 - EKNK
Equipment Settings	0.01 to 10 V/DIV., 0.01 to 10 msec./DIV.
Conditions	keep engine speed at 4,000 rpm with warm engine

MONITOR DESCRIPTION

If the output voltage transmitted by the knock sensor remains low or high for more than 1 second, the ECM interprets this as a malfunction in the sensor circuit, and sets a DTC.
The monitor for DTCs P0327 and P0328 begins to run when 5 seconds have elapsed since the engine was started.
If the malfunction is not repaired successfully, either DTC P0327 or P0328 is set 5 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0327: Knock sensor range check (low voltage) P0328: Knock sensor range check (high voltage)
Required Sensors/Components (Main)	Knock sensor
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	1 second
MIL Operation	Immediate
Sequence of Operation	None

ES

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	None
Battery voltage	10.5 V or more
Starter	OFF
Engine	Running

TYPICAL MALFUNCTION THRESHOLDS

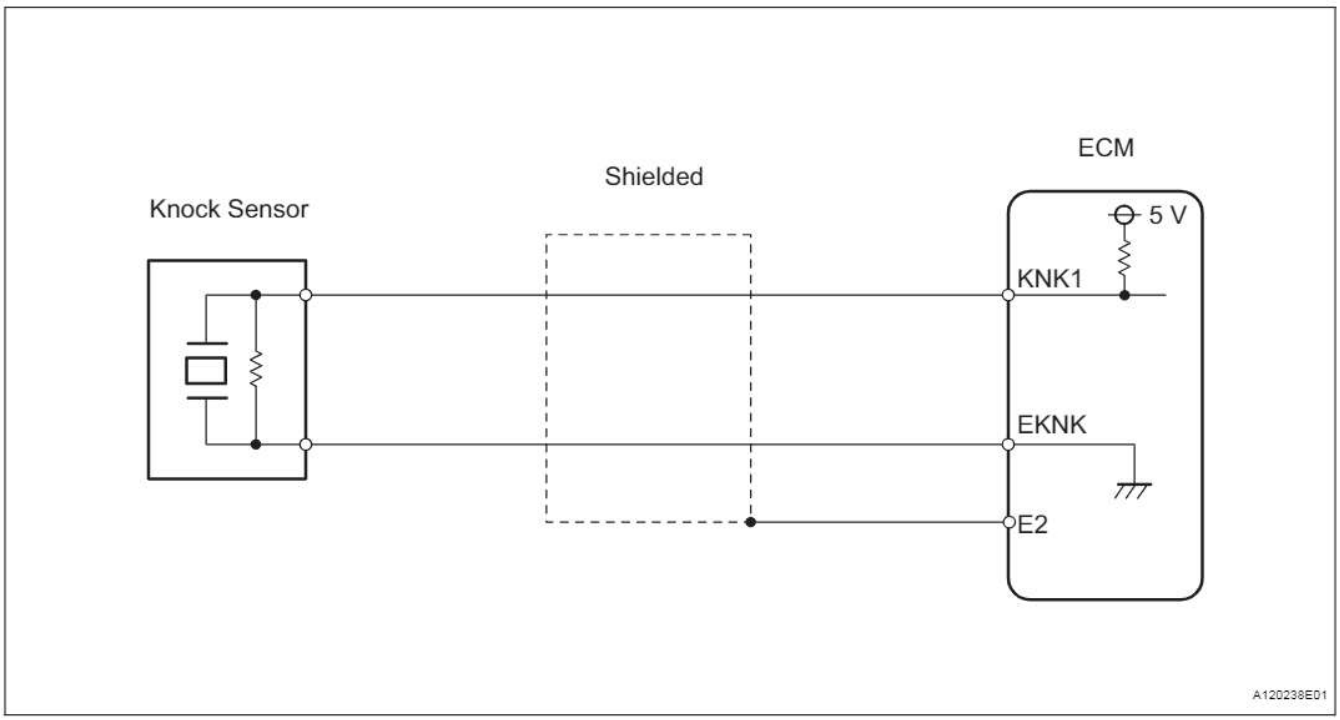
Knock Sensor Range Check (Low voltage) P0327:

Knock sensor voltage	Less than 0.5 V

Knock Sensor Range Check (High voltage) P0328:

Knock sensor voltage	More than 4.5 V

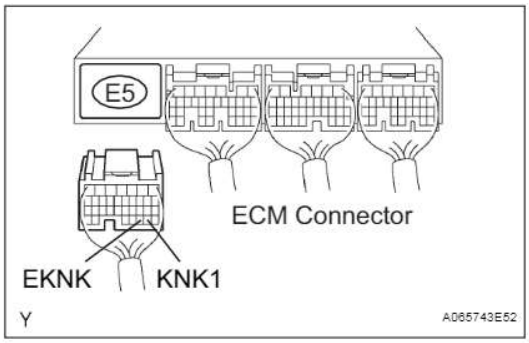
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 CHECK WIRE HARNESS (ECM - KNOCK SENSOR)



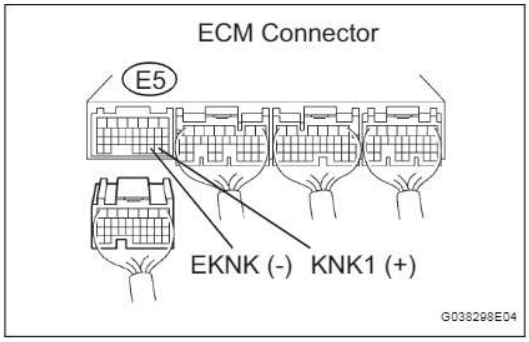
(a) Disconnect the E5 ECM connector.
(b) Measure the resistance of the ECM connector.
Standard resistance

Tester Connection	Specified Condition
KNK1 (E5-29) - EKNK (E5-30)	120 to 280 kΩat 20°C (68°F)

NG → **Go to step 3**

OK

2 INSPECT ECM (KNK1 VOLTAGE)



(a) Disconnect the E5 ECM connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage of the ECM connector.
Standard voltage

Tester Connection	Specified Condition
KNK1 (E5-29) - EKNK (E5-30)	4.5 to 5.5 V

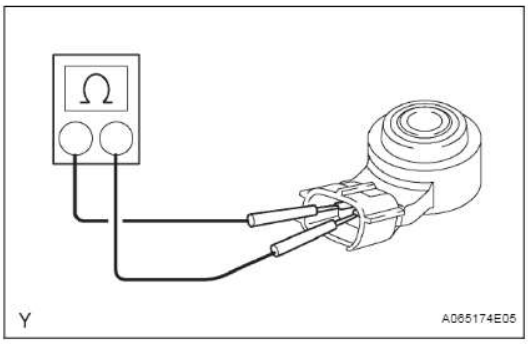
NOTICE:
Fault may be intermittent. Check the wire harness and connectors carefully.

NG → **REPLACE ECM**

OK

CHECK FOR INTERMITTENT PROBLEMS

3	INSPECT KNOCK SENSOR



(a) Remove the knock sensor (see page ES-358).
(b) Measure the resistance of the sensor.
Standard resistance

Tester Connection	Specified Condition
KNK1 (K1-2) - EKNK (K1-1)	120 to 280 kΩ at 20°C (68°F)

NG → REPLACE KNOCK SENSOR

OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

DTC	P0335	Crankshaft Position Sensor "A" Circuit

DTC	P0339	Crankshaft Position Sensor "A" Circuit Intermittent

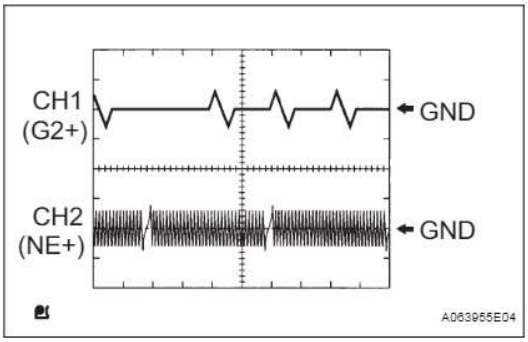
DESCRIPTION

The Crankshaft Position (CKP) sensor system consists of a CKP sensor plate and a pickup coil. The sensor plate has 34 teeth and is installed on the crankshaft. The pickup coil is made of an iron core and a magnet. The sensor plate rotates and, as each tooth passes through the pickup coil, a pulse signal is created. The pickup coil generates 34 signals per engine revolution. Based on these signals, the ECM calculates the crankshaft position and engine RPM. Using these calculations, the fuel injection time and ignition timing are controlled.

ES

DTC No.	DTC Detection Condition	Trouble Area
P0335	• No Crankshaft Position (CKP) sensor signal to ECM while cranking (2 trip detection logic) • No CKP sensor signal to ECM at engine speed of 600 rpm or more (2 trip detection logic)	• Open or short in Crankshaft Position (CKP) sensor circuit • CKP sensor • Crankshaft (sensor plate) • ECM
P0339	Under conditions (a), (b) and (c), no CKP sensor signal to ECM for 0.05 seconds or more (1 trip detection logic): (a) Engine speed 1,000 rpm or more (b) Starter signal OFF (c) 3 seconds or more has lapsed since starter signal switched from ON to OFF	• Open or short in CKP sensor circuit • CKP sensor • Crankshaft (sensor plate) • ECM

Reference: Inspection using an oscilloscope.



HINT:

- The correct waveform is as shown in the illustration.
- G2+ stands for the Camshaft Position (CMP) sensor signal, and NE+ stands for the CKP sensor signal.

Items	Contents
Terminals	CH1: G2+ - NE- CH2: NE+ - NE-
Equipment Settings	5V/DIV., 20msec./DIV.
Conditions	Cranking or idling

MONITOR DESCRIPTION

If there is no signal from the CKP sensor despite the engine revolving, the ECM interprets this as a malfunction of the sensor.
If the malfunction is not repaired successfully, a DTC is set 10 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0335: Crankshaft position sensor range check during cranking P0335: Crankshaft position sensor range check during engine running
Required sensors/components (Main)	Crankshaft Position (CKP) sensor
Required sensors/components (Related)	-
Frequency of operation	Continuous
Duration	4.7 seconds: CKP sensor range check during cranking 0.5 seconds: CKP sensor range check during engine running
MIL operation	Immediate
Sequence of operation	None

ES

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	None

Crankshaft Position Sensor Range Check during Cranking P0335:

Starter	ON
Minimum battery voltage while starter ON	Less than 11 V

Crankshaft Position Sensor Range Check during Engine Running P0335:

Engine speed	600 rpm or more
Starter	OFF
Time after starter from ON to OFF	3 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

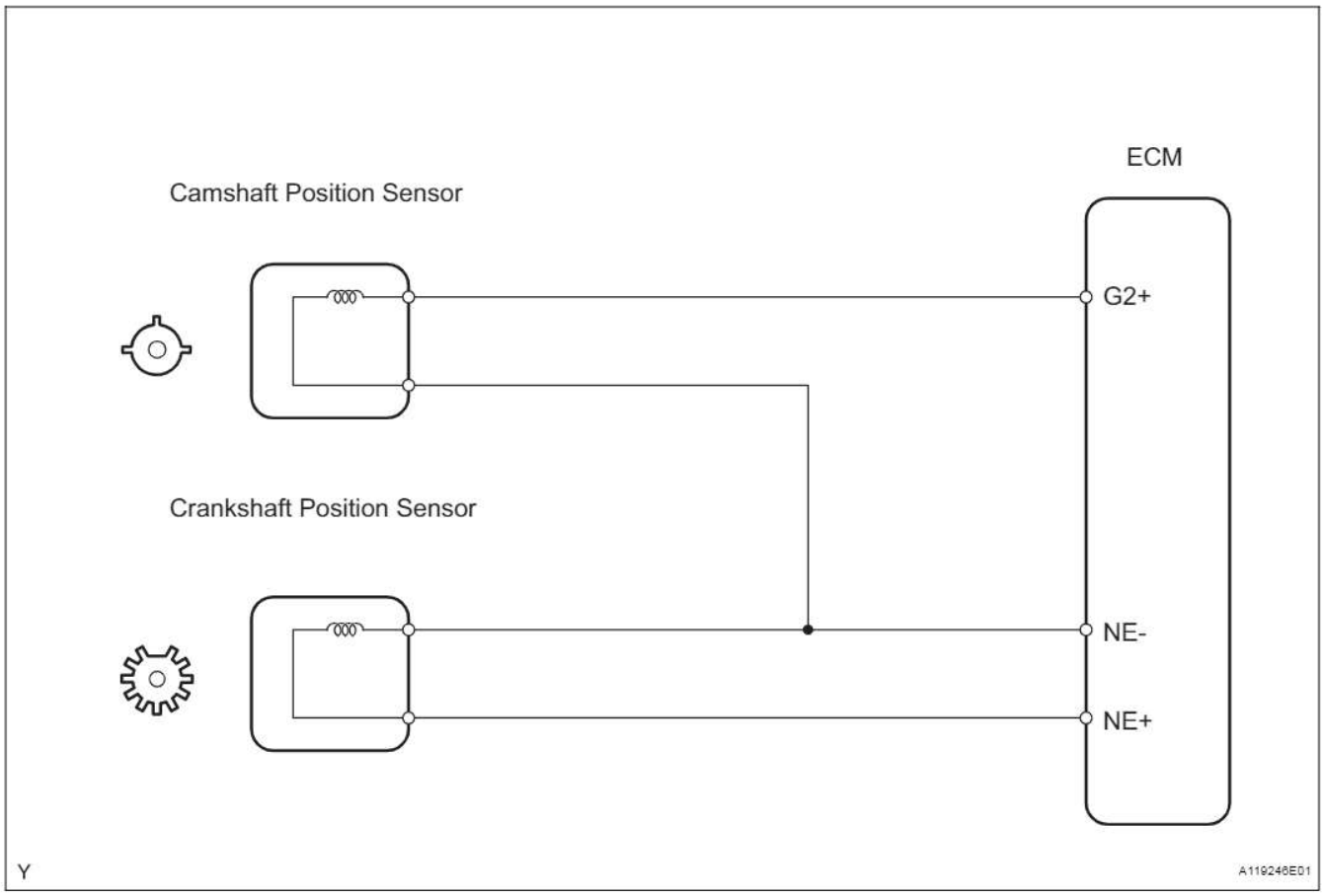
P0335, P0339:

CKP signal during cranking	No signal for 0.5 seconds
CKP signal during engine running	No signal for 4.7 seconds

COMPONENT OPERATING RANGE

CKP sensor	• CKP sensor output voltage fluctuates while crankshaft revolving • 34 CKP sensor signals per crankshaft revolution

WIRING DIAGRAM

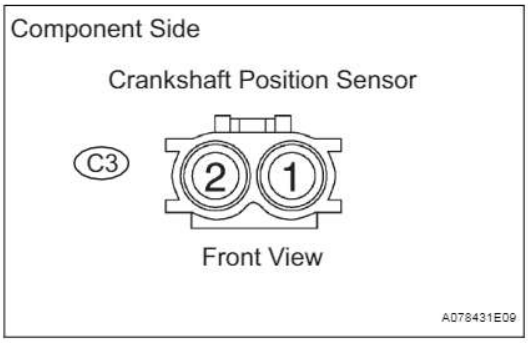


INSPECTION PROCEDURE

HINT:

- If no problem is found by this diagnostic troubleshooting procedure, troubleshoot the engine mechanical systems.
- Check the engine speed. The engine speed can be checked by using the intelligent tester. To check, follow the operation below:
  (a) Connect the intelligent tester to the DLC3.
  (b) Start the engine.
  (c) Turn the tester ON.
  (d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / ENGINE SPD.
  The engine speed may be indicated as zero despite the engine revolving normally. This is caused by a lack of NE signals from the Crankshaft Position (CKP) sensor. Alternatively, the engine speed may be indicated as lower than the actual engine speed if the CKP sensor voltage output is insufficient.
- Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 INSPECT CRANKSHAFT POSITION SENSOR (RESISTANCE)



(a) Disconnect the C3 Crankshaft Position (CKP) sensor connector.
(b) Measure the resistance between terminals 1 and 2.
Standard resistance

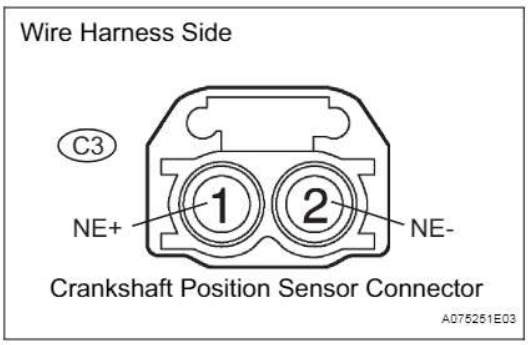
Tester Connection	Specified Condition
1 - 2	985 to 1,600 Ω at cold
1 - 2	1,265 to 1,890 Ω at hot

HINT:
The terms cold and hot refer to the temperature of the sensor. Cold means approximately -10 to 50°C (14 to 122°F). Hot means approximately 50 to 100°C (122 to 212°F).

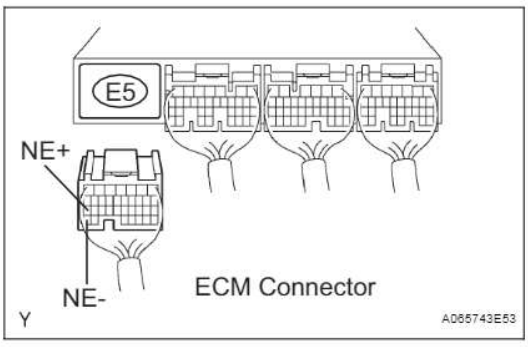
NG → **REPLACE CRANKSHAFT POSITION SENSOR**

OK

2 CHECK HARNESS AND CONNECTOR (CRANKSHAFT POSITION SENSOR - ECM)



(a) Disconnect the C3 CKP sensor connector.



(b) Disconnect the E5 ECM connector.
(c) Measure the resistance of the harness and connectors.
Standard resistance (Check for open)

Tester connection	Specified Condition
NE+ (C3-1) - NE+ (E5-27)	Below 1 Ω
NE- (C3-2) - NE- (E5-34)	Below 1 Ω

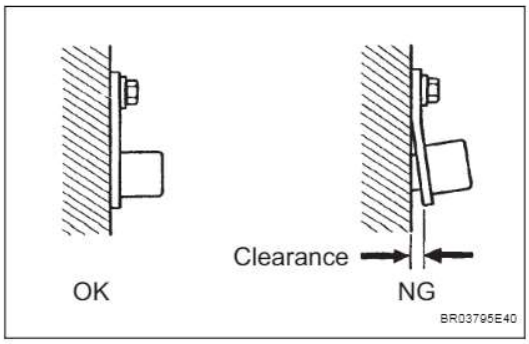
Standard resistance (Check for short)

Tester connection	Specified Condition
NE+ (C3-1) or NE+ (E5-27) - Body ground	10 kΩ or higher
NE- (C3-2) or NE- (E5-34) - Body ground	10 kΩ or higher

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

3	CHECK SENSOR INSTALLATION (CRANKSHAFT POSITION SENSOR)



(a) Check the CKP sensor installation.
OK:
Sensor is installed correctly.

NG → **SECURELY REINSTALL SENSOR**

OK

4	CHECK CRANKSHAFT (TEETH OF SENSOR PLATE)

(a) Check the teeth of the sensor plate.
OK:
Sensor plate teeth do not have any cracks or deformation.

NG → **REPLACE CRANKSHAFT**

OK

REPLACE ECM

DTC	P0340	Camshaft Position Sensor "A" Circuit (Bank 1 or Single Sensor)

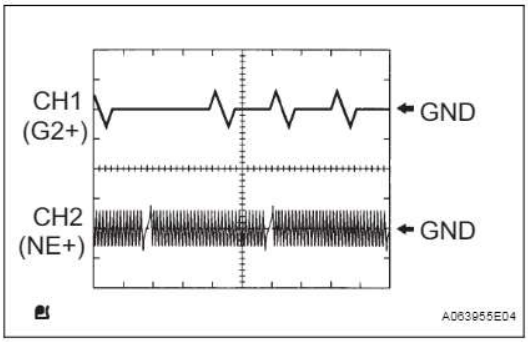
DESCRIPTION

The Camshaft Position (CMP) sensor consists of a magnet and an iron core which is wrapped with copper wire, and is installed on the cylinder head. When the camshaft rotates, each of the 3 teeth on the camshaft pass through the CMP sensor. This activates the internal magnet in the sensor, generating a voltage in the copper wire. The camshaft rotation is synchronized with the crankshaft rotation. When the crankshaft turns twice, the voltage is generated 3 times in the CMP sensor. The generated voltage in the sensor acts as a signal, allowing the ECM to locate the camshaft position. This signal is then used to control ignition timing, fuel injection timing, and the VVT system.

ES

DTC No.	DTC Detection Condition	Trouble Area
P0340	Case 1 Either of following conditions is met: • Crankshaft position/Camshaft position misalignment • No CMP sensor signal to ECM at engine speed of 600 rpm or more (1 trip detection logic) Case 2 • No CMP sensor signal to ECM while cranking (2 trip detection logic)	• Open or short in CMP sensor circuit • CMP sensor • Camshaft • Timing chain has jumped tooth • ECM

HINT:
DTC P0340 indicates a malfunction relating to the CMP sensor (+) circuit (the wire harness between the ECM and CMP sensor, and the CMP sensor itself).
Reference: Inspection using an oscilloscope.



HINT:
- The correct waveform is as shown in the illustration.
- G2+ stands for the CMP sensor signal, and NE+ stands for the Crankshaft Position (CKP) sensor signal.

Items	Contents
Terminals	CH1: G2+ - NE- CH2: NE+ - NE-
Equipment Settings	5V/DIV., 20msec./DIV.
Conditions	Cranking or idling

MONITOR DESCRIPTION

If no signal is transmitted by the CMP sensor despite the engine revolving, or the rotation of the camshaft and the crankshaft is not synchronized, the ECM interprets this as a malfunction of the sensor.
If the malfunction is not repaired successfully, a DTC is set 10 seconds after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0340: Camshaft position sensor range check P0340: Camshaft position/crankshaft position misalignment
Required sensors / components (Main)	Camshaft Position (CMP) sensor
Required sensors / components (Related)	Crankshaft Position (CKP) sensor
Frequency of operation	Continuous
Duration	5 seconds
MIL operation	2 driving cycles: CMP sensor range check Immediate: Camshaft position/crankshaft position misalignment
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	None

Camshaft Position Sensor Range Check P0340:

Starter	ON
Minimal battery voltage while starter ON	11 V

Camshaft Position/Crankshaft Position Misalignment P0340:

Engine speed	600 rpm or more
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

Camshaft Position Sensor Range Check P0340:

CMP sensor signal	No signal

Camshaft Position/Crankshaft Position Misalignment P0340:

Camshaft position and crankshaft position phase	Misaligned

COMPONENT OPERATING RANGE

CMP sensor	• CMP sensor output voltage fluctuates while camshaft revolving • 3 CMP sensor signals per 2 crankshaft revolutions

WIRING DIAGRAM

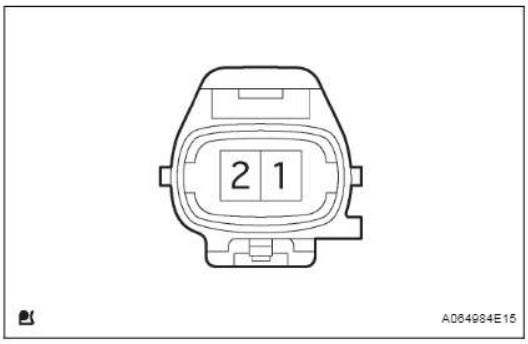
Refer to DTC P0335 (see page ES-178).

INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 INSPECT CAMSHAFT POSITION SENSOR (RESISTANCE)



(a) Disconnect the C1 Camshaft Position (CMP) sensor connector.
(b) Measure the resistance between terminals 1 and 2.
Standard resistance

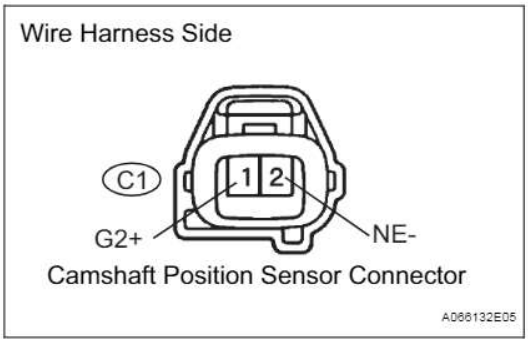
Tester Connection	Specified Condition
1 - 2	1,630 to 2,740 Ω at cold
1 - 2	2,065 to 3,225 Ω at hot

HINT:
The terms cold and hot refer to the temperature of the sensor. Cold means approximately -10 to 50°C (14 to 122°F). Hot means approximately 50 to 100°C (122 to 212°F).

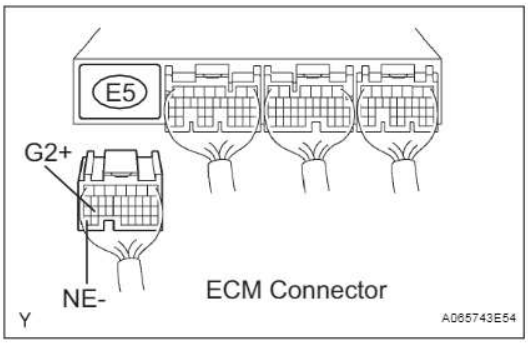
NG → **REPLACE CAMSHAFT POSITION SENSOR**

OK

2 CHECK HARNESS AND CONNECTOR (CAMSHAFT POSITION SENSOR - ECM)



(a) Disconnect the C1 CMP sensor connector.



(b) Disconnect the E5 ECM connector.
(c) Measure the resistance of the wire harness side connectors.
Standard resistance (Check for open)

Tester Connection	Specified Condition
G2+ (C1-1) - G2+ (E5-26)	Below 1 Ω
NE- (C1-2) - NE- (E5-34)	Below 1 Ω

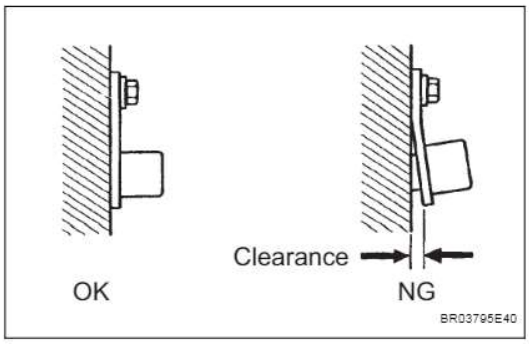
Standard resistance (Check for short)

Tester Connection	Specified Condition
G2+ (C1-1) or G2+ (E5-26) - Body ground	10 kΩ or higher
NE- (C1-2) or NE- (E5-34) - Body ground	10 kΩ or higher

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

3	CHECK SENSOR INSTALLATION (CAMSHAFT POSITION SENSOR)



(a) Check the CMP sensor installation.
OK:
Sensor is installed correctly.

NG → **SECURELY REINSTALL SENSOR**

OK

4	CHECK CAMSHAFT (TEETH OF PLATE)

(a) Check the teeth of the camshaft.
OK:
Camshaft teeth do not have any cracks or deformation.

NG → **REPLACE CAMSHAFT**

OK

REPLACE ECM

DTC	P0351	Ignition Coil "A" Primary / Secondary Circuit
DTC	P0352	Ignition Coil "B" Primary / Secondary Circuit
DTC	P0353	Ignition Coil "C" Primary / Secondary Circuit
DTC	P0354	Ignition Coil "D" Primary / Secondary Circuit

DESCRIPTION

HINT:

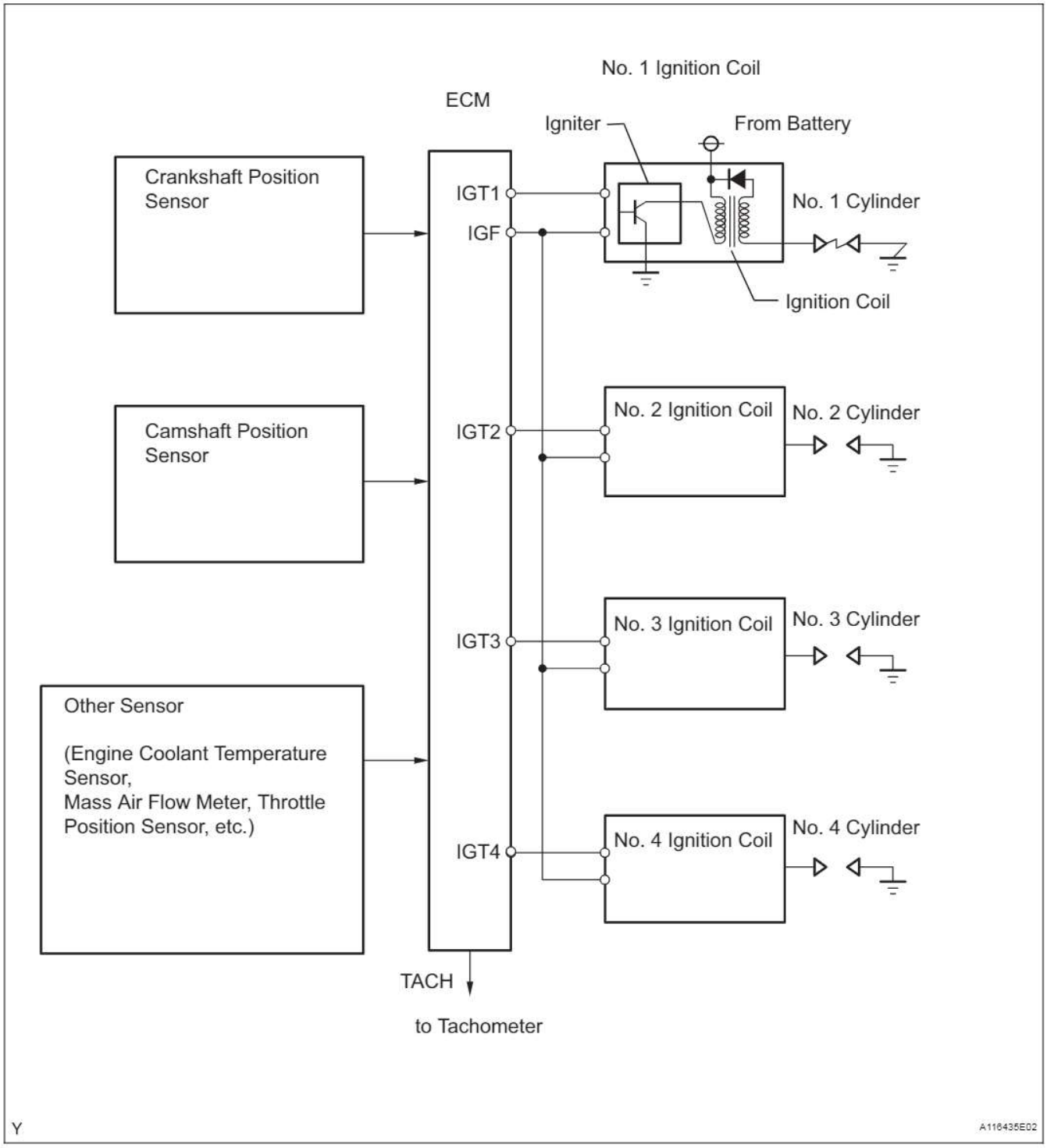
ES

- These DTCs indicate malfunctions relating to the primary circuit.
- If DTC P0351 is set, check No. 1 ignition coil circuit.
- If DTC P0352 is set, check No. 2 ignition coil circuit.
- If DTC P0353 is set, check No. 3 ignition coil circuit.
- If DTC P0354 is set, check No. 4 ignition coil circuit.

A Direct Ignition System (DIS) is used on this vehicle.

The DIS is a 1-cylinder ignition system in which each cylinder is ignited by 1 ignition coil, and 1 spark plug is connected to the end of each secondary wiring. A powerful voltage, generated in the secondary wiring, is applied directly to each spark plug. The sparks of the spark plugs pass from the center electrodes to the ground electrodes.

The ECM determines the ignition timing and transmits the ignition (IGT) signals to each cylinder. Using the IGT signal, the ECM turns the power transistor inside the igniter on and off. The power transistor, in turn, switches on and off the current to the primary coil. When the current to the primary coil is cut off, a powerful voltage is generated in the secondary coil. This voltage is applied to the spark plugs, causing them to spark inside the cylinders. As the ECM cuts the current to the primary coil, the igniter sends back an ignition confirmation (IGF) signal to the ECM, for each cylinder ignition.



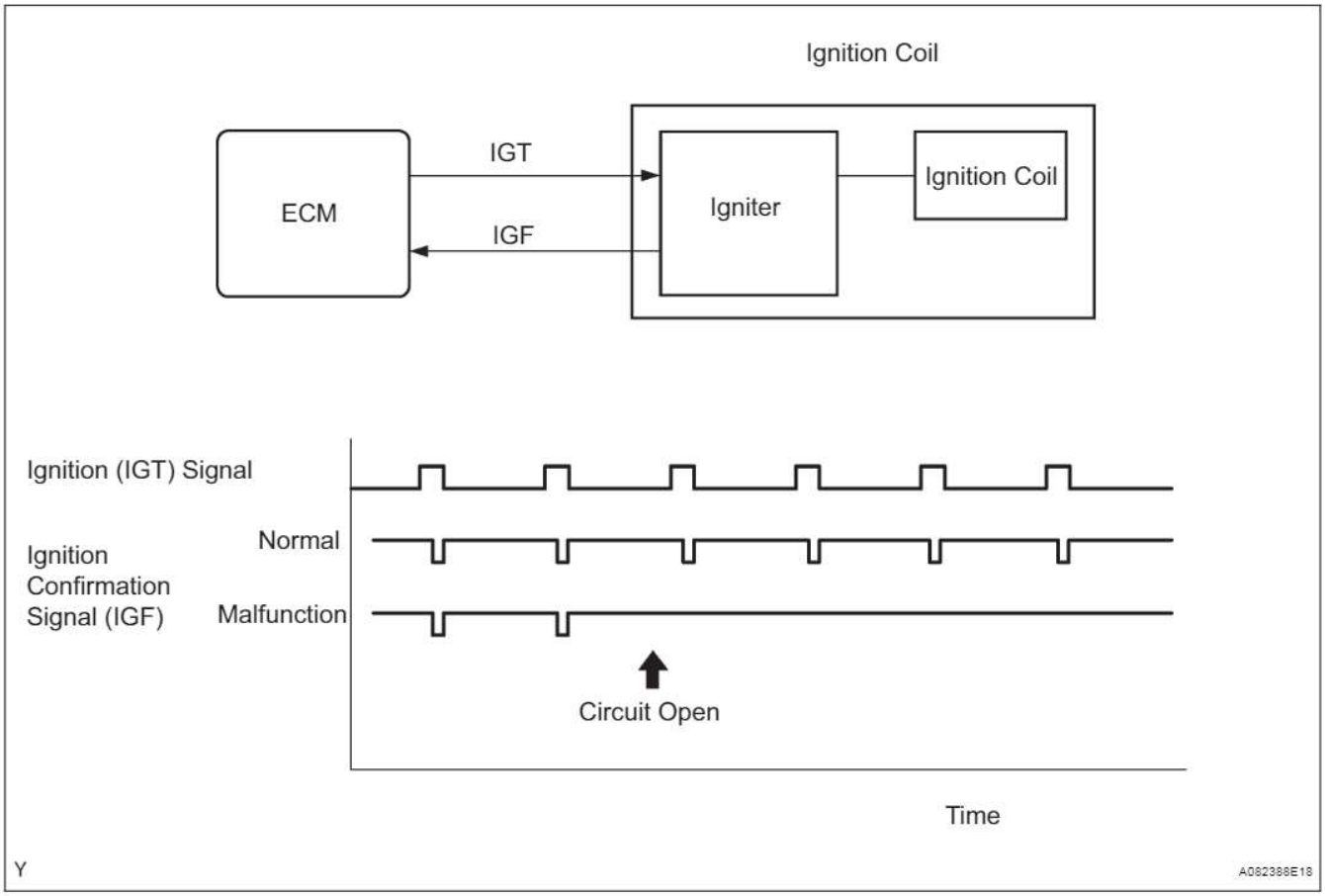
DTC No.	DTC Detection Condition	Trouble Area
P0351 P0352 P0353 P0354	No IGF signal to ECM while engine is running (1 trip detection logic)	• Ignition system • Open or short in IGF or IGT circuit (1 to 4) between ignition coil and ECM • No. 1 to No. 4 ignition coil • ECM

Reference: Inspection using an oscilloscope.

While cranking or idling, check the waveform between terminals IGT (1 to 4) and E1, and IGF and E1 of the E5 ECM connectors.

Item	Content
Terminals	CH1: IGT1, IGT2, IGT3, IGT4 - E1 CH2: IGF - E1
Equipment Settings	2 V/DIV., 20 ms/DIV.
Conditions	Cranking or idling

MONITOR DESCRIPTION



If the ECM does not receive any IGF1 signals despite transmitting the IGT signal, it interprets this as a fault in the igniter and sets a DTC.
If the malfunction is not repaired successfully, a DTC is set 1 second after the engine is next started.

MONITOR STRATEGY

Related DTCs	P0351: Igniter (Cylinder 1) malfunction P0352: Igniter (Cylinder 2) malfunction P0353: Igniter (Cylinder 3) malfunction P0354: Igniter (Cylinder 4) malfunction
Required sensors / components (Main)	Igniter
Required sensors / components (Related)	Crankshaft position sensor
Frequency of operation	Continuous
Duration	0.256 seconds
MIL operation	Immediate
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	None
Either of following conditions met	-
Engine RPM	1,500 rpm or less
Starter	OFF

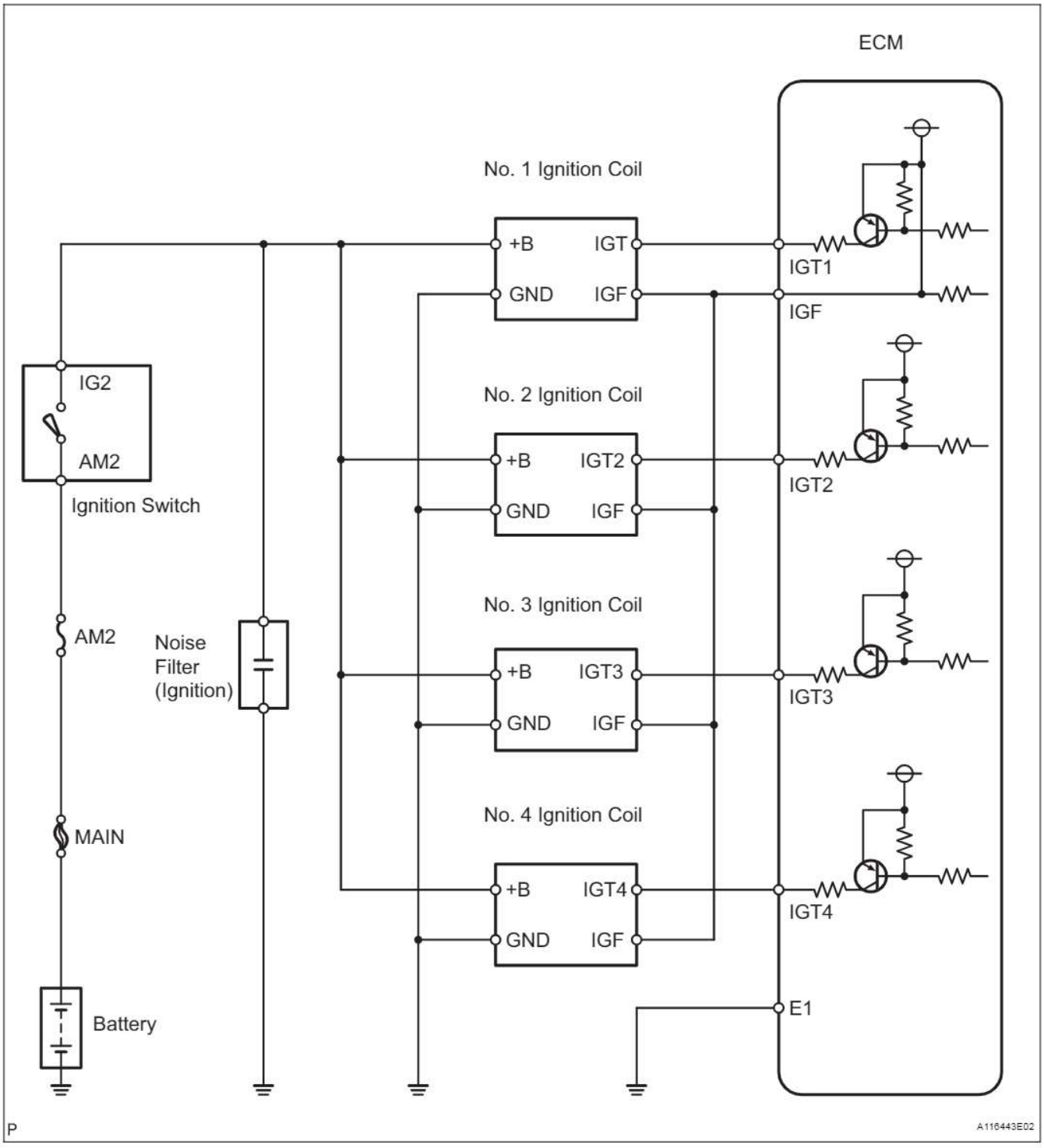
TYPICAL MALFUNCTION THRESHOLDS

IGF signal	ECM does not receive any IGF signal despite ECM sending IGT signal to igniter

COMPONENT OPERATING RANGE

IGF signal	Igniter transmits IGF signal when it receives IGT signal from ECM

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 **CHECK WHETHER DTC OUTPUT RECURS (DTC P0351, P0352, P0353 OR P0354)**

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Clear DTCs (see page ES-37).
(d) Shuffle arrangement of the ignition coils (among No. 1 to No. 4 cylinders).
NOTICE:
Do not shuffle the connectors.
(e) Perform a simulation test.
(f) Check DTCs displayed on the tester.
Result

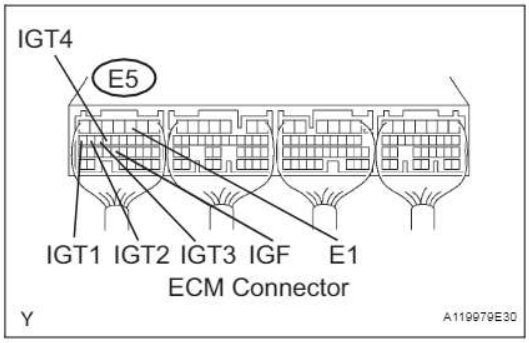
ES

Display (DTC Output)	Proceed to
P0351, P0352, P0353 or P0354	A
Other ignition coil DTC output	B

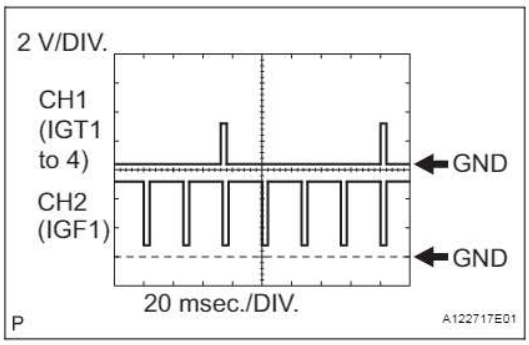
B → **REPLACE IGNITION COIL**

A

2 **INSPECT ECM (IGT1, IGT2, IGT3, IGT4 AND IGF SIGNAL)**



(a) Inspect the ECM using an oscilloscope.



(b) While cranking or idling, check the waveform between the terminals of the E5 ECM connectors.
Standard voltage

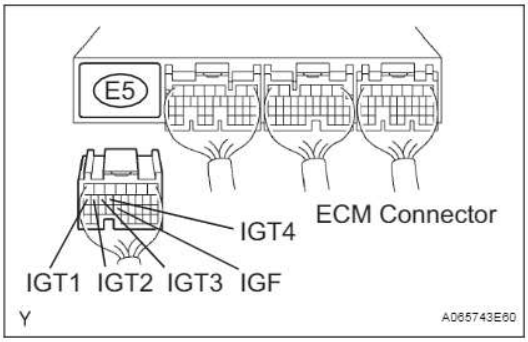
Tester Connection	Specified Condition
IGT1 (E5-17) - E1 (E5-3)	Correct waveform is as shown
IGT2 (E5-16) - E1 (E5-3)	Correct waveform is as shown
IGT3 (E5-15) - E1 (E5-3)	Correct waveform is as shown
IGT4 (E5-14) - E1 (E5-3)	Correct waveform is as shown
IGF (E5-23) - E1 (E5-3)	Correct waveform is as shown

OK → **REPLACE ECM**

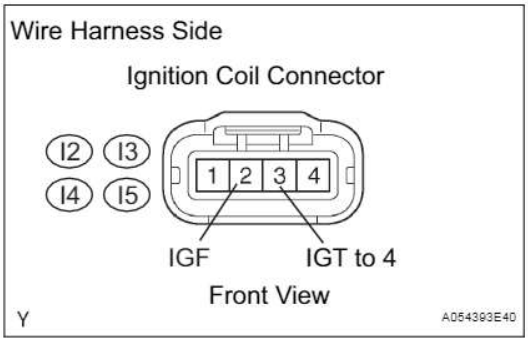
NG

3 **CHECK HARNESS AND CONNECTOR (IGNITION COIL - ECM)**

(a) Disconnect the I2, I3, I4 or I5 ignition coil connector.



(b) Disconnect the E5 ECM connector.



(c) Measure the resistance of the wire harness side connectors.

Standard resistance (Check for open)

Tester Connection	Specified Condition
IGF (I2-2) - IGF (E5-23)	Below 1 Ω
IGF (I3-2) - IGF (E5-23)	Below 1 Ω
IGF (I4-2) - IGF (E5-23)	Below 1 Ω
IGF (I5-2) - IGF (E5-23)	Below 1 Ω

Standard resistance (Check for open)

Tester Connection	Specified Condition
IGT (I2-3) - IGT1 (E5-17)	Below 1 Ω
IGT2 (I3-3) - IGT2 (E5-16)	Below 1 Ω
IGT3 (I4-3) - IGT3 (E5-15)	Below 1 Ω
IGT4 (I5-3) - IGT4 (E5-14)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
IGF (I2-2) or IGF (E5-23) - Body ground	10 kΩ or higher
IGF (I3-2) or IGF (E5-23) - Body ground	10 kΩ or higher
IGF (I4-2) or IGF (E5-23) - Body ground	10 kΩ or higher
IGF (I5-2) or IGF (E5-23) - Body ground	10 kΩ or higher

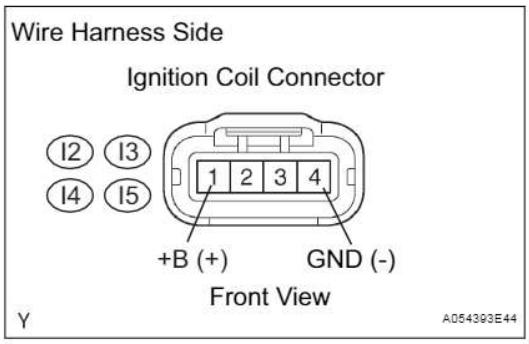
Standard resistance (Check for short)

Tester Connection	Specified Condition
IGT (I2-3) or IGT1 (E5-17) - Body ground	10 kΩ or higher
IGT2 (I3-3) or IGT2 (E5-16) - Body ground	10 kΩ or higher
IGT3 (I4-3) or IGT3 (E5-15) - Body ground	10 kΩ or higher
IGT4 (I5-3) or IGT4 (E5-14) - Body ground	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

4 INSPECT IGNITION COIL (POWER SOURCE)



(a) Disconnect the I2, I3, I4 or I5 ignition coil connector.
(b) Measure the resistance of the ignition coil connectors.
Standard resistance (Check for open)

Tester Connection	Specified Condition
GND (I2-4) - Body ground	Below 1 Ω
GND (I3-4) - Body ground	
GND (I4-4) - Body ground	
GND (I5-4) - Body ground	

(c) Turn the ignition switch ON.
(d) Measure the voltage between the terminals of the wire harness side connectors.
Standard voltage

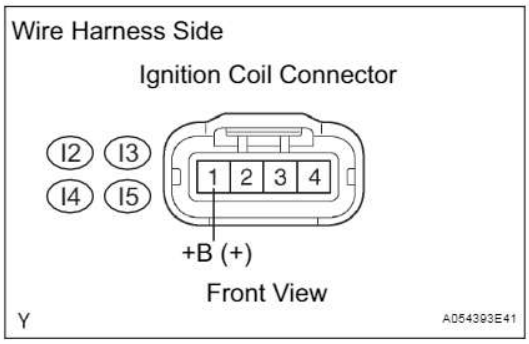
Tester Connection	Specified Condition
+B (I2-1) - GND (I2-4)	9 to 14 V
+B (I3-1) - GND (I3-4)	9 to 14 V
+B (I4-1) - GND (I4-4)	9 to 14 V
+B (I5-1) - GND (I5-4)	9 to 14 V

NG → Go to step 5

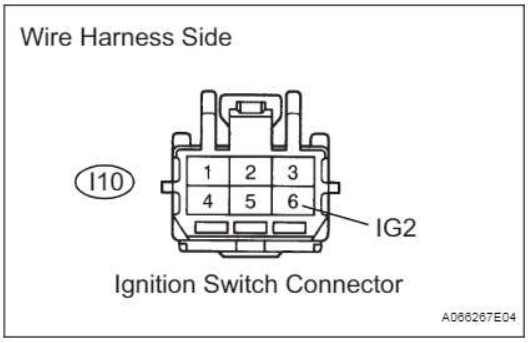
OK →

REPLACE IGNITION COIL

5 CHECK HARNESS AND CONNECTOR (IGNITION COIL ASSEMBLY - IGNITION SWITCH)



(a) Disconnect the I2, I3, I4 or I5 ignition coil connector.



(b) Disconnect the I10 ignition switch connector.
(c) Measure the resistance of the wire harness side connectors.

Standard resistance (Check for open)

Tester Connection	Specified Condition
+B (I2-1) - IG2 (I10-6)	Below 1 Ω
+B (I3-1) - IG2 (I10-6)	Below 1 Ω
+B (I4-1) - IG2 (I10-6)	Below 1 Ω
+B (I5-1) - IG2 (I10-6)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
+B (I2-1) or IG2 (I10-6) - Body ground	10 kΩ or higher
+B (I3-1) or IG2 (I10-6) - Body ground	10 kΩ or higher
+B (I4-1) or IG2 (I10-6) - Body ground	10 kΩ or higher
+B (I5-1) or IG2 (I10-6) - Body ground	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE IGNITION COIL

DTC	P0420	Catalyst System Efficiency Below Threshold (Bank 1)

MONITOR DESCRIPTION

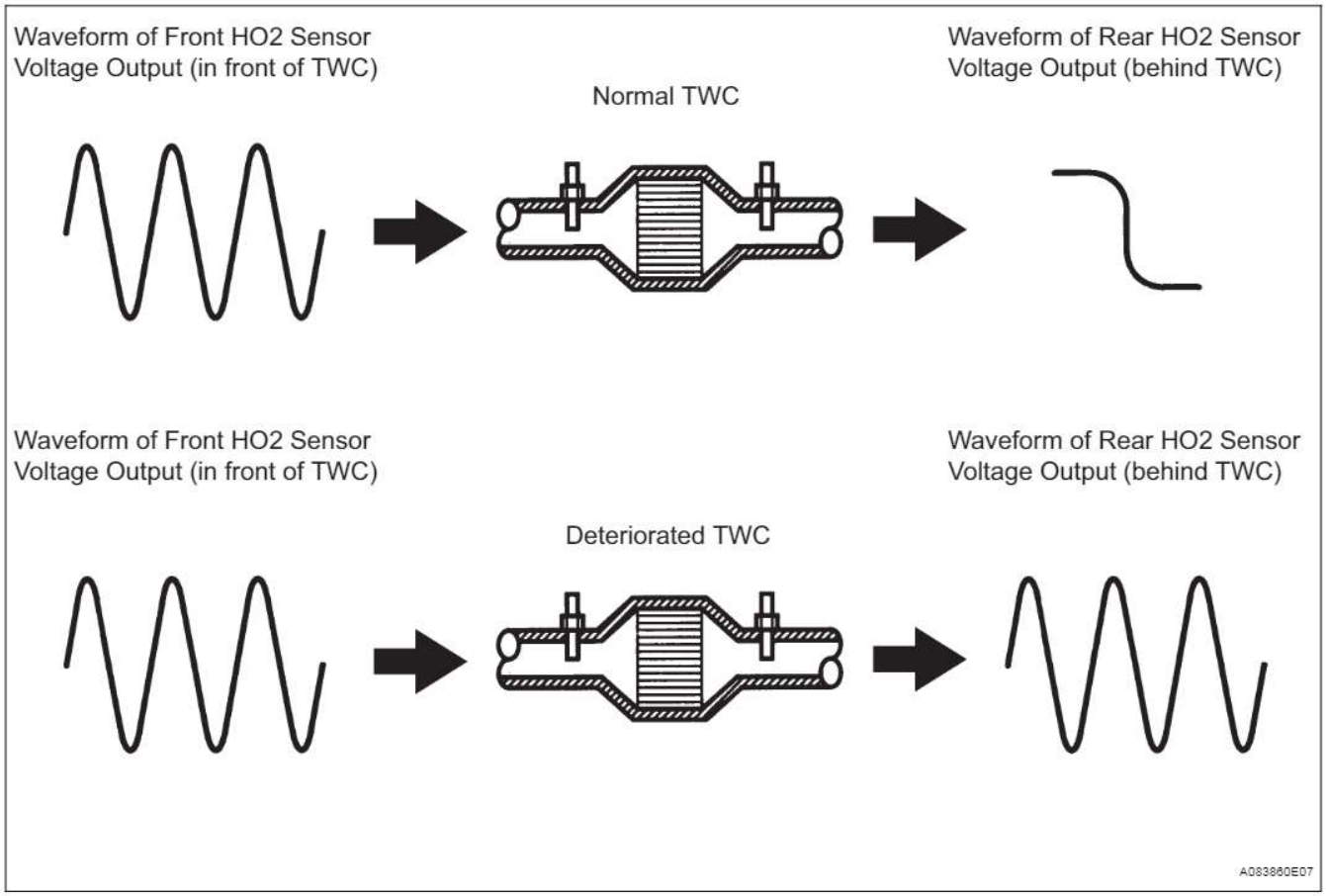
The ECM uses the 2 Heated Oxygen (HO2) sensors, mounted in front of and behind the Three-Way Catalytic Converter (TWC), to monitor its efficiency.

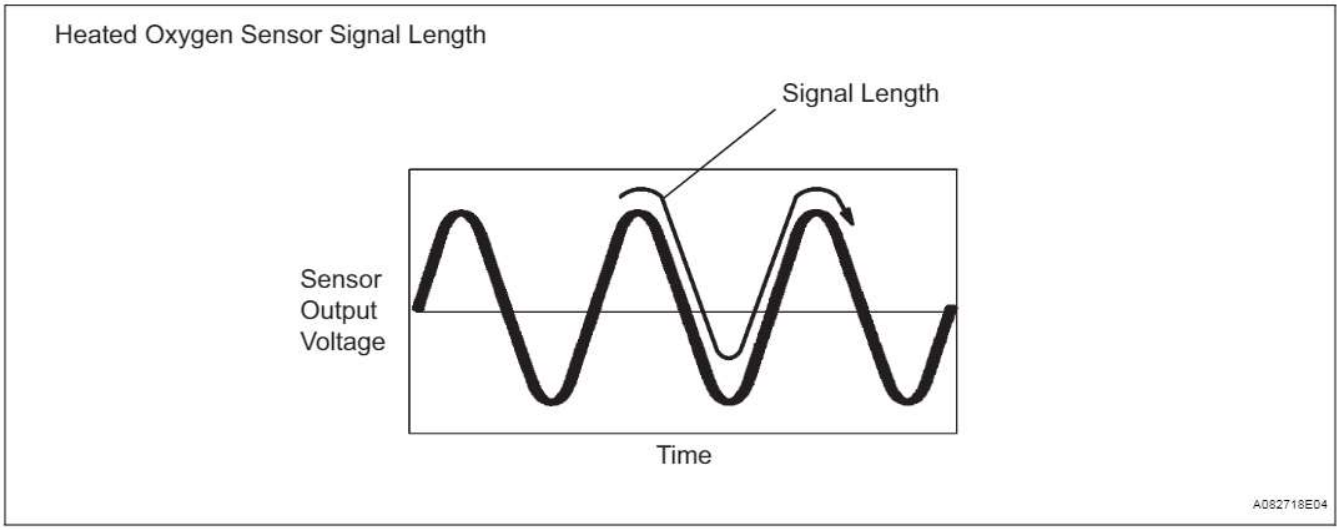
The first sensor, Sensor 1, sends pre-catalyst information to the ECM. The second sensor, Sensor 2, sends post-catalyst information to the ECM. The ECM compares the information transmitted by these 2 sensors to determine the efficiency of the TWC performance and its ability to store oxygen.

When the TWC is functioning properly, the variation in the oxygen concentration in the exhaust gas, after it has passed through the TWC, is small. In this condition, the voltage output of sensor 2 slowly alternates between the rich and lean signal voltages (shown in the illustration below). As the TWC performance efficiency deteriorates, its oxygen storage capacity decreases, and the variation in the oxygen concentration in the exhaust gas increases. As a result, the sensor voltage output fluctuates frequently. While the catalyst monitor is running, the ECM measures the signal lengths of both sensors 1 and 2, and calculates the ratio of the signal lengths to determine the extent of the TWC deterioration. If the deterioration level exceeds the preset threshold, the ECM interprets this as the TWC malfunction. The ECM then illuminates the MIL and sets the DTC.

This monitor begins to run when the following preconditions apply:

- The engine has warmed up (the engine coolant temperature is 75°C [167° F] or more).
- The vehicle has driven at between 60 km/h and 100 km/h (37 mph and 63 mph) for 15 minutes.





DTC No.	DTC Detection Condition	Trouble Area
P0420	Under conditions (a) and (b), front and rear Heated Oxygen (HO2) sensor voltage output fluctuation amplitudes similar: (a) Engine and Three-Way Catalytic Converter (TWC) warmed up (b) Vehicle driven with vehicle and engine speeds within predetermined ranges	• Gas leakage from exhaust system • Heated Oxygen (HO2) sensor (bank 1 sensors 1, 2) • TWC

MONITOR STRATEGY

Related DTCs	P0420: Catalyst deterioration
Required Sensors/Components (Main)	TWC
Required Sensors/Components (Related)	HO2 sensor, Intake Air Temperature (IAT) sensor, Mass Air Flow (MAF) meter, Crankshaft Position (CKP) sensor, Engine Coolant Temperature (ECT) sensor
Frequency of Operation	Once per driving cycle
Duration	60 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever these DTCs not present	P0011 (VVT system 1 - advance) P0012 (VVT system - retard) P0031, P0032 (heated oxygen sensor 1) P0037, P0038 (heated oxygen sensor 2) P0100 - P0103 (MAF meter) P0115 - P0118 (ECT sensor) P0120 - P0123 (TP sensor) P0125 (insufficient ECT for closed loop) P0130 (heated oxygen sensor 1) P0134 (heated oxygen sensor 1) P0136 (heated oxygen sensor 2) P0171, P0712 (fuel system) P0300 - P0304 (misfire) P0335 (crankshaft position sensor) P0340 (camshaft position sensor) P0351 - P0354 (igniter) P0500 (VSS)
Accumulated time that following conditions met	20 seconds
Battery voltage	11 V or more
IAT	-10°C (14°F) or more
Idle	OFF

MAF	8 to 25 g/sec.
Engine RPM	Less than 4,500 rpm
ECT	75°C (167°F) or more
Estimated TWC temperature	Up stream catalyst: 600 to 750°C (1,112 to 1,382°F) Down stream catalyst: 600 to 750°C (1,112 to 1,382°F)
Fuel system status	Closed loop

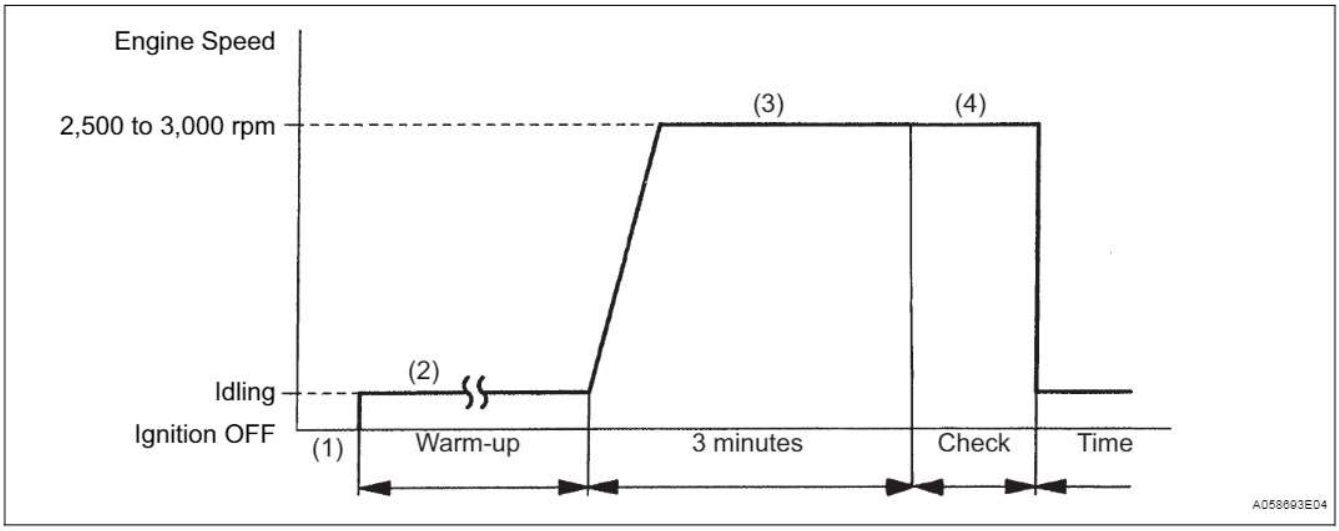
TYPICAL MALFUNCTION THRESHOLDS

Rear HO2 sensor locus length	0.5 V or more (varies with A/F sensor locus length)
Frequency of the monitor	2 times

MONITOR RESULT

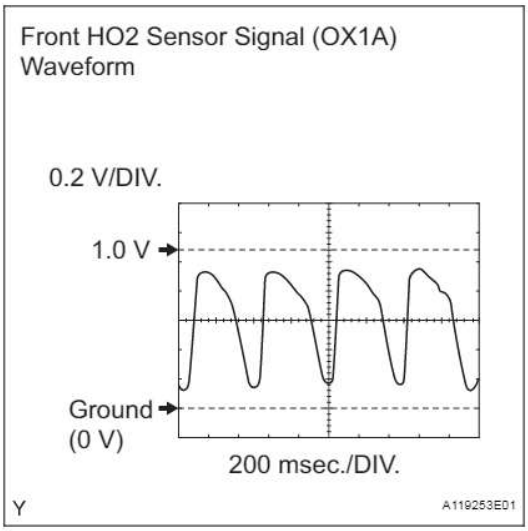
Refer to CHECKING MONITOR STATUS (see page ES-19).

CONFIRMATION DRIVING PATTERN



(1) If using the intelligent tester: Connect the intelligent tester to the DLC3.
(2) If not using the intelligent tester: Connect oscilloscope tester probes to terminals OX1A (front Heated Oxygen [HO2] sensor: Sensor 1), OX1B (rear HO2 sensor: Sensor 2) and E1 of the ECM connector.
(3) Start the engine.
(4) Warm up the engine with all the accessories switched OFF until the engine coolant temperature stabilizes.
(5) Run the engine at an engine speed between 2,500 rpm and 3,000 rpm for approximately 3 minutes.

(6) Check that the waveform of the OX1A (rear HO2 sensor) signal.



HINT:
If there is still a malfunction in the system, the waveform of OX1B may become similar to the OX1A waveform shown in the diagram above.

INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester. Freeze frame data records the engine conditions when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0420)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read DTCs (see page ES-48).

Result

Display (DTC Output)	Proceed to
P0420	A
P0420 and other DTCs	B

HINT:
If any DTCs other than P0420 are output, troubleshoot those DTCs first.

B → GO TO DTC CHART

A

2	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (A/F CONTROL)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Start the engine.

(d) Warm up the engine at an engine speed of 2,500 rpm for approximately 90 seconds.
(e) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / A/F CONTROL.
(f) Perform the A/F CONTROL operation with the engine in an idling condition (press the RIGHT or LEFT button to change the fuel injection volume).
(g) Monitor the voltage outputs of the HO2 sensors (O2S B1S1 and O2S B1S2) displayed on the tester.
HINT:
- The A/F CONTROL operation lowers the fuel injection volume by 12.5% or increases the injection volume by 25%.
- Each sensor reacts in accordance with increases and decreases in the fuel injection volume.

ES

Standard:

Tester Display (Sensor)	Injection Volumes	Status	Voltages
O2S B1S1 (Front HO2 Sensor)	+25%	Rich	More than 0.55
O2S B1S1 (Front HO2 Sensor)	-12.5%	Lean	Less than 0.4
O2S B1S2 (Rear HO2 Sensor)	+25%	Rich	More than 0.5
O2S B1S2 (Rear HO2 Sensor)	-12.5%	Lean	Less than 0.4

Status O2S B1S1	Status O2S B1S2	A/F Condition and HO2 Sensors (sensors 1 and 2) Condition	Misfires	Main Suspected Trouble Areas	Proceed to
Lean / Rich	Lean / Rich	Normal	-	• TWC • Gas leakage from exhaust system	A
Lean	Lean / Rich	HO2 sensor (sensor 1) malfunction	-	• HO2 sensor (sensor 1)	B
Rich	Lean / Rich	HO2 sensor (sensor 1) malfunction	-	• HO2 sensor (sensor 1)	B
Lean / Rich	Lean	HO2 sensor (sensor 2) malfunction	-	• HO2 sensor (sensor 2) • Gas leakage from exhaust system	C
Lean / Rich	Rich	HO2 sensor (sensor 2) malfunction	-	• HO2 sensor (sensor 2) • Gas leakage from exhaust system	C
Lean	Lean	Actual air-fuel ratio (A/F) lean	May occur	• Extremely rich or lean actual A/F • Gas leakage from exhaust system	A
Rich	Rich	Actual A/F rich	-	• Extremely rich or lean actual A/F • Gas leakage from exhaust system	A

Result:

Status O2S B1S1	Status O2S B1S2	A/F Condition and HO2 Sensors (sensors 1 and 2) Condition	Misfires	Main Suspected Trouble Areas	Proceed to
Lean / Rich	Lean / Rich	Normal	-	• TWC • Gas leakage from exhaust system	A
Lean	Lean / Rich	HO2 sensor (sensor 1) malfunction	-	• HO2 sensor (sensor 1)	B
Rich	Lean / Rich	HO2 sensor (sensor 1) malfunction	-	• HO2 sensor (sensor 1)	B

Status O2S B1S1	Status O2S B1S2	A/F Condition and HO2 Sensors (sensors 1 and 2) Condition	Misfires	Main Suspected Trouble Areas	Proceed to
Lean / Rich	Lean	HO2 sensor (sensor 2) malfunction	-	• HO2 sensor (sensor 2) • Gas leakage from exhaust system	C
Lean / Rich	Rich	HO2 sensor (sensor 2) malfunction	-	• HO2 sensor (sensor 2) • Gas leakage from exhaust system	C
Lean	Lean	Actual air-fuel ratio (A/F) lean	May occur	• Extremely rich or lean actual A/F • Gas leakage from exhaust system	A
Rich	Rich	Actual A/F rich	-	• Extremely rich or lean actual A/F • Gas leakage from exhaust system	A

ES

Lean: During A/F CONTROL, the HO2 sensor (sensors 1 and 2) output voltages are consistently less than 0.4 V.
Rich: During A/F CONTROL, the HO2 sensor (sensors 1 and 2) output voltages are consistently more than 0.50 to 0.55 V.

B → **CHECK AND REPLACE OXYGEN SENSOR (SENSOR 1)**

C → **CHECK AND REPLACE HEATED OXYGEN SENSOR (SENSOR 2), OR CHECK AND REPAIR EXHAUST GAS LEAKAGE**

A

3 CHECK FOR EXHAUST GAS LEAKAGE

OK:
No gas leakage.

NG → **REPAIR OR REPLACE EXHAUST GAS LEAKAGE POINT**

OK

4 REPLACE THREE-WAY CATALYTIC CONVERTER (EXHAUST MANIFOLD)

NOTICE:
Replace both the front and rear catalysts (front exhaust pipe).

NEXT

END

DTC	P043E	Evaporative Emission System Leak Detection Reference Orifice Low Flow

DTC	P043F	Evaporative Emission System Reference Orifice High Flow

DTC SUMMARY

DTC No.	Monitoring Items	Malfunction Detection Conditions	Trouble Areas	Detection Timing	Detection Logic
P043E	Reference orifice clogged	P043E, P043F, P2401, P2402 and P2419 are present when one of the following conditions is met during key-off EVAP monitor: • EVAP pressure just after reference pressure measurement greater than -1 kPa-g (755 mmHg-a) • Reference pressure less than -4.85 kPa-g (726 mmHg-a) • Reference pressure greater than -1 kPa-g (755 mmHg-a) • Reference pressure is not saturated • Reference pressure difference between first and second is 0.7 kPa-g (5 mmHg-g) or more HINT: These values are typical	• Canister pump module (Reference orifice, leak detection pump, vent valve) • Connector/wire harness (Canister pump module - ECM) • EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) • ECM	Ignition switch OFF	2 trip

ES

DTC No.	Monitoring Items	Malfunction Detection Conditions	Trouble Areas	Detection Timing	Detection Logic
P043F	Reference orifice high-flow	P043E, P043F, P2401, P2402 and P2419 are present when one of the following conditions is met during key-off EVAP monitor: • EVAP pressure just after reference pressure measurement greater than -1 kPa-g (755 mmHg-a) • Reference pressure less than -4.85 kPa-g (726 mmHg-a) • Reference pressure greater than -1 kPa-g (755 mmHg-a) • Reference pressure is not saturated • Reference pressure difference between first and second is 0.7 kPa-g (5 mmHg-g) or more HINT: These values are typical	• Canister pump module (Reference orifice, leak detection pump, vent valve) • Connector/wire harness (Canister pump module - ECM) • EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) • ECM	Ignition switch OFF	2 trip

ES

DESCRIPTION

The circuit description can be found in the Evaporative Emission (EVAP) system (see page ES-273).

INSPECTION PROCEDURE

Refer to the EVAP system (see page ES-273).

MONITOR DESCRIPTION

5 hours* after the ignition switch is turned OFF, the leak detection pump creates negative pressure (vacuum) in the EVAP system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

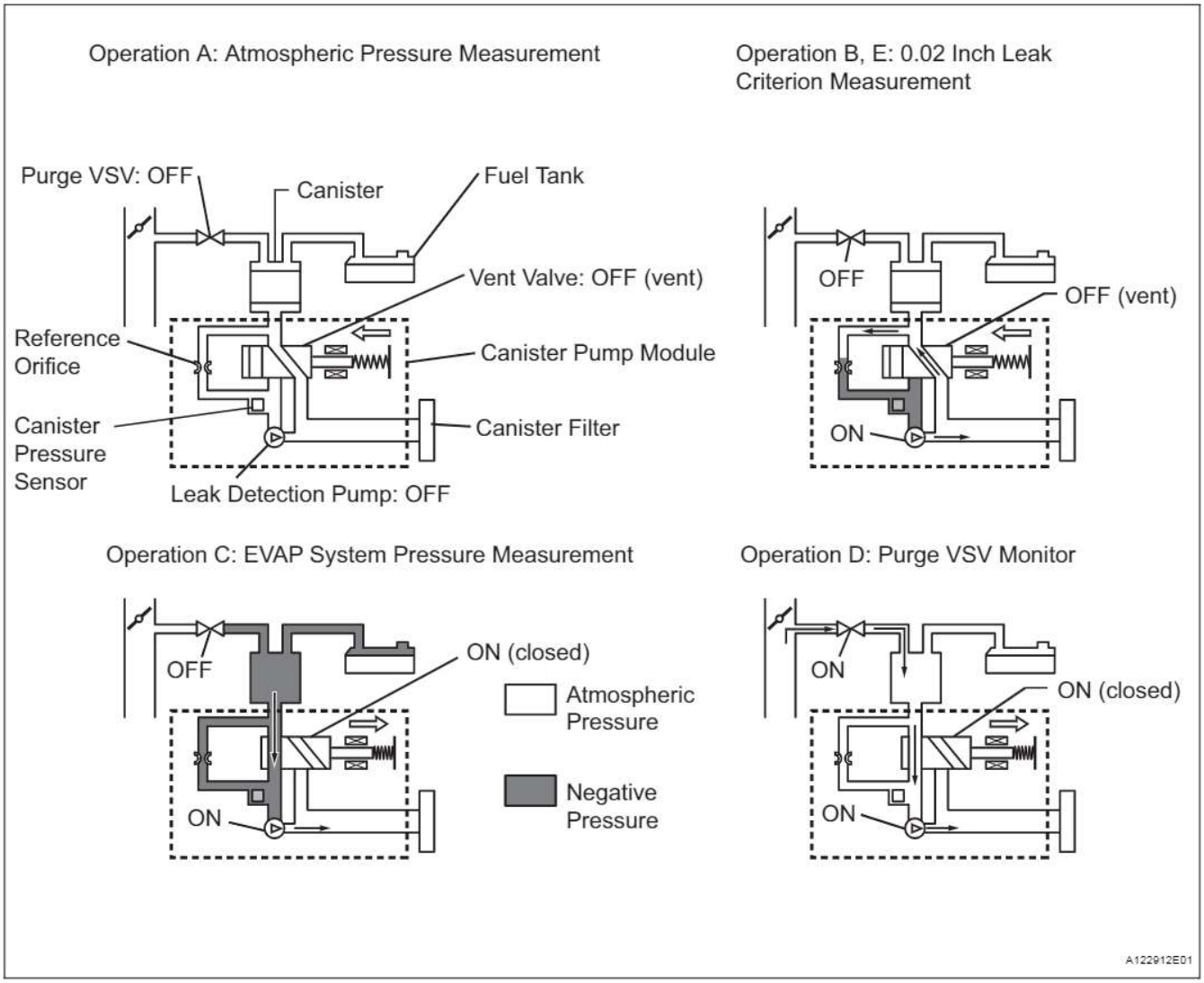
HINT:

*: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the ignition switch is turned OFF, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the ignition switch is turned OFF, the monitor check starts 2.5 hours later.

Sequence	Operations	Descriptions	Duration
-	ECM activation	Activated by soak timer 5, 7 or 9.5 hours after ignition switch OFF.	-

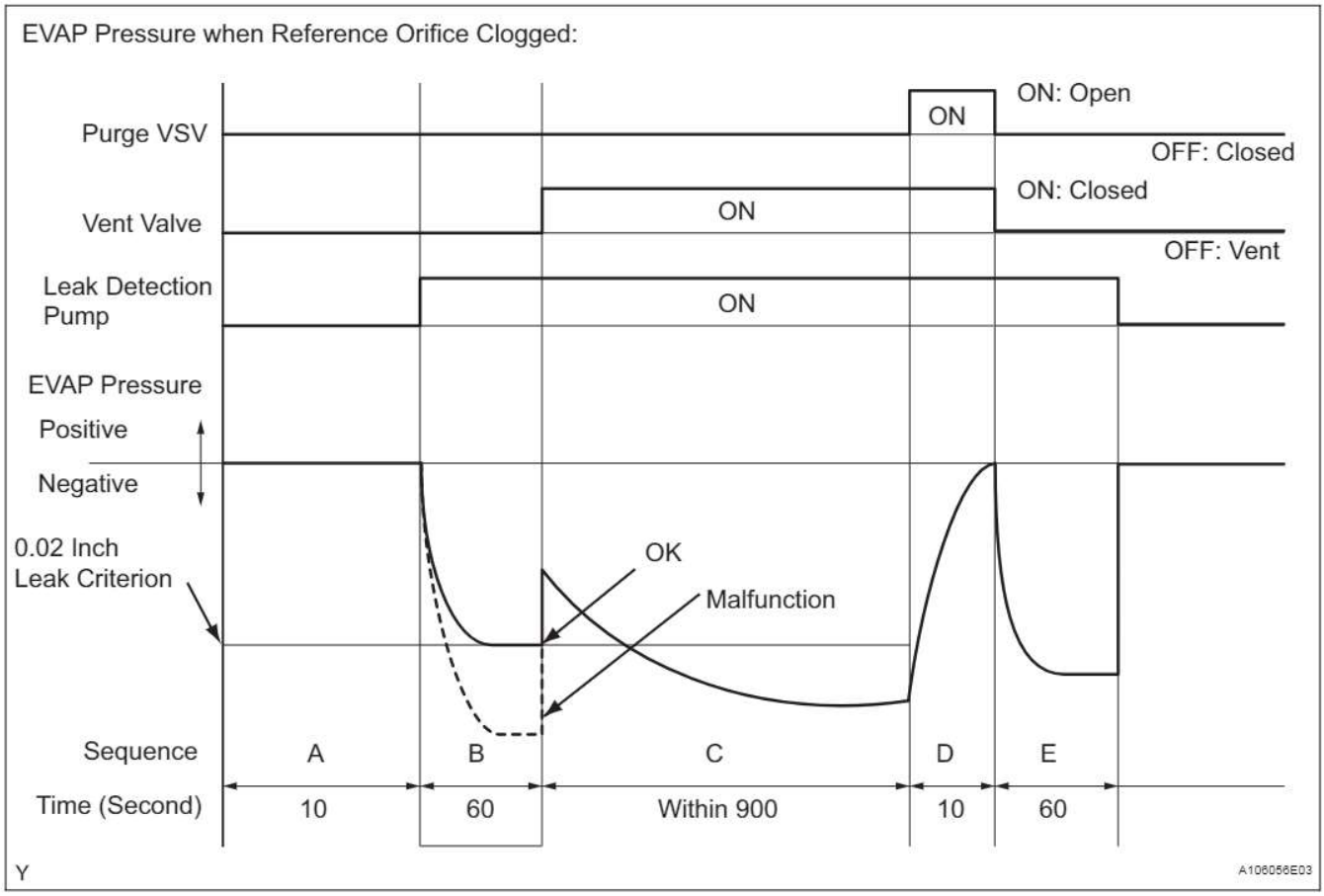
Sequence	Operations	Descriptions	Duration
A	Atmospheric pressure measurement	Vent valve turned OFF (vent) and EVAP system pressure measured by ECM in order to register atmospheric pressure. If pressure in EVAP system not between 70 kPa and 110 kPa (525 mmHg and 825 mmHg), ECM cancels EVAP system monitor.	10 seconds
B	First 0.02 inch leak criterion measurement	In order to determine 0.02 inch leak criterion, leak detection pump creates negative pressure (vacuum) through reference orifice and then ECM checks if leak detection pump and vent valve operate normally.	60 seconds
C	EVAP system pressure measurement	Vent valve turned ON (closed) to shut EVAP system. Negative pressure (vacuum) created in EVAP system, and EVAP system pressure then measured. Write down measured value as it will be used in leak check. If EVAP pressure does not stabilize within 900 seconds, ECM cancels EVAP system monitor.	900 seconds*
D	Purge VSV monitor	Purge VSV opened and then EVAP system pressure measured by ECM. Large increase indicates normal.	10 seconds
E	Second 0.02 inch leak criterion measurement	After second 0.02 inch leak criterion measurement, leak check performed by comparing first and second 0.02 inch leak criterion. If stabilized system pressure higher than second 0.02 inch leak criterion, ECM determines that EVAP system leaking.	60 seconds
F	Final check	Atmospheric pressure measured and then monitoring result recorded by ECM.	-

*: If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.


Operation A: Atmospheric Pressure Measurement
Purge VSV: OFF
Canister
Fuel Tank
Vent Valve: OFF (vent)
Reference Orifice
Canister Pump Module
Canister Pressure Sensor
Canister Filter
Leak Detection Pump: OFF
Operation B, E: 0.02 Inch Leak Criterion Measurement
OFF
OFF (vent)
ON
Operation C: EVAP System Pressure Measurement
OFF
ON (closed)
Atmospheric Pressure
Negative Pressure
ON
Operation D: Purge VSV Monitor
ON
ON (closed)
ON
A122912E01

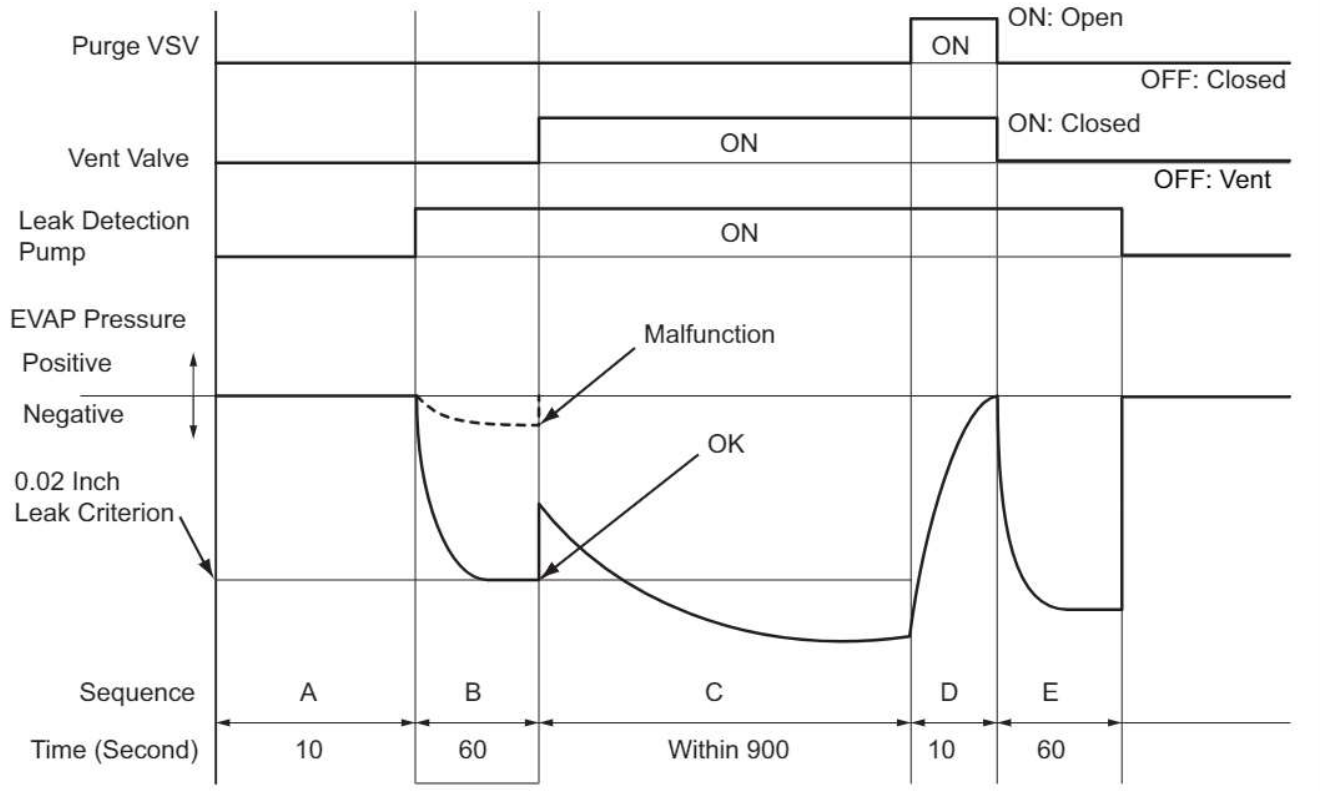
1. P043E: Reference orifice clogged
   In operation B, the leak detection pump creates negative pressure (vacuum) through the reference orifice. The EVAP system pressure is then measured by the ECM using the canister pressure sensor to determine the 0.02 inch leak criterion. If the pressure is lower than -4.85 kPa (-36.38 mmHg)*, the ECM interprets this as a clog malfunction in the reference orifice, and stops the EVAP system monitor. The ECM then illuminates the MIL and sets the DTC (2 trip detection logic).
   *: The threshold varies according to the atmospheric pressure measured in operation A. The value described above is based on an atmospheric pressure of 100 kPa (750.1 mmHg): absolute pressure.

EVAP Pressure when Reference Orifice Clogged:



2. P043F: Reference orifice high-flow
In operation B, the leak detection pump creates negative pressure (vacuum) through the reference orifice. The EVAP system pressure is then measured by the ECM using the canister pressure sensor to determine the 0.02 inch leak criterion. If the pressure is lower than -1.06 kPa (-7.95 mmHg)*, the ECM interprets this as a high-flow malfunction in the reference orifice, and stops the EVAP system monitor. The ECM then illuminates the MIL and sets the DTC (2 trip detection logic).
*: The threshold varies according to the atmospheric pressure measured in operation A. The value described above is based on an atmospheric pressure of 100 kPa (750.1 mmHg): absolute pressure.

EVAP Pressure when Reference Orifice High-flow Malfunction:



MONITOR STRATEGY

Required Sensors/Components	Canister pump module
Frequency of Operation	Once per driving cycle
Duration	Within 900 seconds
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Enabling conditions of EVAP key-OFF monitor

P043E (Reference orifice - low flow) P043F (Reference orifice - high flow) P0441 (Purge VSV - stuck open) P0441 (Purge VSV - stuck closed) P0451 (Canister pressure sensor - noise) P0455 (EVAP gross leak) P0456 (EVAP 0.02 inch leak) P2401 (Leak detection pump - stuck OFF) P2402 (Leak detection pump - stuck ON) P2419 (Vent valve - stuck ON) P2420 (Vent valve - stuck OFF)	
Atmospheric pressure	70 to 110 kPa (525 to 825 mmHg)
Battery voltage	10.5 V or higher
Vehicle speed	4 km/h (2.5 mph) or less
Ignition switch	OFF
Time after key off	5 or 7 or 9.5 hours
Canister pressure sensor malfunction (P0450, P0452, P0453)	Not detected
Purge VSV	Not operated by scan tool
Vent valve	Not operated by scan tool
Leak detection pump	Not operated by scan tool
Both of the following conditions 1 and 2 are met before key off	-
1. Duration that vehicle has been driven	5 minutes or more
2. EVAP purge operation	Performed
ECT	4.4 to 35°C (40 to 95°F)
IAT	4.4 to 35°C (40 to 95°F)

ES

1. Key-off monitor sequence 1 to 8

1. Atmospheric pressure measurement

Next sequence is run if the following condition is met	-
Atmospheric pressure change	Within 0.3 kPa (2.25 mmHg) in 1 second

2. First reference pressure measurement

Next sequence is run if the following conditions are met	-
EVAP pressure just after reference pressure measurement start	-1 kPa (-7.5 mmHg) or lower
Reference pressure	-4.85 to -1.05 kPa (726 to 754 mmHg)
Reference pressure	Saturated within 60 seconds

3. Vent valve stuck closed check

Next sequence is run if the following condition is met	-
EVAP pressure change after vent valve is ON	0.3 kPa (2.25 mmHg) or more

4. Vacuum introduction

Next sequence is run if the following condition is met	-
EVAP pressure	Saturated within 900 seconds

5. Purge VSV stuck closed check

Next sequence is run if the following condition is met	-
EVAP pressure change after purge valve is open	0.3 kPa (2.25 mmHg) or more

6. Second reference pressure measurement

Next sequence is run if the following conditions are met	-
EVAP pressure just after reference pressure measurement	-1 kPa (-7.5 mmHg) or lower
Reference pressure	-4.85 to -1.05 kPa (726 to 754 mmHg)
Reference pressure	Saturated within 60 seconds
Reference pressure difference between first and second	Less than 0.7 kPa (5.25 mmHg)

7. Leak check

Next sequence is run if the following condition is met	-
EVAP pressure when vacuum introduction is complete	Lower than second reference pressure

8. Atmospheric pressure measurement

EVAP monitor is complete if the following condition is met	-
Atmospheric pressure difference between sequence 1 and 8	Within 0.3 kPa (2.25 mmHg)

TYPICAL MALFUNCTION THRESHOLDS

"Saturated" indicates that the EVAP pressure change is less than 0.1 kPa (0.75 mmHg) in 30 seconds.

One of following conditions met	-
FTP when just after reference pressure measurement started	-1 kPa (755 mmHg) or higher
Reference pressure	-4.85 kPa (726 mmHg) or lower
Reference pressure	-1.05 kPa (754 mmHg) or higher
Reference pressure	Not saturated within 60 seconds
Difference between first reference pressure and second reference pressure	0.7 kPa (5.25 mmHg)

MONITOR RESULT

Refer to CHECKING MONITOR STATUS (see page ES-19).

DTC	P0441	Evaporative Emission Control System Incorrect Purge Flow

DTC SUMMARY

DTC No.	Monitoring Items	Malfunction Detection Conditions	Trouble Areas	Detection Timing	Detection Logic
P0441	Purge Vacuum Switching Valve (VSV) stuck open	Leak detection pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure measured. 0.02 inch leak criterion measured at start and at end of leak check. If stabilized pressure higher than [second 0.02 inch leak criterion x 0.2], ECM determines that purge VSV stuck open.	• Purge VSV • Connector/wire harness (purge VSV - ECM) • ECM • Canister pump module • Leakage from EVAP system	While ignition switch OFF	2 trip
P0441	Purge VSV stuck closed	After EVAP leak check performed, purge VSV turned ON (open), and atmospheric air introduced into EVAP system. 0.02 inch leak criterion measured at start and at end of leak check. If pressure does not return to near atmospheric pressure, ECM determines that purge VSV stuck closed.	• Purge VSV • Connector/wire harness (purge VSV - ECM) • ECM • Canister pump module • Leakage from EVAP system	While ignition switch OFF	2 trip
P0441	Purge flow	While engine running, following conditions are met: • Negative pressure not created in EVAP system when purge VSV turned ON (open) • EVAP system pressure change less than 0.5 kPa (3.75 mmHg) when vent valve turned ON (closed) • Atmospheric pressure change before and after purge flow monitor less than 0.1 kPa (0.75 mmHg)	• Purge VSV • Connector/wire harness (purge VSV - ECM) • Leakage from EVAP line (purge VSV - Intake manifold) • ECM	While engine running	2 trip

DESCRIPTION

The circuit description can be found in the Evaporative Emission (EVAP) system (see page ES-273).

INSPECTION PROCEDURE

Refer to the EVAP system (see page ES-273).

MONITOR DESCRIPTION

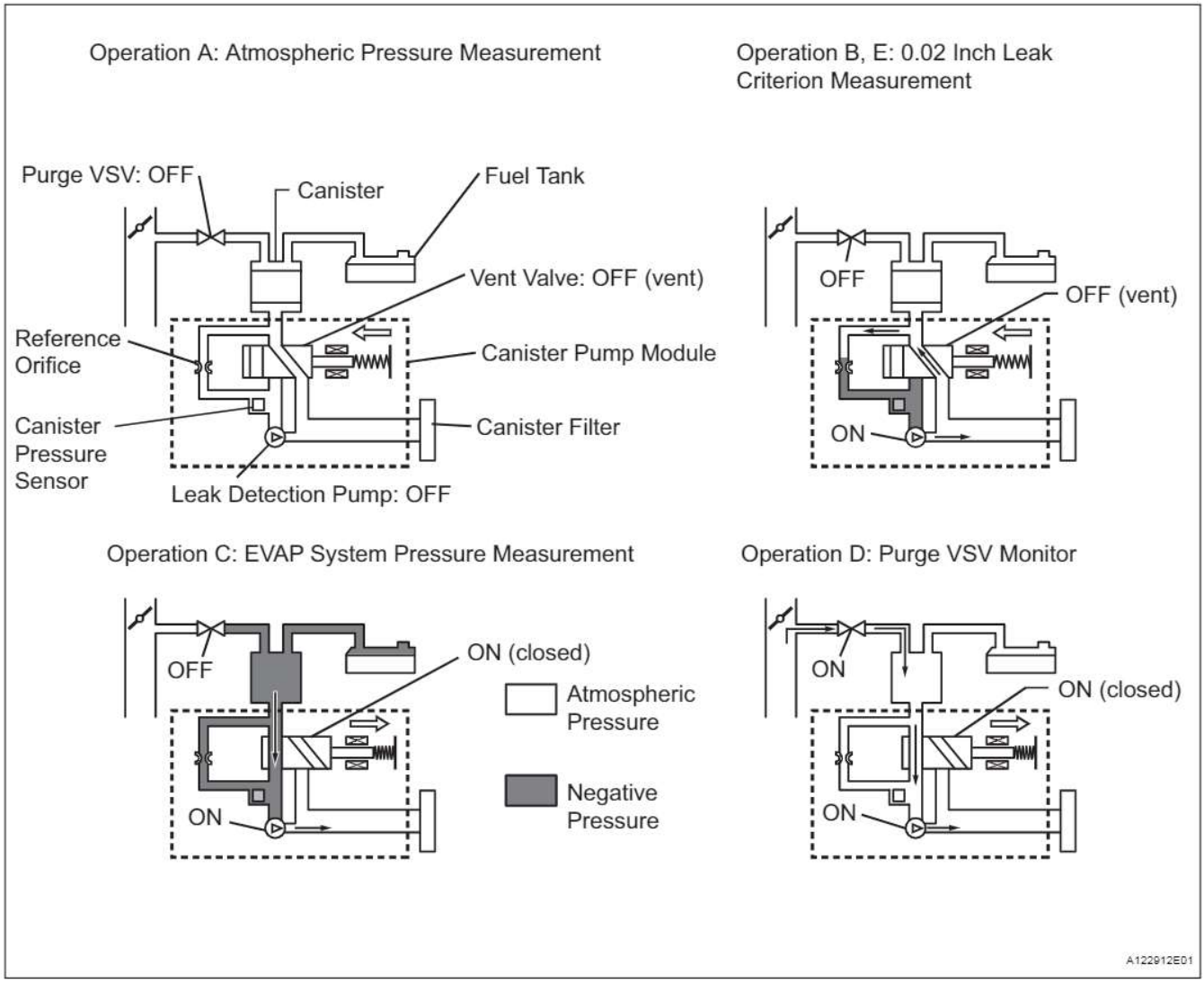
The 2 monitors, key-off and purge flow, are used to detect malfunctions relating to DTC P0441. The key-off monitor is initiated by the ECM internal timer, known as the soak timer, 5 hours* after the ignition switch is turned OFF. The purge flow monitor runs while the engine is running.

1. Key-off monitor
   5 hours* after the ignition switch is turned OFF, the leak detection pump creates negative pressure (vacuum) in the EVAP system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.
   HINT:
   *: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the ignition switch is turned OFF, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the ignition switch is turned OFF, the monitor check starts 2.5 hours later.

Sequence	Operations	Descriptions	Duration
-	ECM activation	Activated by soak timer 5, 7 or 9.5 hours after ignition switch OFF.	-
A	Atmospheric pressure measurement	Vent valve turned OFF (vent) and EVAP system pressure measured by ECM in order to register atmospheric pressure. If pressure in EVAP system not between 70 kPa and 110 kPa (525 mmHg and 825 mmHg), ECM cancels EVAP system monitor.	10 seconds
B	First 0.02 inch leak criterion measurement	In order to determine 0.02 inch leak criterion, leak detection pump creates negative pressure (vacuum) through reference orifice and then ECM checks if leak detection pump and vent valve operate normally.	60 seconds
C	EVAP system pressure measurement	Vent valve turned ON (closed) to shut EVAP system. Negative pressure (vacuum) created in EVAP system, and EVAP system pressure then measured. Write down measured value as it will be used in leak check. If EVAP pressure does not stabilize within 900 seconds, ECM cancels EVAP system monitor.	900 seconds*
D	Purge VSV monitor	Purge VSV opened and then EVAP system pressure measured by ECM. Large increase indicates normal.	10 seconds

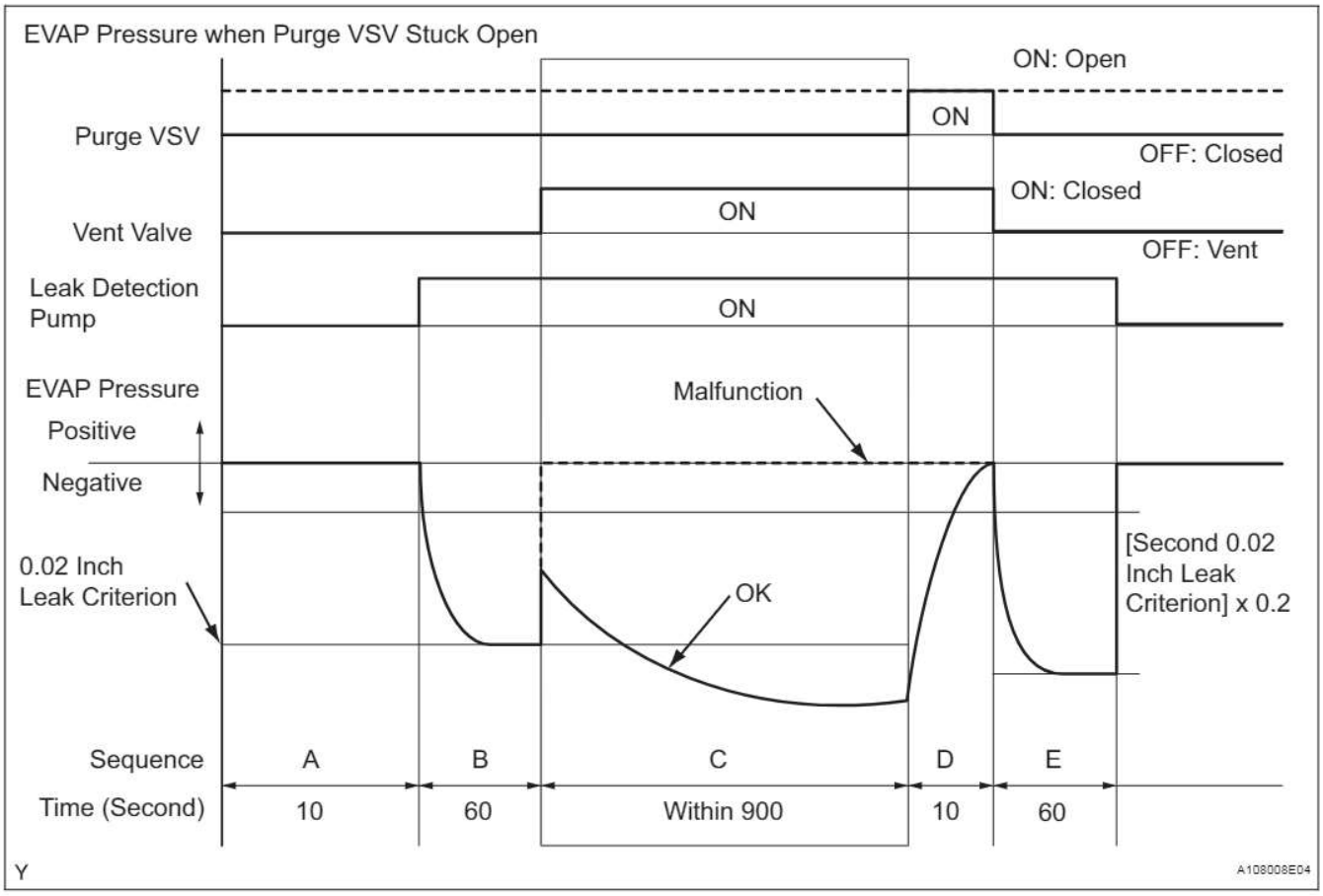
Sequence	Operations	Descriptions	Duration
E	Second 0.02 inch leak criterion measurement	After second 0.02 inch leak criterion measurement, leak check performed by comparing first and second 0.02 inch leak criterion. If stabilized system pressure higher than second 0.02 inch leak criterion, ECM determines that EVAP system leaking.	60 seconds
F	Final check	Atmospheric pressure measured and then monitoring result recorded by ECM.	-

*: If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.



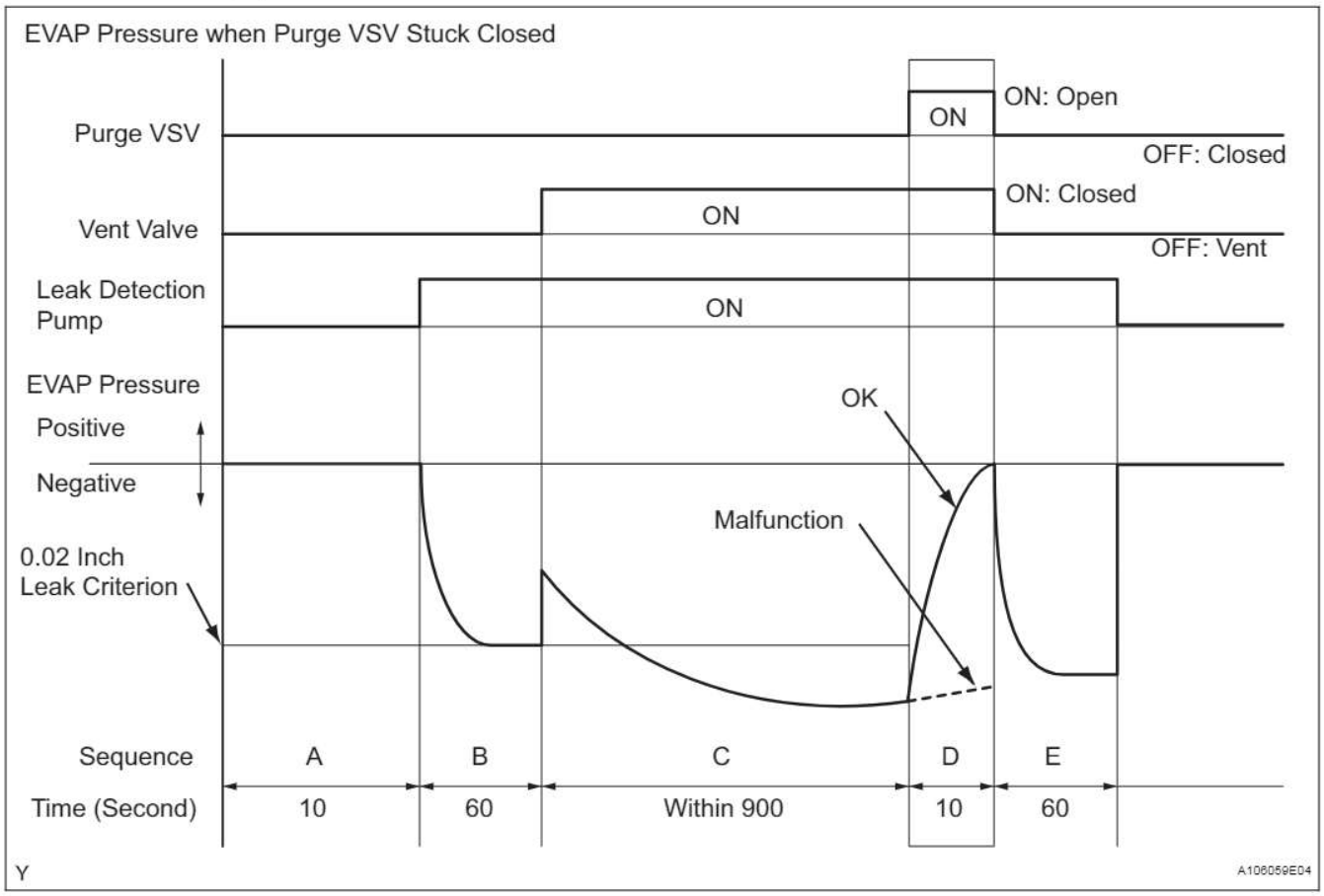
(a) Purge VSV stuck open

In operation C, the leak detection pump creates negative pressure (vacuum) in the EVAP system. The EVAP system pressure is then measured by the ECM using the canister pressure sensor. If the stabilized system pressure is higher than [second 0.02 inch leak criterion x 0.2], the ECM interprets this as the purge Vacuum Switching Valve (VSV) being stuck open. The ECM illuminates the MIL and sets the DTC (2 trip detection logic).

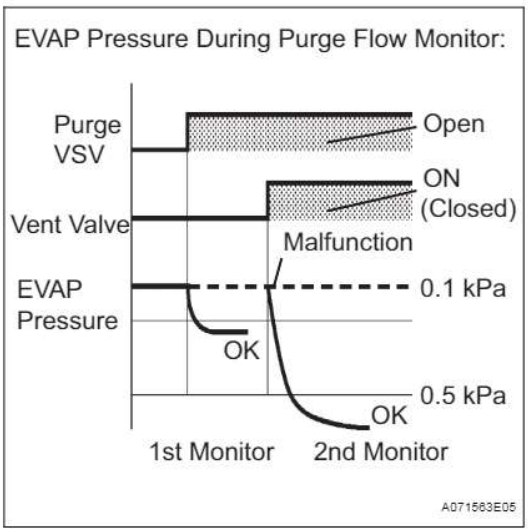


(b) Purge VSV stuck closed

In operation D, the canister pressure sensor measures the EVAP system pressure. The pressure measurement for the purge VSV monitor begins when the purge VSV is turned ON (open) after the EVAP leak check. When the measured pressure indicates an increase of 0.3 kPa (2.25 mmHg) or more, the purge VSV is functioning normally. If the pressure does not increase, the ECM interprets this as the purge VSV being stuck closed. The ECM illuminates the MIL and sets the DTC (2 trip detection logic).



2. Purge flow monitor



The purge flow monitor consists of the 2 step monitors. The 1st monitor is conducted every time and the 2nd monitor is activated if necessary.

- The 1st monitor
  While the engine is running and the purge VSV is ON (open), the ECM monitors the purge flow by measuring the EVAP pressure change. If negative pressure is not created, the ECM begins the 2nd monitor.
- The 2nd monitor
  The vent valve is turned ON (closed) and the EVAP pressure is then measured. If the variation in the pressure is less than 0.5 kPa (3.75 mmHg), the ECM interprets this as the purge VSV being stuck closed, illuminates the MIL and sets DTC P0441 (2 trip detection logic).

Atmospheric pressure check:
In order to ensure reliable malfunction detection, the variation between the atmospheric pressure before and after conduction of the purge flow monitor is measured by the ECM.

MONITOR STRATEGY

Related DTCs	P0441: Purge VSV stuck open P0441: Purge VSV stuck closed P0441: Purge flow
Required Sensors/Components	Purge VSV and canister pump module
Frequency of Operation	Once per driving cycle
Duration	Within 900 seconds (varies with amount of fuel in tank)
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Purge Flow Monitor:

Monitor runs whenever following DTC not present	-
Engine	Running
ECT	4.4°C (40°F) or more
IAT	4.4°C (40°F) or more
FTP sensor malfunction	Not detected
Purge VSV	Not detected by scan tool
EVAP system check	Not detected by scan tool
Battery voltage	10 V or higher
Purge duty cycle	8% or more

Purge VSV Stuck:

Enabling conditions of EVAP key-OFF monitor	
P043E (Reference orifice - low flow) P043F (Reference orifice - high flow) P0441 (Purge VSV - stuck open) P0441 (Purge VSV - stuck closed) P0451 (Canister pressure sensor - noise) P0455 (EVAP gross leak) P0456 (EVAP 0.02 inch leak) P2401(Leak detection pump - stuck OFF) P2402 (Leak detection pump - stuck ON) P2419 (Vent valve - stuck ON) P2420 (Vent valve - stuck OFF)	
Atmospheric pressure	70 to 110 kPa (525 to 825 mmHg)
Battery voltage	10.5 V or higher
Vehicle speed	4 km/h (2.5 mph) or less
Ignition switch	OFF
Time after key off	5 or 7 or 9.5 hours
Canister pressure sensor malfunction (P0450, P0452, P0453)	Not detected
Purge VSV	Not operated by scan tool

Vent valve	Not operated by scan tool
Leak detection pump	Not operated by scan tool
Both of the following conditions 1 and 2 are met before key off	-
1. Duration that vehicle has been driven	5 minutes or more
2. EVAP purge operation	Performed
ECT	4.4 to 35°C (40 to 95°F)
IAT	4.4 to 35°C (40 to 95°F)

1. Key-off monitor sequence 1 to 8

1. Atmospheric pressure measurement

Next sequence is run if the following condition is met	-
Atmospheric pressure change	Within 0.3 kPa (2.25 mmHg) in 1 second

2. First reference pressure measurement

Next sequence is run if the following conditions are met	-
EVAP pressure just after reference pressure measurement start	-1 kPa (-7.5 mmHg) or lower
Reference pressure	-4.85 to -1.05 kPa (726 to 754 mmHg)
Reference pressure	Saturated within 60 seconds

3. Vent valve stuck closed check

Next sequence is run if the following condition is met	-
EVAP pressure change after vent valve is ON	0.3 kPa (2.25 mmHg) or more

4. Vacuum introduction

Next sequence is run if the following condition is met	-
EVAP pressure	Saturated within 900 seconds

5. Purge VSV stuck closed check

Next sequence is run if the following condition is met	-
EVAP pressure change after purge valve is open	0.3 kPa (2.25 mmHg) or more

6. Second reference pressure measurement

Next sequence is run if the following conditions are met	-
EVAP pressure just after reference pressure measurement	-1 kPa (-7.5 mmHg) or lower
Reference pressure	-4.85 to -1.05 kPa (726 to 754 mmHg)
Reference pressure	Saturated within 60 seconds
Reference pressure difference between first and second	Less than 0.7 kPa (5.25 mmHg)

7. Leak check

Next sequence is run if the following condition is met	-
EVAP pressure when vacuum introduction is complete	Lower than second reference pressure

8. Atmospheric pressure measurement

EVAP monitor is complete if the following condition is met	-
Atmospheric pressure difference between sequence 1 and 8	Within 0.3 kPa (2.25 mmHg)

TYPICAL MALFUNCTION THRESHOLDS

"Saturated" indicates that the EVAP pressure change is less than 0.1 kPa (0.75 mmHg) in 30 seconds.

Purge Flow Monitor:

Both of the following conditions are met	-
EVAP pressure change when purge flow is started	Lower than 0.1 kPa (0.75 mmHg)
EVAP pressure change during purge flow when EVAP pressure switching valve is ON (closed)	0.5 kPa (3.75 mmHg) or more

Key-off Monitor: Purge VSV stuck open

FTP when vacuum introduction complete	Higher than reference pressure x 0.2

Key-off Monitor: Purge VSV stuck closed

FTP change after purge VSV ON (open)	Less than 0.3 kPa (2.25 mmHg)

MONITOR RESULT

Refer to CHECKING MONITOR STATUS (see page ES-19).

ES

DTC	P0450	Evaporative Emission Control System Pressure Sensor Malfunction

DTC	P0451	Evaporative Emission Control System Pressure Sensor Range / Performance

DTC	P0452	Evaporative Emission Control System Pressure Sensor / Switch Low Input

DTC	P0453	Evaporative Emission Control System Pressure Sensor / Switch High Input

ES

DTC SUMMARY

DTC No.	Monitoring Items	Malfunction Detection Conditions	Trouble Area	Detection Timing	Detection logic
P0450	Canister pressure sensor voltage abnormal fluctuation	Sensor output voltage rapidly fluctuates beyond upper and lower malfunction thresholds for 0.5 seconds.	• Canister pump module • EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) • ECM	• EVAP monitoring (ignition switch OFF) • Ignition switch ON	1 trip
P0451	Canister pressure sensor noisy	Sensor output voltage fluctuates frequently in certain time period.	• Canister pump module • Connector/wire harness (canister pump module - ECM) • EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) • ECM	• EVAP monitoring (ignition switch OFF) • Engine running	2 trip
P0451	Canister pressure sensor stuck	Sensor output voltage does not vary in certain time period.	• Canister pump module • Connector/wire harness (canister pump module - ECM) • EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) • ECM	• EVAP monitoring (ignition switch OFF)	2 trip

DTC No.	Monitoring Items	Malfunction Detection Conditions	Trouble Area	Detection Timing	Detection logic
P0452	Canister pressure sensor voltage low	Sensor output voltage less than 0.45 V for 0.5 seconds.	• Canister pump module • Connector/wire harness (canister pump module - ECM) • EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) • ECM	• EVAP monitoring (ignition switch OFF) • Ignition switch ON	1 trip
P0453	Canister pressure sensor voltage high	Sensor output voltage more than 4.9 V for 0.5 seconds.	• Canister pump module • Connector/wire harness (canister pump module - ECM) • EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) • ECM	• EVAP monitoring (ignition switch OFF) • Ignition switch ON	1 trip

ES

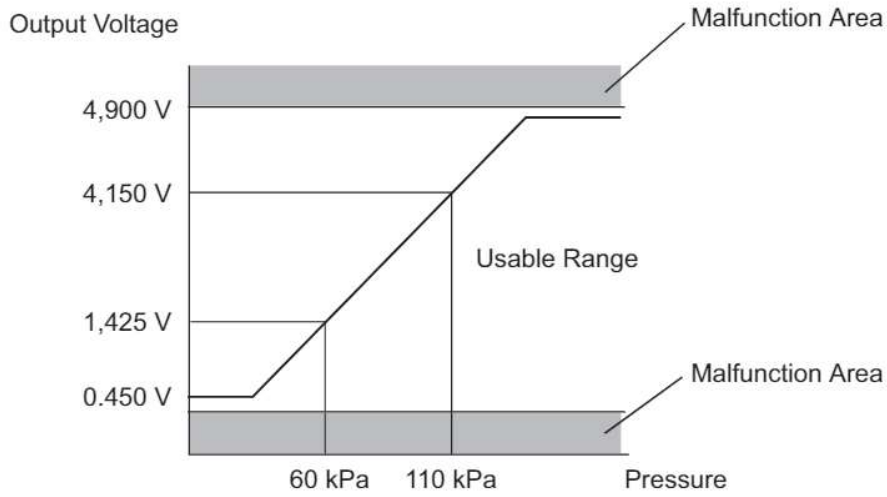
HINT:
The canister pressure sensor is built into the canister pump module.

DESCRIPTION

The circuit description can be found in the Evaporative Emission (EVAP) system (see page ES-273).

MONITOR DESCRIPTION

Canister Pressure Sensor Specification



HINT:

Standard atmospheric pressure is 101.3 kPa

A115543E03

(a) DTC P0450: Canister pressure sensor voltage abnormal fluctuation
If the canister pressure sensor voltage output rapidly fluctuates between less than 0.45 V and more than 4.9 V, the ECM interprets this as an open or short circuit malfunction in the canister pressure sensor or its circuit, and stops the EVAP system monitor. The ECM then illuminates the MIL and sets the DTC (1 trip detection logic).

(b) DTC P0451: Canister pressure sensor noisy or stuck
If the canister pressure sensor voltage output fluctuates rapidly for 10 seconds, the ECM stops the EVAP system monitor. The ECM interprets this as noise from the canister pressure sensor, and stops the EVAP system monitor. The ECM then illuminates the MIL and sets the DTC.
Alternatively, if the sensor voltage output does not change for 10 seconds, the ECM interprets this as the sensor being stuck, and stops the monitor. The ECM then illuminates the MIL and sets the DTC. (Both of the malfunctions are detected by 2 trip detection logic).

(c) DTC P0452: Canister pressure sensor voltage low
If the canister pressure sensor voltage output is below 0.45 V, the ECM interprets this as an open or short circuit malfunction in the canister pressure sensor or its circuit, and stops the EVAP system monitor. The ECM then illuminates the MIL and sets the DTC (1 trip detection logic).

(d) DTC P0453: Canister pressure sensor voltage high
If the canister pressure sensor voltage output is 4.9 V or more, the ECM interprets this as an open or short circuit malfunction in the canister pressure sensor or its circuit, and stops the EVAP system monitor. The ECM then illuminates the MIL and sets the DTC (1 trip detection logic).

MONITOR STRATEGY

Required Sensors/Components	Canister pump module
Frequency of Operation	Continuous
Duration	Within 15 minutes

MIL Operation	Immediate: P0450, P0452, P0453 2 driving cycles: P0451
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

P0451 (Noise Monitor):

Monitor runs whenever following DTCs are not present	None
Atmospheric pressure	70 to 110 kPa (525 to 825 mmHg) [absolute pressure]
Battery voltage	10.5 V or more
Intake air temperature	4.4 to 35 °C (40 to 95°F)
EVAP canister pressure sensor malfunction (P0450, P0452, P0453)	Not detected
Either of following conditions is met	A or B
A. Engine	Running
B. Soak time (ignition switch OFF time)	5 hours

ES

Example of restart time

First time	7 hours
Second time	9 hours and 30 minutes

P0451 (Stuck Monitor):

Monitor runs whenever following DTCs are not present	None
Atmospheric pressure	70 to 110 kPa (525 to 825 mmHg)
Battery voltage	10.5 V or more
Intake air temperature	4.4 to 35°C (40 to 95°F)
EVAP pressure sensor malfunction	Not detected
Soak time (ignition switch OFF time)	5 hours

Example of restart time

First time	7 hours
Second time	9 hours and 30 minutes

P0450, P0452 and P0453:

Monitor runs whenever following DTCs are not present	None
Either of following conditions is met	A or B
A. Ignition switch	ON
B. Soak timer	ON

TYPICAL MALFUNCTION THRESHOLDS

1. P0450: Canister pressure sensor chattering

EVAP pressure	Less than 42.1 kPa (317 mmHg) or more than 123.8 kPa (928.5 mmHg)

2. P0451: Canister pressure sensor noise

Pressure variation indicated by canister pressure sensor in 10 seconds	More than +-0.3 kPa (+-2.25 mmHg) 10 times

3. P0451: Canister pressure sensor stuck

EVAP pressure change during reference pressure in 10 seconds	0.65 kPa (4.87 mmHg) or less

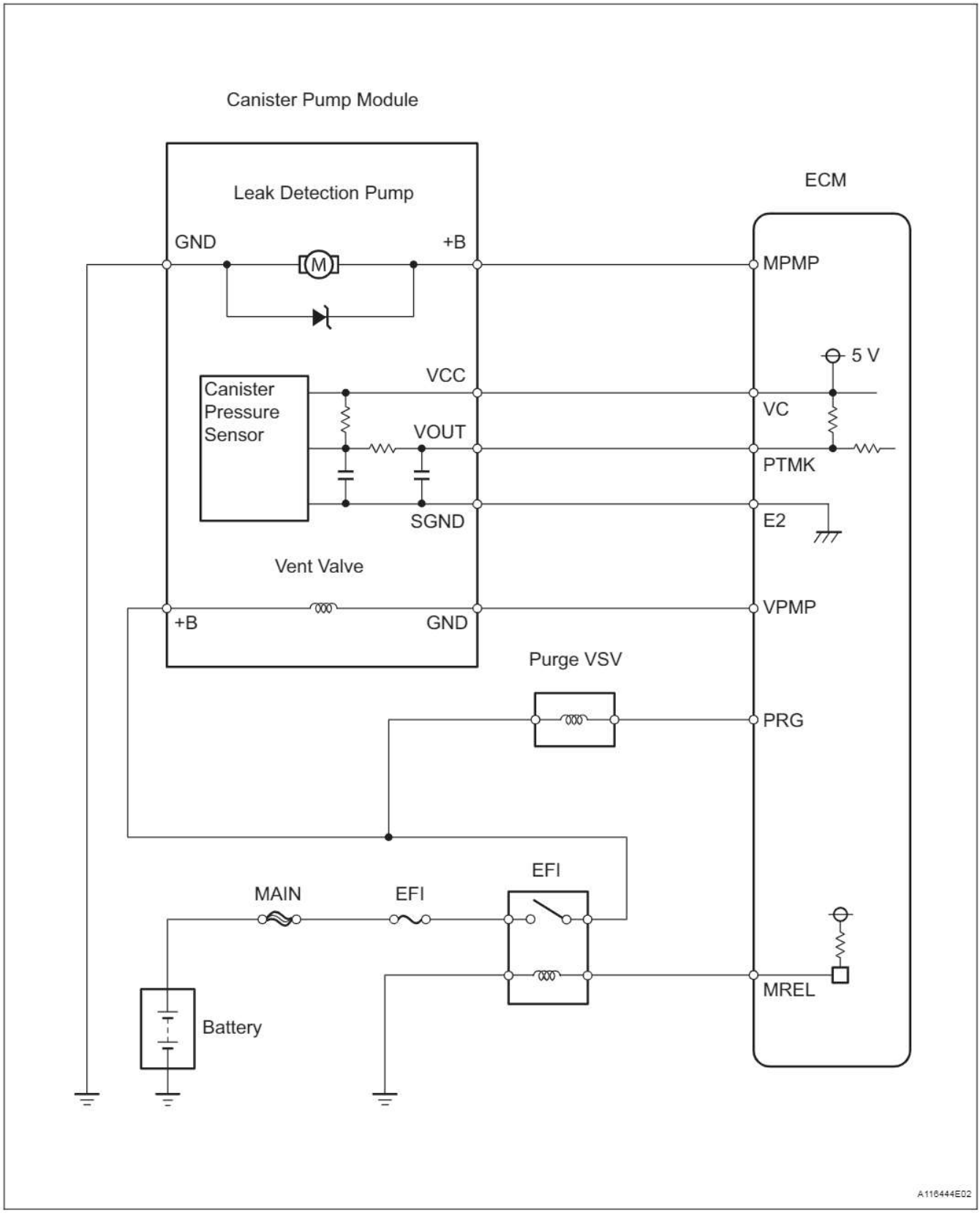
4. P0452: Canister pressure sensor low voltage

EVAP pressure	Less than 42.1 kPa (317 mmHg)

5. P0453: Canister pressure sensor high voltage

EVAP pressure	More than 123.8 kPa (928.5 mmHg)

WIRING DIAGRAM



INSPECTION PROCEDURE

NOTICE:

- **When a vehicle is brought into the workshop, leave it as it is. Do not change the vehicle condition. For example, do not tighten the fuel cap.**
- **Do not disassemble the canister pump module.**
- **The intelligent tester is required to conduct the following diagnostic troubleshooting procedure.**

1	CONFIRM DTC AND EVAP PRESSURE

ES

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the intelligent tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read the values.
(e) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / EVAP / VAPOR PRESS.
(f) Read the EVAP pressure displayed on the intelligent tester.

Result

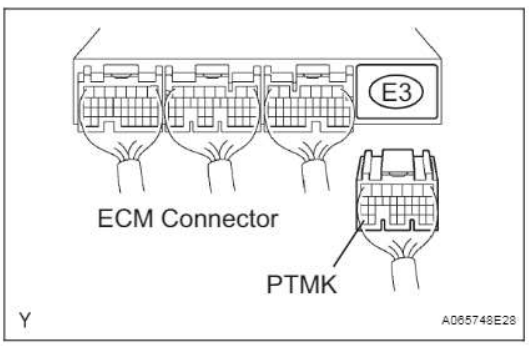
Display (DTC Output)	Test Result	Suspected Trouble Areas	Proceed to
P0451	-	• Canister pressure sensor	A
P0452	Less than 45 kPa (430 mmHg)	• Wire harness/connector (ECM - canister pressure sensor) • Canister pressure sensor • Short in ECM circuit	B
P0453	More than 120 kPa (900 mmHg)	• Wire harness/connector (ECM - canister pressure sensor) • Canister pressure sensor • Open in ECM circuit	C

A → GO TO EVAP SYSTEM

C → Go to step 4

B

2	CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)



(a) Turn the ignition switch OFF.
(b) Disconnect the E3 ECM connector.
(c) Measure the resistance between the PTMK (E3-31) terminal of the ECM connector and the body ground.

Result

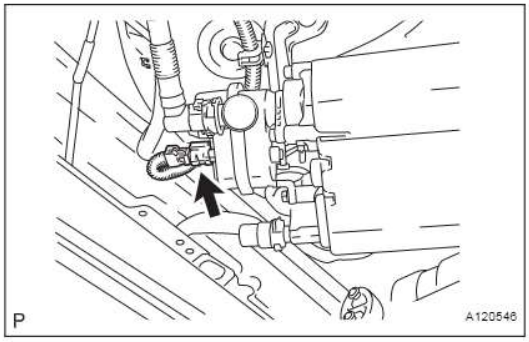
Test Results	Suspected Trouble Areas	Proceed to
10 Ω or less	• Wire harness/connector (ECM - canister pressure sensor) • Short in canister pressure sensor circuit	A
10 kΩ or more	• Wire harness/connector (ECM - canister pressure sensor) • Short in ECM circuit	B

B → Go to step 7

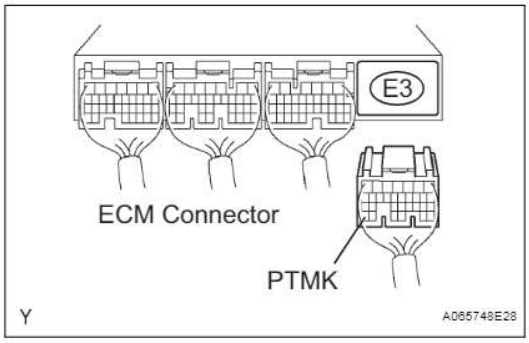
A

ES

3 CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)



(a) Disconnect the C10 canister connector.



(b) Disconnect the E3 ECM connector.
(c) Measure the resistance between the PTMK (E3-31) terminal of the ECM connector and the body ground.

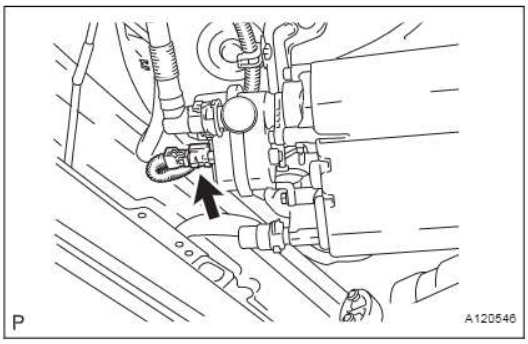
Result

Test Results	Suspected Trouble Areas	Proceed to
10 kΩ or more	• Short in canister pressure sensor circuit	A
10 kΩ or less	• Short in wire harness/connector (ECM - canister pressure sensor)	B

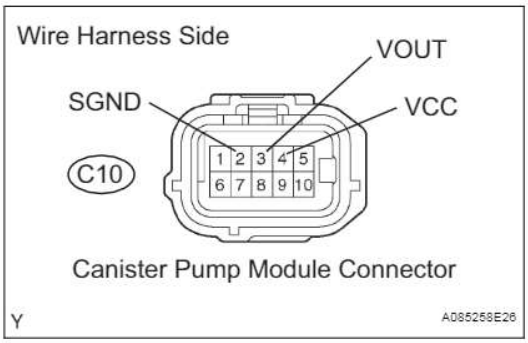
B → Go to step 6

A

4 CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)



(a) Disconnect the C10 canister connector.



(b) Turn the ignition switch ON.

(c) Measure the voltage and resistance of the canister pump module connector.

Standard voltage

Tester Connection	Specified Condition
VCC (C10-4) - Body ground	4.5 to 5.0 V
VOUT (C10-3) - Body ground	4.5 to 5.0 V

Standard resistance

Tester Connection	Specified Condition
SGND (C10-2) - Body ground	100 Ω or less

Result

Test Results	Suspected Trouble Areas	Proceed to
Voltage and resistance within standard ranges	• Open in canister pressure sensor circuit	A
Voltage and resistance outside standard ranges	• Open in wire harness/connector (ECM - canister pressure sensor)	B

B → Go to step 6

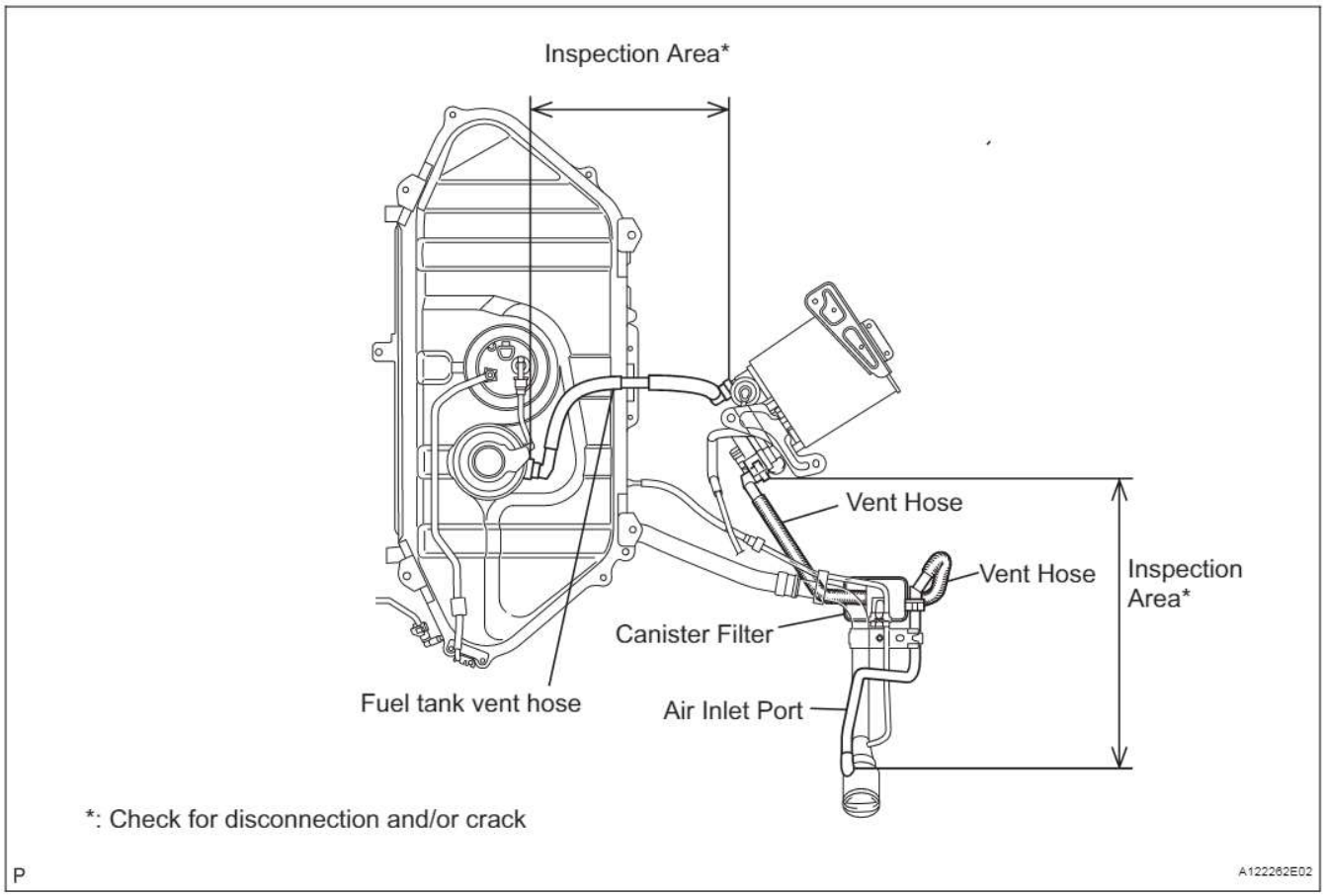
A

5 REPLACE CANISTER ASSEMBLY

(a) Replace the canister assembly (see page EC-9).

NOTICE:

When replacing the canister, check the canister pump module interior and related pipes for water, fuel or other liquids. If liquids are present, check for disconnections and/or cracks in the following: 1) the pipe from the air inlet port to the canister pump module; 2) the canister filter; and 3) the fuel tank vent hose.



NEXT	Go to step 8

6	REPAIR OR REPLACE HARNESS OR CONNECTOR

HINT:
If the exhaust tailpipe has been removed, go to the next step before reinstalling it.

NEXT	Go to step 8

7	REPLACE ECM

(a) Replace the ECM (see page ES-363).

NEXT	Go to step 8

8	CHECK WHETHER DTC OUTPUT RECURS (AFTER REPAIR)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the intelligent tester ON.
(c) Wait for at least 60 seconds.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / PENDING CODES.

HINT:
If no pending DTC is displayed on the intelligent tester, the repair has been successfully completed.

NEXT

COMPLETED

REGISTRATION

NOTICE:
The Vehicle Identification Number (VIN) must be input into the replacement ECM.
HINT:
The VIN is a 17-digit alphanumeric vehicle identification number. The intelligent tester is required to register the VIN.

1. INPUT INSTRUCTIONS

HINT:
Below are the general VIN input instructions using the intelligent tester.

(a) General
The arrow buttons (UP, DOWN, RIGHT and LEFT) and numerical buttons (0 to 9) are used to input the VIN.

(b) Cursor Operation
To move the cursor around the tester screen, press the RIGHT and LEFT buttons.

(c) Alphabetical Character Input
(1) Press the UP and DOWN buttons to select the desired alphabetical character.
(2) After selection, the cursor should move.

(d) Numeric Character Input
(1) Press the numerical button corresponding to the number that you want to input.
HINT:
Numerical characters can also be selected and input using the UP and DOWN buttons.

(e) Correction
(1) After input, the cursor should move.
(2) When correcting the input character(s), put the cursor onto the character using the RIGHT or LEFT buttons.

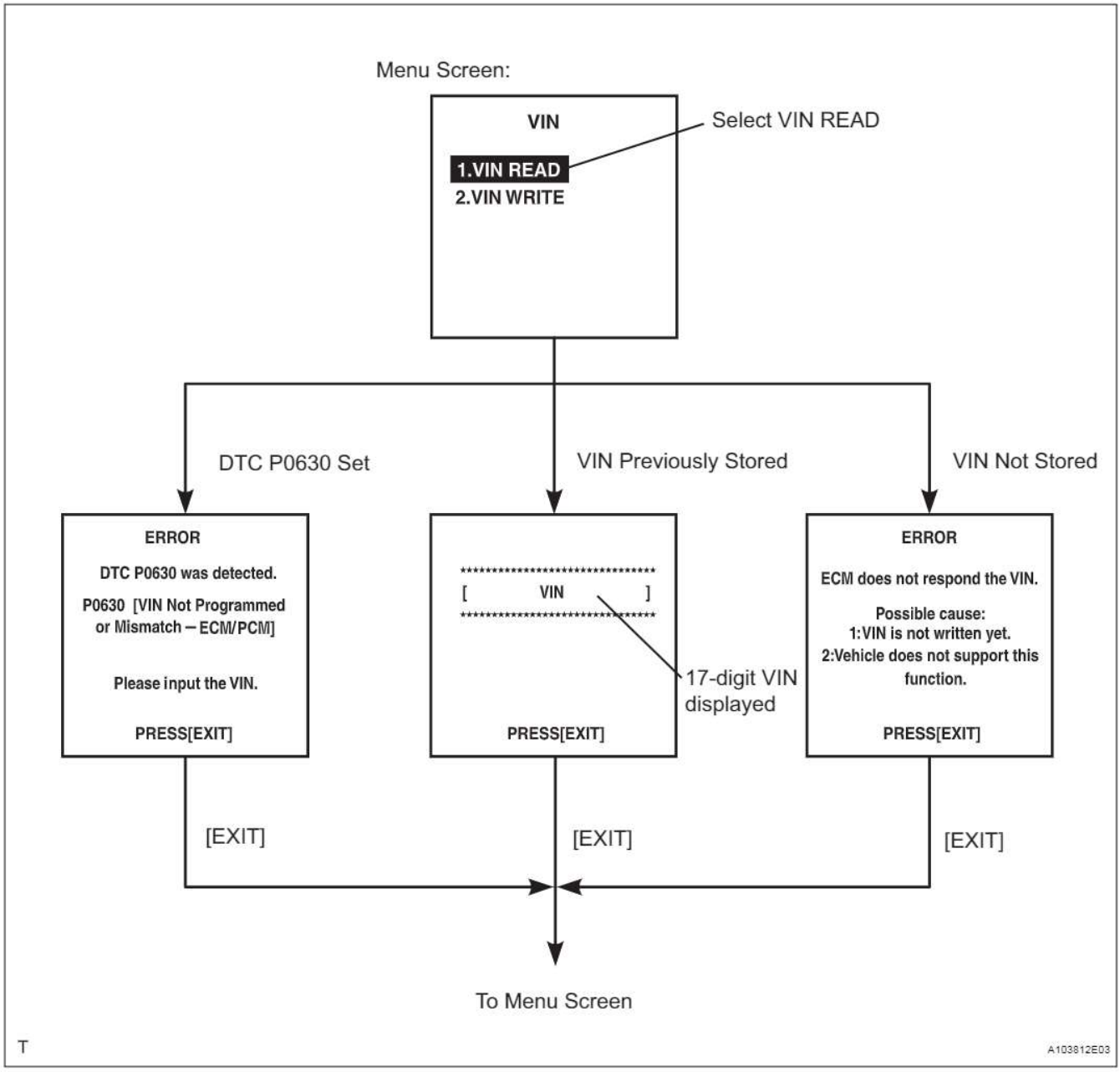
(f) Finishing Input Operation
(1) Make sure that the input VIN matches the vehicle VIN after input.
(2) Press the ENTER button on the tester.

2. READ VIN (Vehicle Identification Number)

HINT:
Below are the VIN reading instructions. Use the procedures and flowchart below. Reading the VIN stored in the ECM is necessary when comparing it to the VIN provided with the vehicle.

(a) Read VIN using the intelligent tester.
(b) Check the vehicle's VIN.
(c) Connect the intelligent tester to the DLC3.
(d) Turn the ignition switch ON.
(e) Turn the tester ON.

(f) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / VIN.



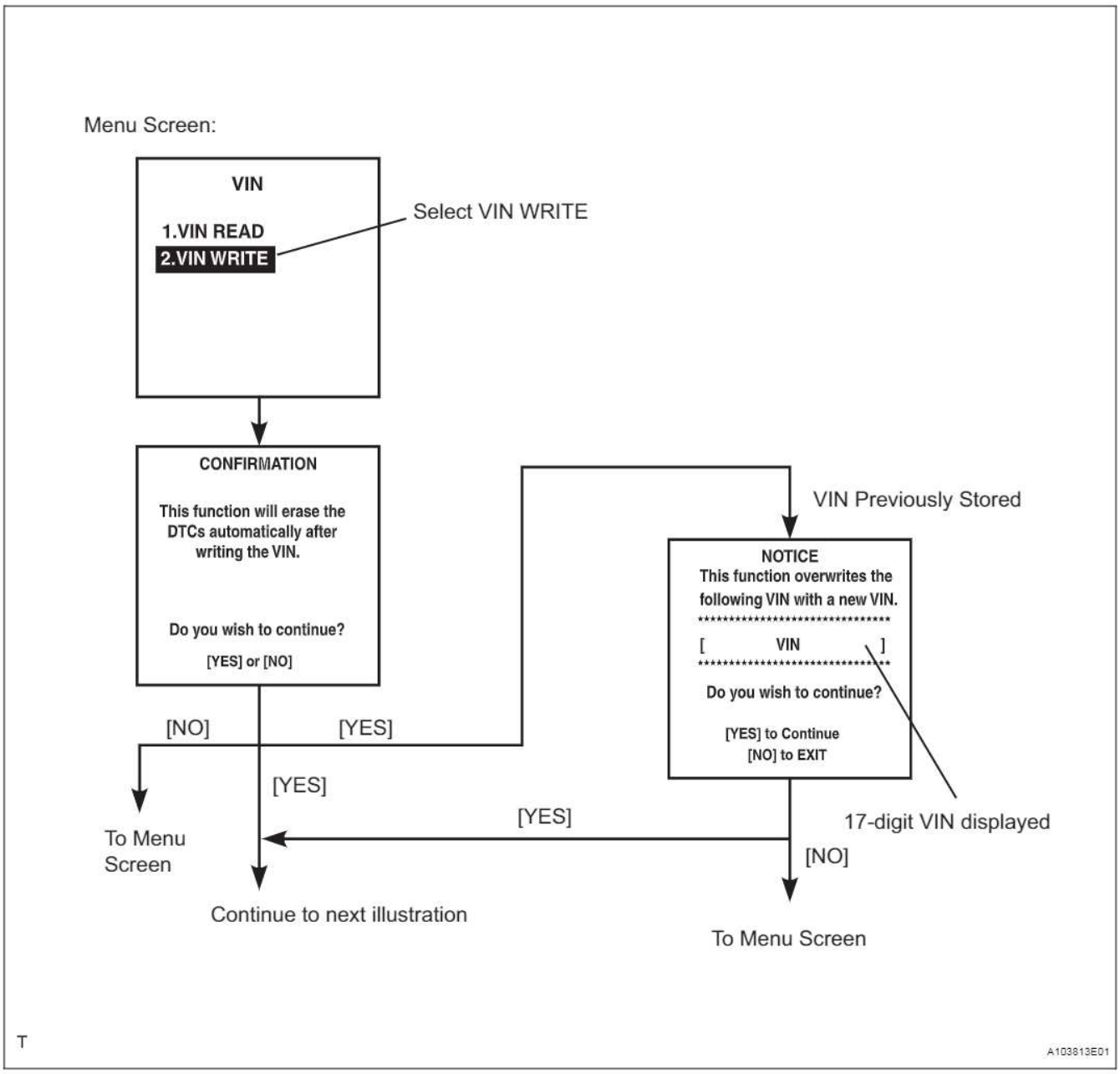
3. WRITE VIN

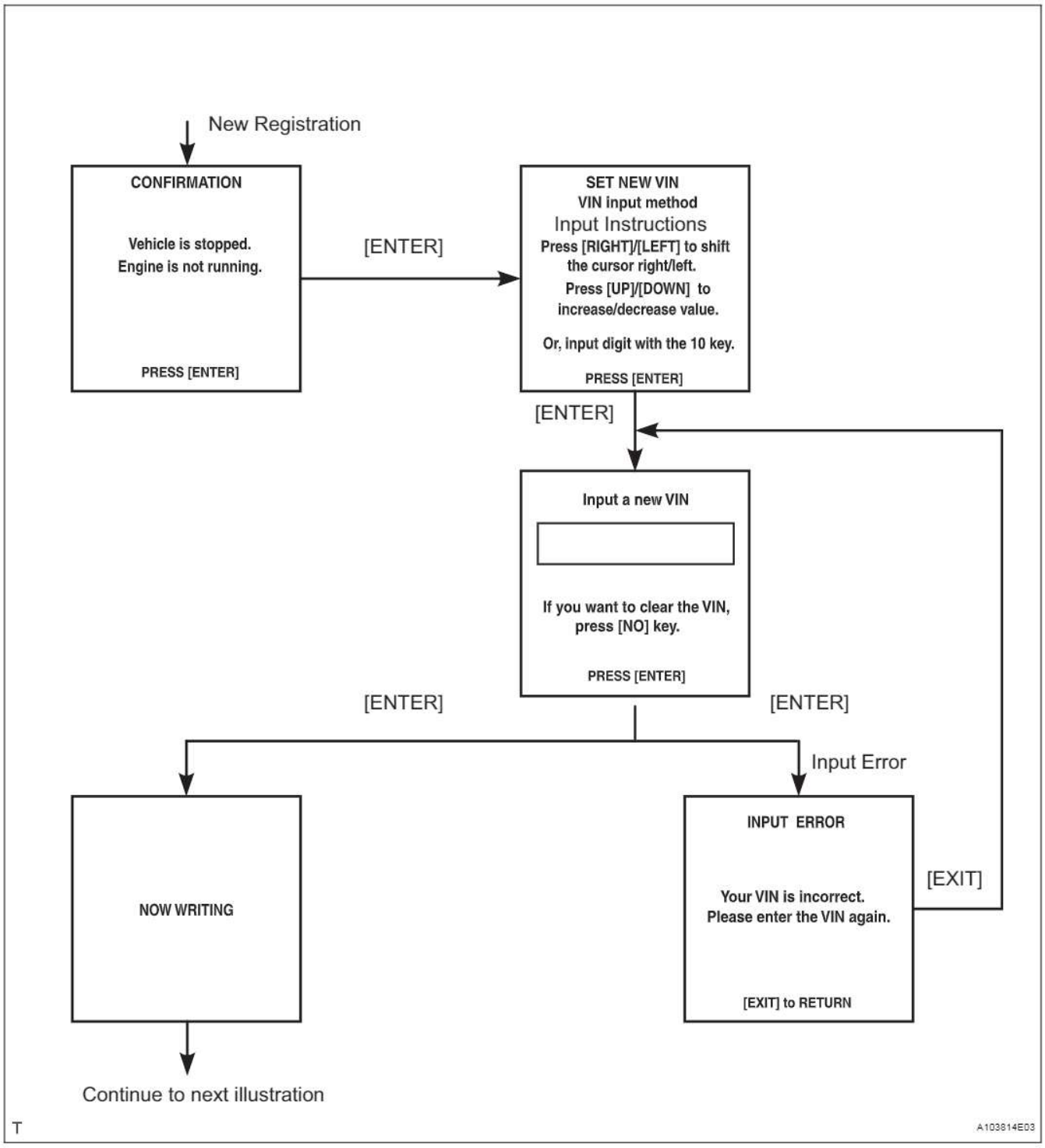
HINT:

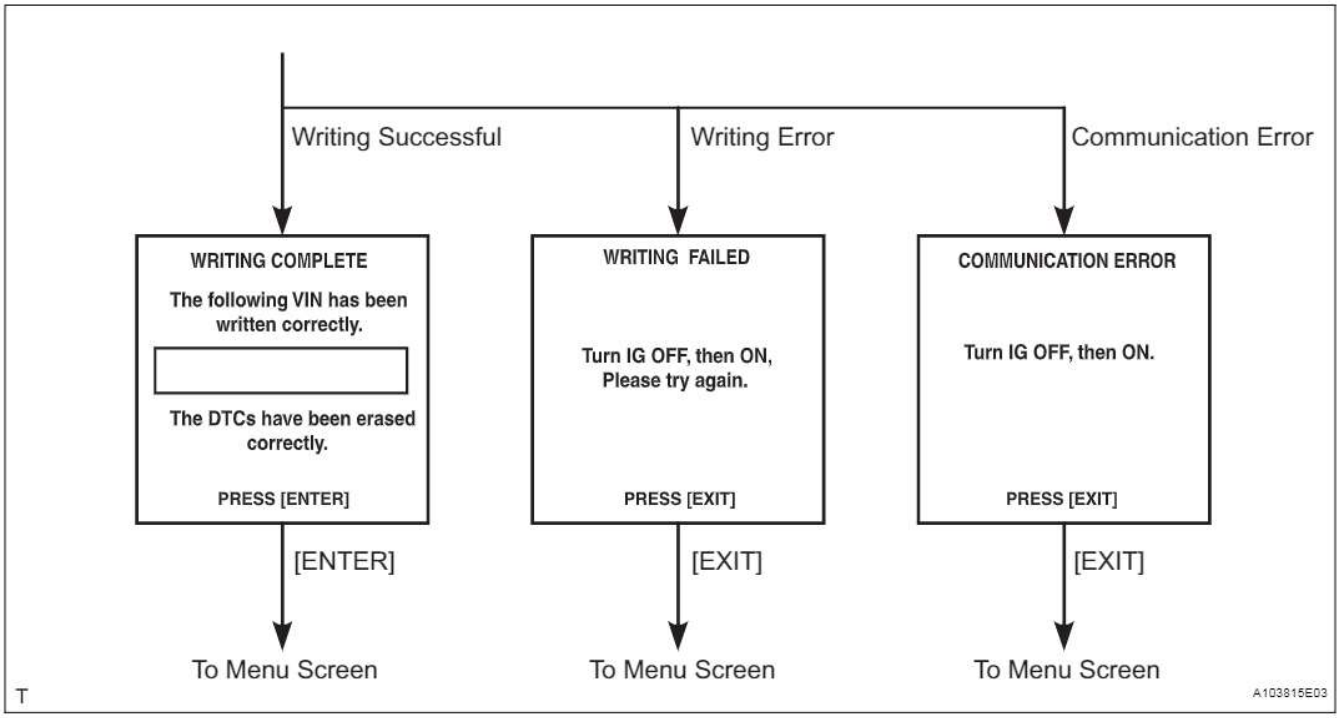
Below are the VIN writing instructions. Use the procedures and flowchart below. This process allows the VIN to be input into the ECM. If the ECM is changed, or the ECM VIN and vehicle VIN do not match, the VIN can be registered or overwritten in the ECM by following this procedure.

(a) Write VIN using the intelligent tester.
(b) Connect the intelligent tester to the DLC3.
(c) Turn the ignition switch ON.
(d) Turn the tester ON.

(e) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / VIN.




New Registration
CONFIRMATION
Vehicle is stopped.
Engine is not running.
PRESS [ENTER]
[ENTER]
SET NEW VIN
VIN input method
Input Instructions
Press [RIGHT]/[LEFT] to shift the cursor right/left.
Press [UP]/[DOWN] to increase/decrease value.
Or, input digit with the 10 key.
PRESS [ENTER]
[ENTER]
Input a new VIN
If you want to clear the VIN, press [NO] key.
PRESS [ENTER]
[ENTER]
[ENTER]
Input Error
NOW WRITING
INPUT ERROR
Your VIN is incorrect.
Please enter the VIN again.
[EXIT] to RETURN
[EXIT]
Continue to next illustration
T
A103814E03


Writing Successful
Writing Error
Communication Error
WRITING COMPLETE
The following VIN has been written correctly.
The DTCs have been erased correctly.
PRESS [ENTER]
WRITING FAILED
Turn IG OFF, then ON, Please try again.
PRESS [EXIT]
COMMUNICATION ERROR
Turn IG OFF, then ON.
PRESS [EXIT]
[ENTER]
[EXIT]
[EXIT]
To Menu Screen
To Menu Screen
To Menu Screen
T
A103815E03

DTC	P0455	Evaporative Emission Control System Leak Detected (Gross Leak)

DTC	P0456	Evaporative Emission Control System Leak Detected (Very Small Leak)

DTC SUMMARY

DTC No.	Monitoring Items	Malfunction Detection Conditions	Trouble Area	Detection Timing	Detection Logic
P0455	EVAP gross leak	Leak detection pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure measured. 0.02 inch leak criterion measured at start and at end of leak check. If stabilized pressure higher than [second 0.02 inch leak criterion x 0.2], ECM determines that EVAP system has large leakage.	• Fuel cap (loose) • Leakage from EVAP line (canister - fuel tank) • Leakage from EVAP line (purge VSV - canister) • Canister pump module • Leakage from fuel tank • Leakage from canister	While ignition switch OFF	2 trip
P0456	EVAP small leak	Leak detection pump creates negative pressure (vacuum) in EVAP system and EVAP system pressure measured. 0.02 inch leak criterion measured at start and at end of leak check. If stabilized pressure higher than second 0.02 inch leak criterion, ECM determines that EVAP system has small leakage.	Same as above	While ignition switch OFF	2 trip

ES

DESCRIPTION

The circuit description can be found in the Evaporative Emission (EVAP) system (see page ES-273).

INSPECTION PROCEDURE

Refer to the EVAP system (see page ES-273).

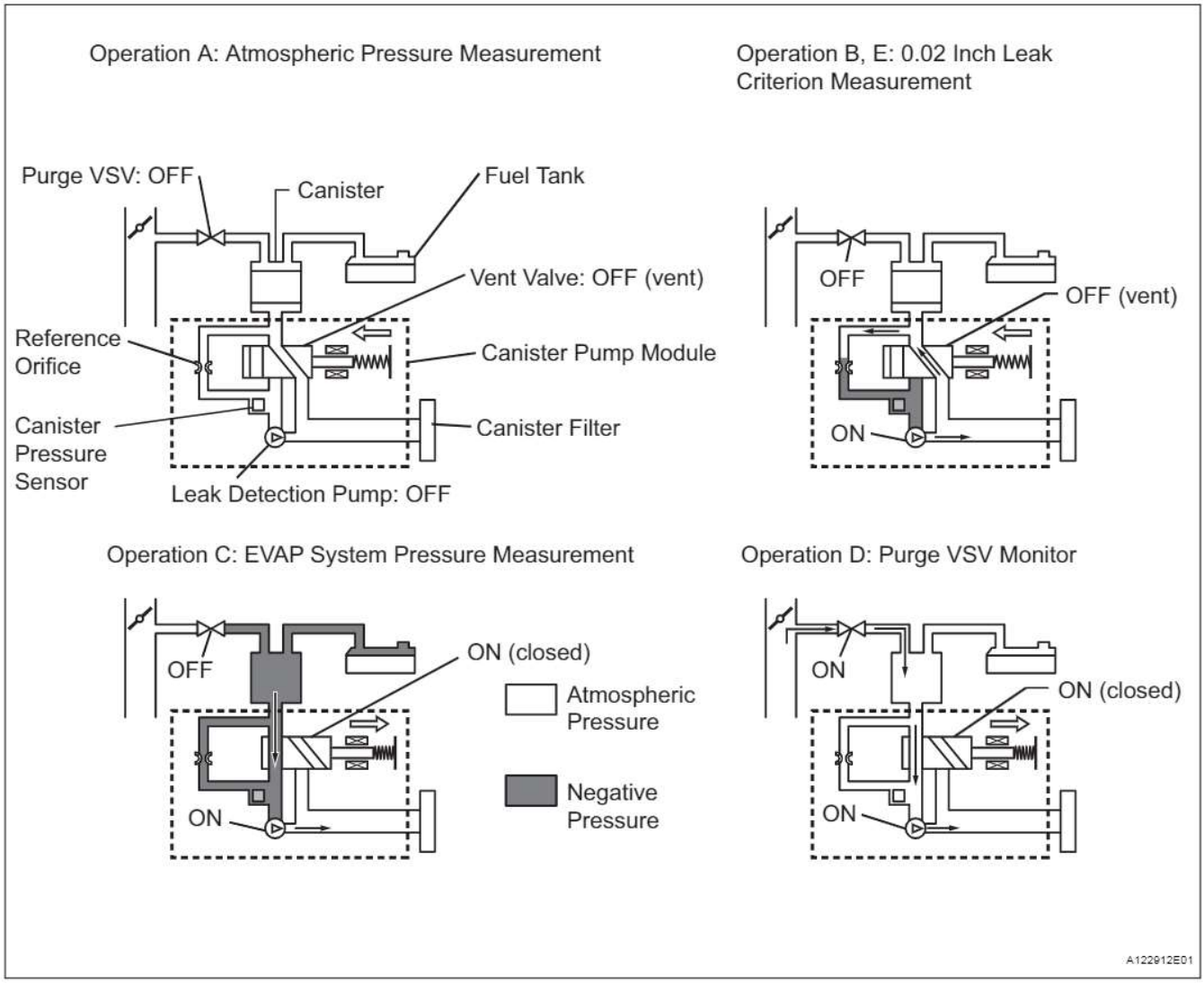
MONITOR DESCRIPTION

5 hours* after the ignition switch is turned OFF, the leak detection pump creates negative pressure (vacuum) in the EVAP system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

HINT:
*: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the ignition switch is turned OFF, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the ignition switch is turned OFF, the monitor check starts 2.5 hours later.

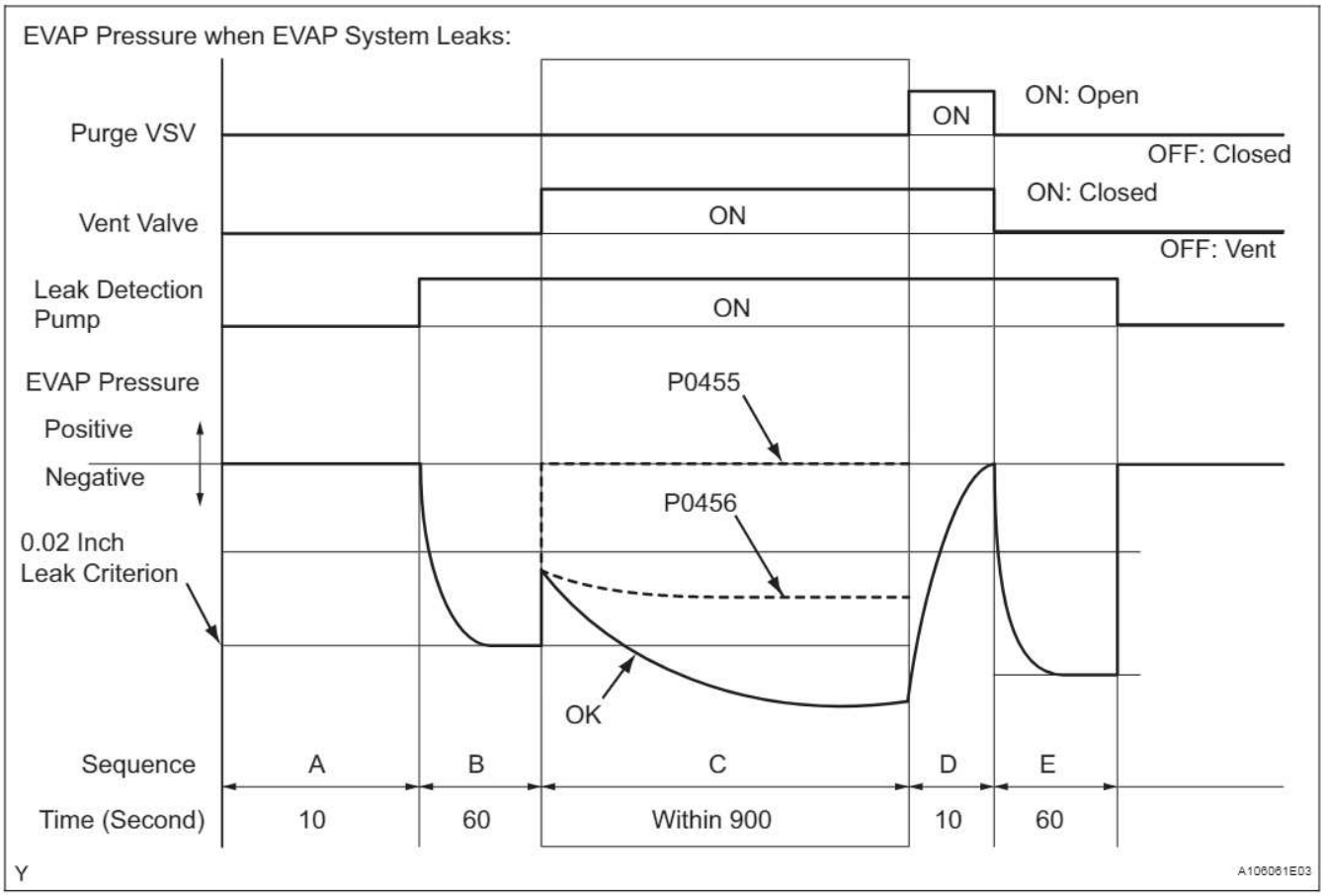
Sequence	Operations	Descriptions	Duration
-	ECM activation	Activated by soak timer 5, 7 or 9.5 hours after ignition switch OFF.	-
A	Atmospheric pressure measurement	Vent valve turned OFF (vent) and EVAP system pressure measured by ECM in order to register atmospheric pressure. If pressure in EVAP system not between 70 kPa and 110 kPa (525 mmHg and 825 mmHg), ECM cancels EVAP system monitor.	10 seconds
B	First 0.02 inch leak criterion measurement	In order to determine 0.02 inch leak criterion, leak detection pump creates negative pressure (vacuum) through reference orifice and then ECM checks if leak detection pump and vent valve operate normally.	60 seconds
C	EVAP system pressure measurement	Vent valve turned ON (closed) to shut EVAP system. Negative pressure (vacuum) created in EVAP system, and EVAP system pressure then measured. Write down measured value as it will be used in leak check. If EVAP pressure does not stabilize within 900 seconds, ECM cancels EVAP system monitor.	900 seconds*
D	Purge VSV monitor	Purge VSV opened and then EVAP system pressure measured by ECM. Large increase indicates normal.	10 seconds
E	Second 0.02 inch leak criterion measurement	After second 0.02 inch leak criterion measurement, leak check performed by comparing first and second 0.02 inch leak criterion. If stabilized system pressure higher than second 0.02 inch leak criterion, ECM determines that EVAP system leaking.	60 seconds
F	Final check	Atmospheric pressure measured and then monitoring result recorded by ECM.	-

*: If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.



1. P0455: EVAP gross leak
   In operation C, the leak detection pump creates negative pressure (vacuum) in the EVAP system and the EVAP system pressure is measured. If the stabilized system pressure is higher than [second 0.02 inch leak criterion x 0.2] (near atmospheric pressure), the ECM determines that the EVAP system has a large leakage, illuminates the MIL and sets the DTC (2 trip detection logic).

2. P0456: EVAP very small leak
In operation C, the leak detection pump creates negative pressure (vacuum) in the EVAP system and the EVAP system pressure is measured. If the stabilized system pressure is higher than the second 0.02 inch leak criterion, the ECM determines that the EVAP system has a small leakage, illuminates the MIL and sets the DTC (2 trip detection logic).



MONITOR STRATEGY

Required Sensors/Components	Purge VSV and canister pump module
Frequency of Operation	Once per driving cycle
Duration	Within 900 seconds (varies with amount of fuel in tank)
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Enabling conditions of EVAP key-OFF monitor	
P043E (Reference orifice - low flow) P043F (Reference orifice - high flow) P0441 (Purge VSV - stuck open) P0441 (Purge VSV - stuck closed) P0451 (Canister pressure sensor - noise) P0455 (EVAP gross leak) P0456 (EVAP 0.02 inch leak) P2401 (Leak detection pump - stuck OFF) P2402 (Leak detection pump - stuck ON) P2419 (Vent valve - stuck ON) P2420 (Vent valve - stuck OFF)	
Atmospheric pressure	70 to 110 kPa (525 to 825 mmHg)

Battery voltage	10.5 V or higher
Vehicle speed	4 km/h (2.5 mph) or less
Ignition switch	OFF
Time after key off	5 or 7 or 9.5 hours
Canister pressure sensor malfunction (P0450, P0452, P0453)	Not detected
Purge VSV	Not operated by scan tool
Vent valve	Not operated by scan tool
Leak detection pump	Not operated by scan tool
Both of the following conditions 1 and 2 are met before key off	-
1. Duration that vehicle has been driven	5 minutes or more
2. EVAP purge operation	Performed
ECT	4.4 to 35°C (40 to 95°F)
IAT	4.4 to 35°C (40 to 95°F)

1. Key-off monitor sequence 1 to 8

1. Atmospheric pressure measurement

Next sequence is run if the following condition is met	-
Atmospheric pressure change	Within 0.3 kPa (2.25 mmHg) in 1 second

2. First reference pressure measurement

Next sequence is run if the following conditions are met	-
EVAP pressure just after reference pressure measurement start	-1 kPa (-7.5 mmHg) or lower
Reference pressure	-4.85 to -1.05 kPa (726 to 754 mmHg)
Reference pressure	Saturated within 60 seconds

3. Vent valve stuck closed check

Next sequence is run if the following condition is met	-
EVAP pressure change after vent valve is ON	0.3 kPa (2.25 mmHg) or more

4. Vacuum introduction

Next sequence is run if the following condition is met	-
EVAP pressure	Saturated within 900 seconds

5. Purge VSV stuck closed check

Next sequence is run if the following condition is met	-
EVAP pressure change after purge valve is open	0.3 kPa (2.25 mmHg) or more

6. Second reference pressure measurement

Next sequence is run if the following conditions are met	-
EVAP pressure just after reference pressure measurement	-1 kPa (-7.5 mmHg) or lower
Reference pressure	-4.85 to -1.05 kPa (726 to 754 mmHg)
Reference pressure	Saturated within 60 seconds
Reference pressure difference between first and second	Less than 0.7 kPa (5.25 mmHg)

7. Leak check

Next sequence is run if the following condition is met	-
EVAP pressure when vacuum introduction is complete	Lower than second reference pressure

8. Atmospheric pressure measurement

EVAP monitor is complete if the following condition is met	-
Atmospheric pressure difference between sequence 1 and 8	Within 0.3 kPa (2.25 mmHg)

TYPICAL MALFUNCTION THRESHOLDS

"Saturated" indicates that the EVAP pressure change is less than 0.1 kPa (0.75 mmHg) in 30 seconds.

P0455: EVAP gross leak

FTP when vacuum introduction complete	Higher than reference pressure x 0.2

P0456: EVAP small leak

FTP when vacuum introduction complete	Between "reference pressure" and "reference pressure x 0.2"

MONITOR RESULT

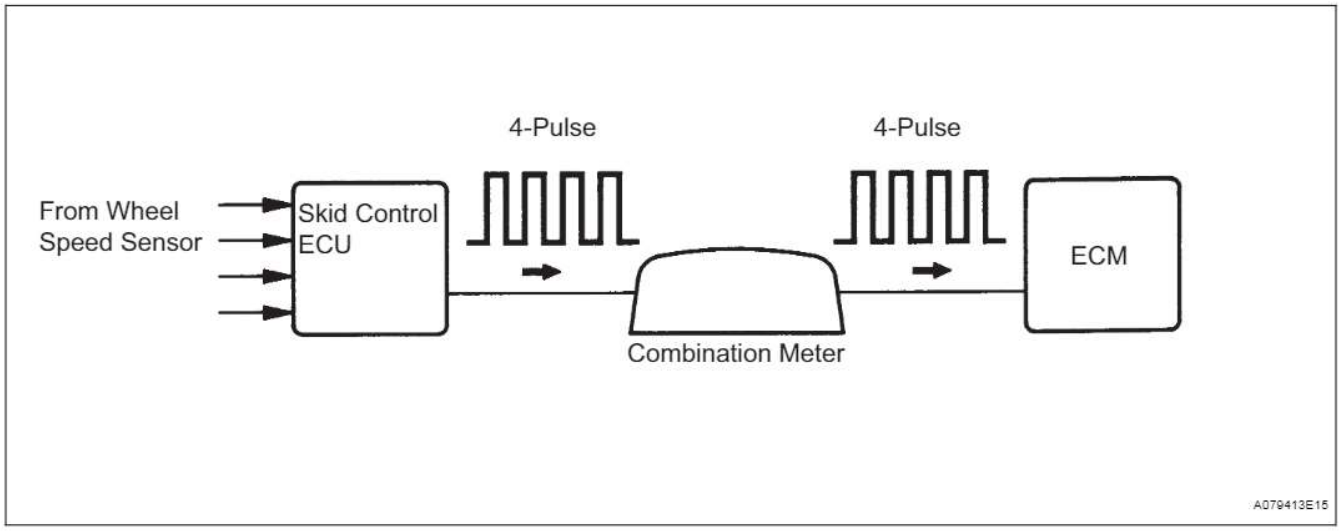
Refer to CHECKING MONITOR STATUS (see page ES-19).

ES

DTC	P0500	Vehicle Speed Sensor "A"

DESCRIPTION

Vehicles, which are equipped with ABS (Anti-lock Brake System), detect the vehicle speed using the skid control ECU and wheel speed sensor. The wheel speed sensor monitors the wheel rotation speed and sends a signal to the skid control ECU. The skid control ECU converts the wheel speed signal into a 4-pulse signal and transmits it to the ECM via the combination meter. The ECM determines the vehicle speed based on the frequency of the pulse signal.



DTC No.	DTC Detection Condition	Trouble Area
P0500	While vehicle being driven, no vehicle speed sensor signal to ECM (1 trip detection logic: Automatic transaxle) (2 trip detection logic: Manual transaxle)	• Open or short in vehicle speed sensor circuit • Vehicle speed sensor • Combination meter • ECM • Skid control ECU

MONITOR DESCRIPTION

Automatic Transaxle Models:
The ECM assumes that the vehicle is being driven when the indicated engine speed is more than 2,300 rpm and 30 seconds have elapsed since the Park/Neutral Position (PNP) switch was turned OFF. If there is no signal from vehicle speed sensor, despite these conditions being met, the ECM interprets this as a malfunction in the sensor. The ECM then illuminates the MIL and sets the DTC.
Manual Transaxle Models:
The ECM assumes that the vehicle is being driven while the vehicle speed sensor signal is being transmitted by the combination meter. If there is no signal from the vehicle speed sensor despite this condition being met, the ECM interprets this as a malfunction in the sensor. The ECM then illuminates the MIL and sets the DTC.

MONITOR STRATEGY

Related DTCs	P0500: Vehicle speed sensor "A" pulse input error
Required sensors / components (Main)	Vehicle Speed Sensor (VSS), Combination meter and Skid control ECU
Required sensors / components (Related)	PNP switch, Engine Coolant Temperature (ECT) sensor, Crankshaft Position (CKP) sensor and Mass Air Flow (MAF) meter
Frequency of operation	Continuous
Duration	2 seconds: Automatic transaxle, Intake air temperature -10°C (14°F) or more 8 seconds: Automatic transaxle, Intake air temperature less than -10°C (14°F) 8 seconds: Manual transaxle

MIL operation	Immediate: Automatic transaxle 2 driving cycles: Manual transaxle
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	None

M/T:

Engine coolant temperature	70°C (158°F) or more
Engine speed	2,000 to 5,000 rpm
Fuel cut at high engine speed	Not executing

ES

A/T:

Either of following conditions (a) or (b) met:	-
(a) Following conditions 1 and 2 met:	-
1. ECT and ECT sensor	20°C (68°F) or more, and sensor does not malfunction (P0115 or P0116)
2. Time after PNP switch turned OFF	10 seconds or more
(b) Following conditions 1 and 2 met:	-
1. ECT and ECT sensor	Less than 20°C (68°F), and sensor malfunction (P0115 or P0116)
2. Time after PNP switch turned OFF	30 seconds or more
Engine speed	2,800 rpm or more (varies with throttle valve opening angle)
Fuel cut at high engine speed	Not executing
Time after ignition switch turned ON	3 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

Vehicle speed sensor signal	No pulse input

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

Read freeze frame data using the intelligent tester. Freeze frame data records the engine conditions when a malfunction is detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

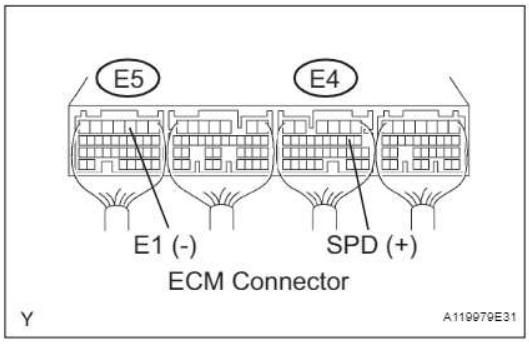
1	CHECK OPERATION OF SPEEDOMETER

(a) Drive the vehicle and check if the operation of the speedometer in the combination meter is normal.
HINT:
The vehicle speed sensor is operating normally if the speedometer reading is normal.

NG → CHECK SPEEDOMETER CIRCUIT

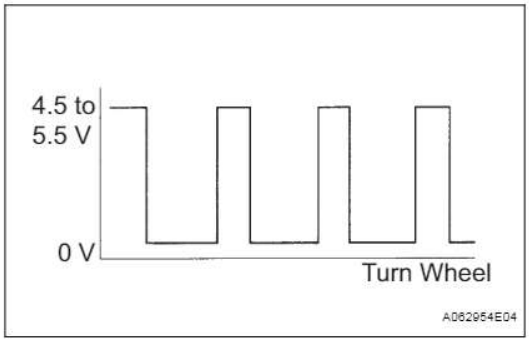
OK

2	INSPECT ECM (SPD VOLTAGE)



(a) Move the transmission gear selector lever to the neutral position.
(b) Jack up the vehicle.
(c) Turn the ignition switch ON.
(d) Measure the voltage between the terminals of the E4 and E5 ECM connectors as the front wheel is turned slowly.
Standard voltage

Tester Connection	Specified Condition
SPD (E4-8) - E1 (E5-3)	Voltage generated intermittently



HINT:
The output voltage should fluctuate up and down similarly to the diagram when the wheel is turned slowly.

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ECM

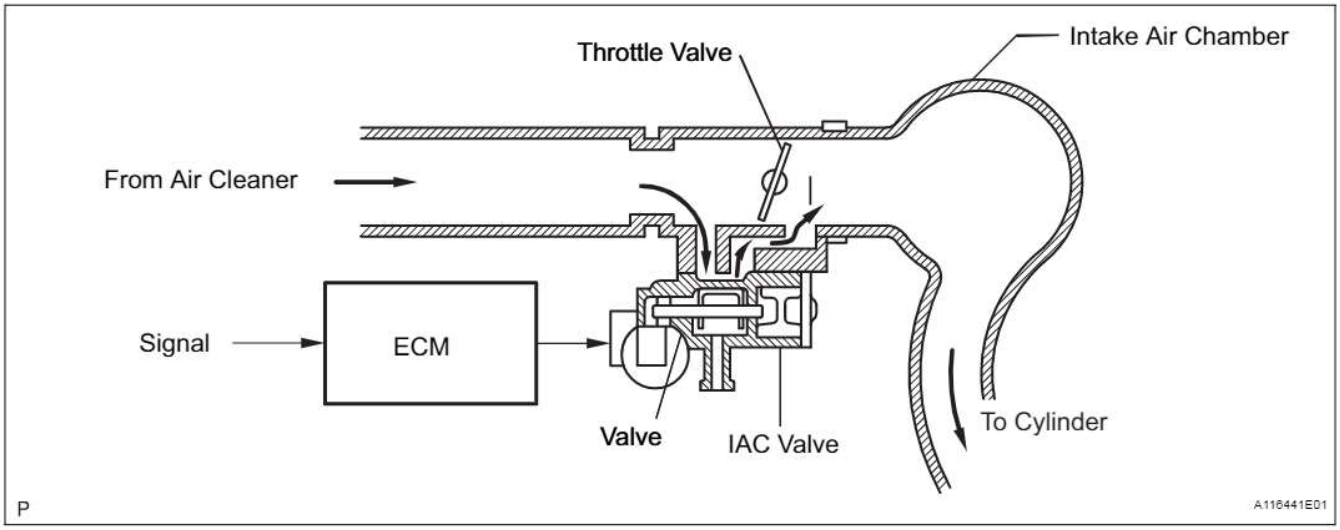
DTC	P0505	Idle Control System Malfunction

DTC	P0511	Idle Air Control Circuit

DESCRIPTION

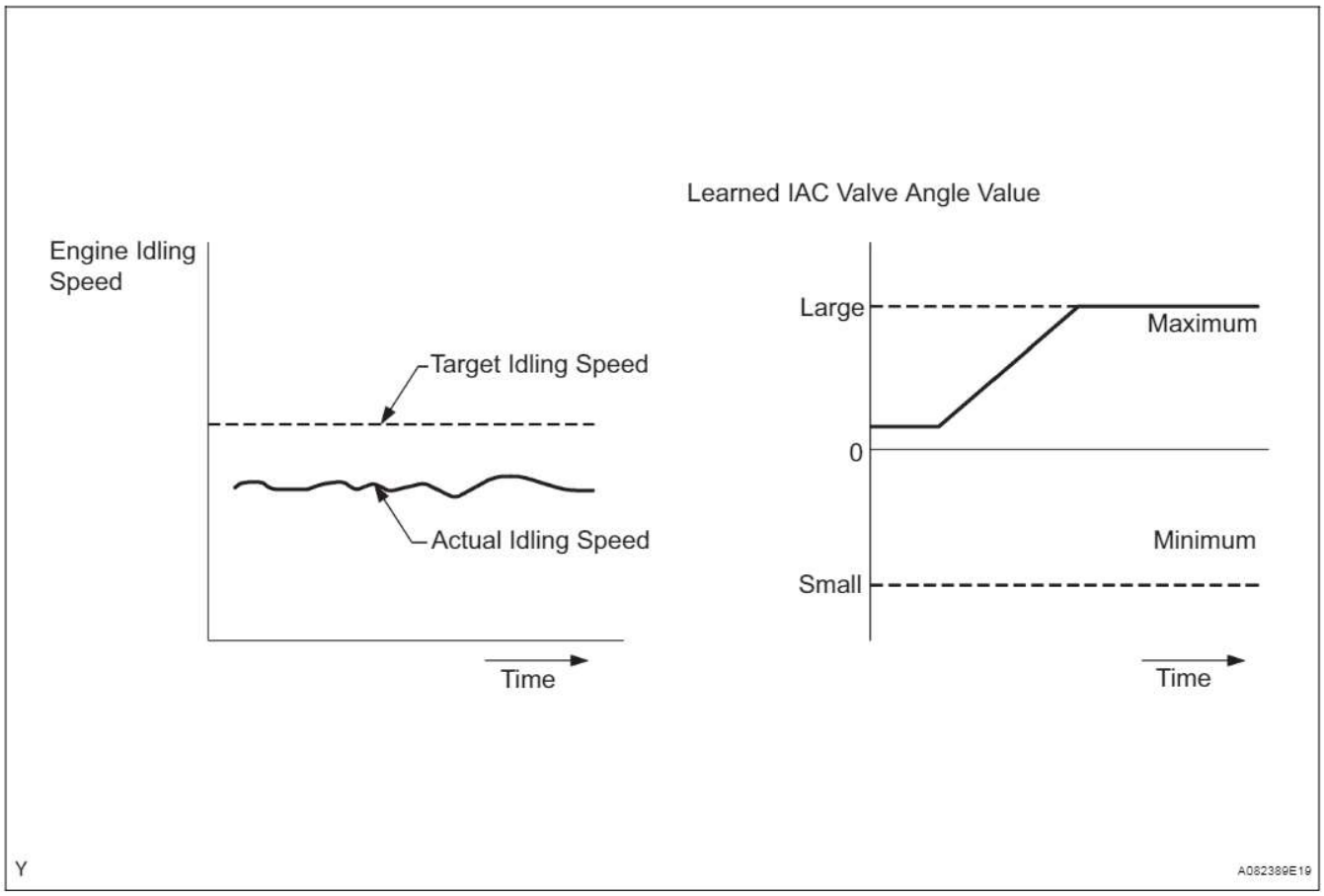
The Idle Air Control (IAC) valve, a rotary solenoid type, is located under the throttle body. Intake air bypassing the throttle valve flows into the IAC valve through a passage.
The valve regulates the volume of intake air that bypasses the throttle valve and allows the engine idling speed to be controlled.
The IAC valve is used by the ECM to perform idle-up and its feedback signal is used as one factor in target engine idling speed regulation.

ES



DTC No.	DTC Detection Condition	Trouble Area
P0505	Engine idling speed continues to vary greatly from target idling speed (2 trip detection logic)	• Open or short in IAC valve circuit • IAC valve stuck or closed • A/C switch circuit • Air induction system • Ventilation valve and hose • ECM
P0511	Open or short IAC valve circuit (1 trip detection logic)	• Open or short in IAC valve circuit • IAC valve stuck or closed • ECM

MONITOR DESCRIPTION



The IAC valve controls the volume of air that bypasses the throttle valve.
Idling speed is determined by the volume of air that passes through the Intake Air Control (IAC) valve. When the volume is large, the idling speed increases. Conversely, when it is small, the idling speed decreases. The ECM sends a duty signal to the IAC valve and drives the IAC valve motor to regulate this air volume.
If any of the following conditions apply, the ECM determines that the IAC system is malfunctioning, and illuminates the MIL and sets a DTC. The actual engine idling speed does not reach the target idling speed, the IAC learned valve angle remains at the maximum or minimum, or the duty ratio signal to the IAC valve is stuck.
Example:
The ECM sets DTC P0505 if either of the following conditions applies:
- The difference between the actual and target engine idling speeds exceeds 200* rpm while the engine idles, and this occurs 5 times.
- The IAC learned valve angle remains at the maximum or minimum for 5 seconds.

The ECM sets DTC P0511 (open/short circuit) if the following condition applies:
- The duty ratio signal to the IAC valve is stuck at 0 or 100%.

*: The threshold varies according to engine load.

MONITOR STRATEGY

Related DTCs	P0505: Idle Air Control (IAC) valve P0511: Idle Air Control (IAC) valve
Required Sensors/Components (Main)	Crankshaft position (CKP) sensor
Required Sensors/Components (Related)	Engine Coolant Temperature (ECT) sensor and Vehicle Speed Sensor (VSS)
Frequency of Operation	P0505 Functional check: once per driving cycle P0505 Range check, P0511: continuous

Duration	10 minutes: IAC functional check 10 seconds: IAC range check
MIL Operation	P0505 Functional check: 2 driving cycles P0505 Range check, P0511: Immediate
Sequence Operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	None

P0505 IAC functional check:

Engine	Running

P0505 IAC range check:

IAC duty ratio	10 to 90%
Battery voltage	10 V or more

P0511:

IAC duty ratio	10 to 90%
Battery voltage	10 V or more
Time after first missing of voltage change	10 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

P0505 IAC functional check:

When either condition below is met:	1 or 2
1. Frequency that both of following conditions (a) and (b) set	5 times or more
(a) Engine rpm - Target engine rpm	Less than -100 rpm, or more than 150 rpm
(b) Vehicle condition	Stop after vehicle was driven by 10 km/h (6.25 mph) or more
2. Frequency that both of following conditions (c) and (d) set	Once
(c) Engine rpm - Target engine rpm	Less than -100 rpm, or more than 150 rpm
(d) IAC flow rate learning value	0.55 L/sec. or less, or 2.75 L/sec. or more

P0505 IAC range check:

Number of missed output voltage change	2,000 times or more

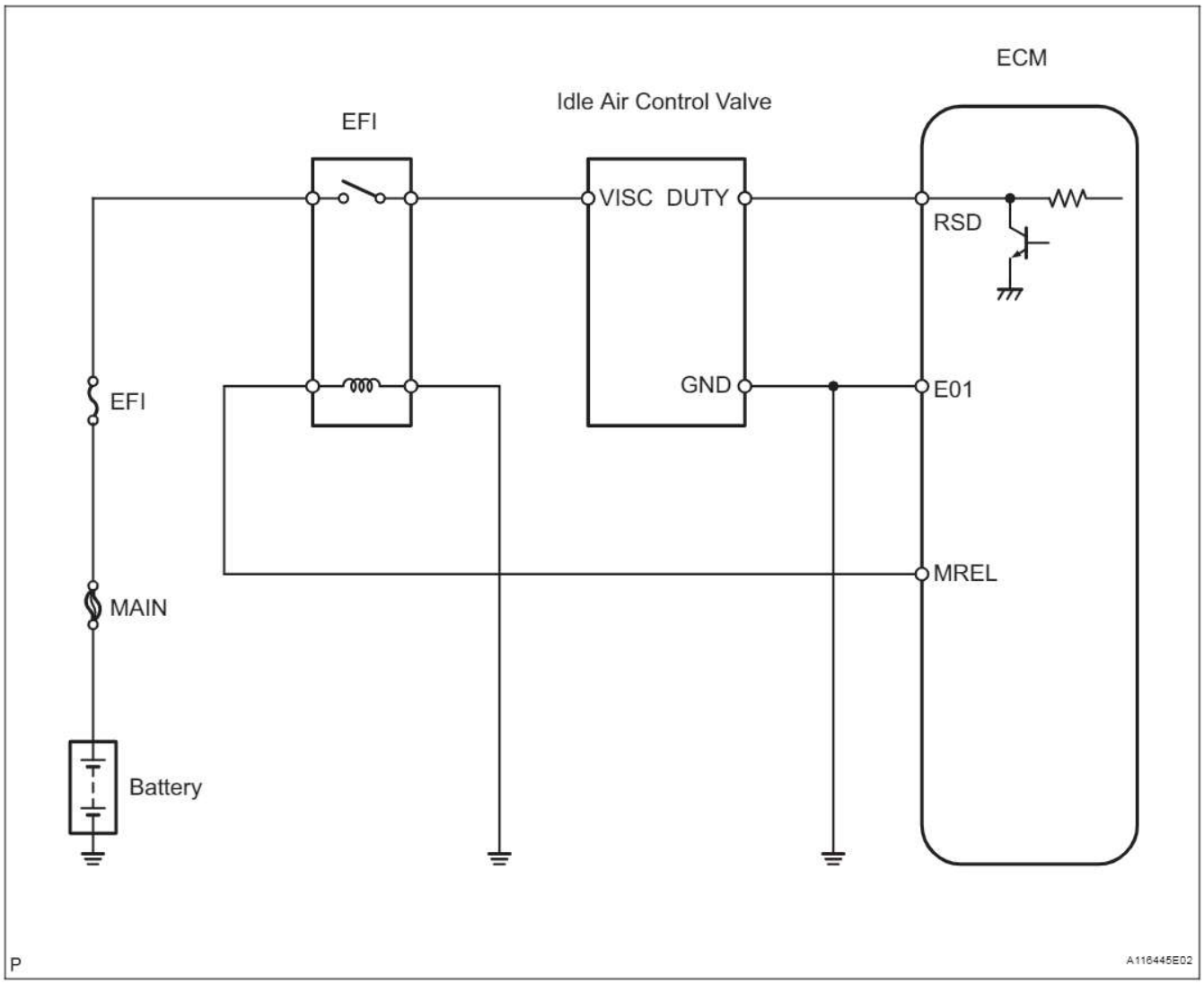
P0511:

Number of miss output voltage change	1,000 times or more

COMPONENT OPERATING RANGE

Time with no missed voltage change	0.5 seconds or more

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- When the throttle position is slightly opened (the accelerator pedal is slightly depressed) because a floor carpet is overlapped on the accelerator pedal, or if not fully releasing the accelerator pedal, etc., DTC P505 will possibly be detected.
- Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	CHECK ANY OTHER DTCS OUTPUT (IN ADDITION TO DTC P0505)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read DTCs (see page ES-48).

Result

Display (DTC Output)	Proceed to
P0505	A
P0511	B

B → Go to step 7

A

2 CHECK VENTILATION HOSE CONNECTIONS

OK:
Ventilation hose is connected correctly and is not damaged.

NG → REPAIR OR REPLACE VENTILATION HOSE

OK

3 CHECK AIR INDUCTION SYSTEM

(a) Check the air induction system for vacuum leakage.
OK:
No leakage from air induction system.

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

4 PERFORM ACTIVE TEST BY INTELLIGENT TESTER (CHECK IAC VALVE OPERATION)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Start the engine and warm it up to the normal operating temperature.
(d) Switch off all the accessories (if on).
(e) Switch off A/C (if on).
(f) Move the gear selector lever to the N position.
(g) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / IAC STEP POS.
(h) Check that the engine speed varies when the Idle Air Control (IAC) step position is changed using the tester.
OK:
Engine speed fluctuates according to IAC step position variation.

OK → CHECK FOR INTERMITTENT PROBLEMS

NG

5	CHECK A/C SIGNAL CIRCUIT

(a) Check the A/C signal circuit (see page AC-11).

NG → REPAIR OR REPLACE MALFUNCTIONING PARTS, COMPONENT AND AREA

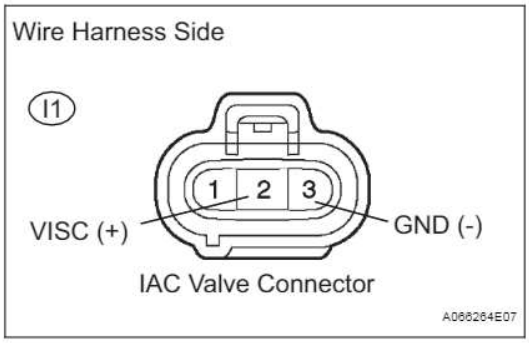
OK

6	CHECK FOR BLOCKAGE IN IAC VALVE AND PASSAGE TO BYPASS THROTTLE VALVE

NG → REPLACE IDLE AIR CONTROL VALVE

OK

7	CHECK HARNESS AND CONNECTOR (BATTERY - IAC VALVE, IAC VALVE - BODY GROUND)



(a) Disconnect the I1 IAC valve connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage between the terminals of the IAC valve wire harness side connector.

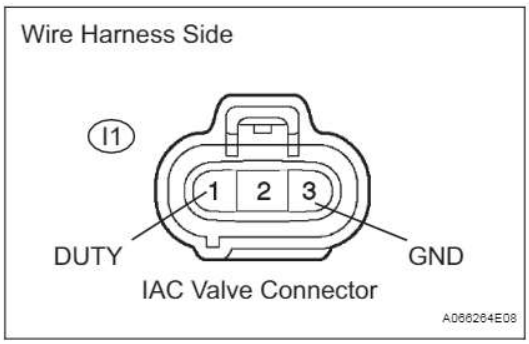
Standard voltage

Tester Connection	Specified Condition
VISC (I1-2) - GND (I1-3)	9 to 14 V

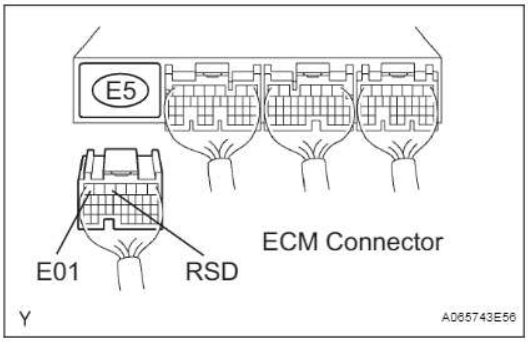
NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

8	CHECK HARNESS AND CONNECTOR (IAC VALVE - ECM)



(a) Disconnect the I1 IAC valve connector.



(b) Disconnect the E5 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard resistance (Check for open)

Tester Connection	Specified Condition
DUTY (I1-1) - RSD (E5-5)	Below 1 Ω
GND (I1-3) - E01 (E5-7)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
DUTY (I1-1) or RSD (E5-5) - Body ground	10 kΩ or higher

ES

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

9	INSPECT IDLE AIR CONTROL VALVE

(a) Inspect the IAC valve (see page ES-352).

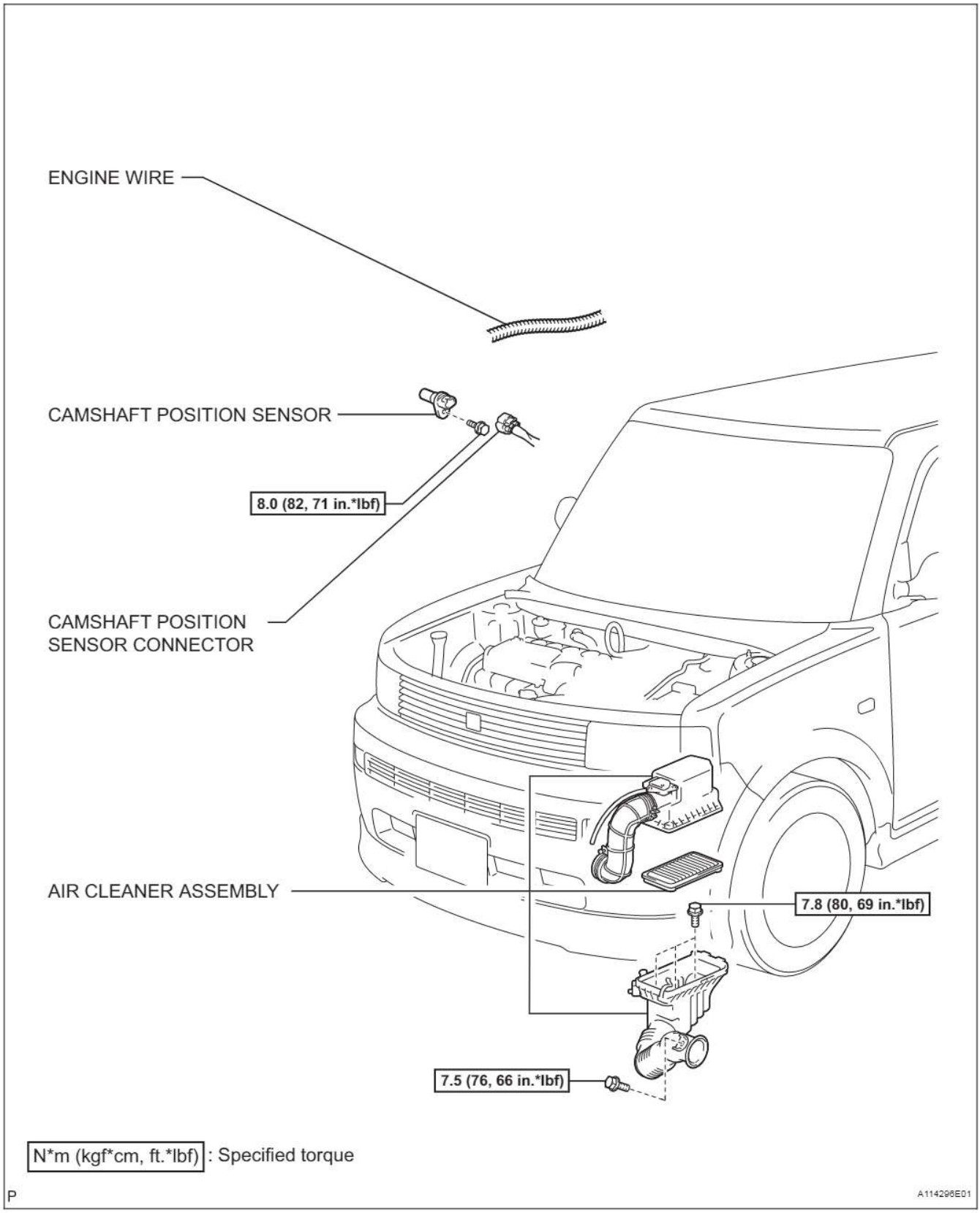
NG → **REPLACE IDLE AIR CONTROL VALVE**

OK

REPLACE ECM

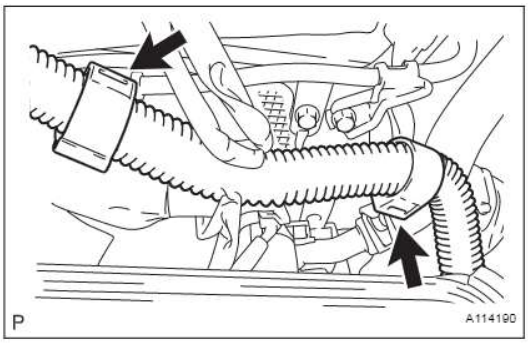
CAMSHAFT POSITION SENSOR

COMPONENTS

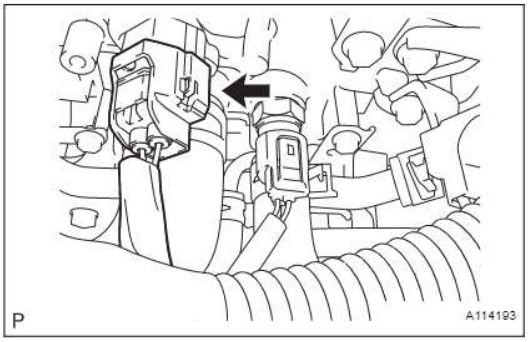


REMOVAL

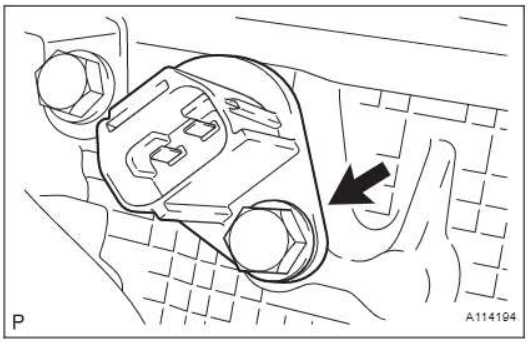
1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
2. **REMOVE AIR CLEANER ASSEMBLY (See page ES-347)**
3. **DISCONNECT ENGINE WIRE**
   (a) Disconnect the 2 clamps of the engine wire.



4. **REMOVE CAMSHAFT POSITION SENSOR**
   (a) Disconnect the sensor connector.

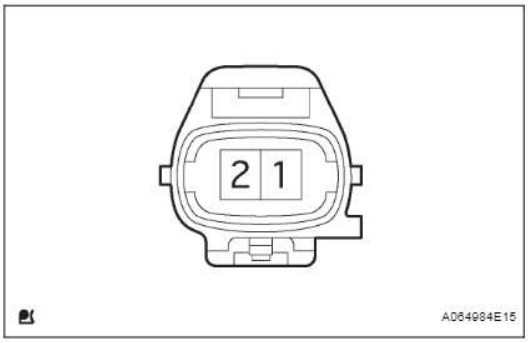


   (b) Remove the bolt and sensor.



INSPECTION

1. **INSPECT CAMSHAFT POSITION SENSOR**
   (a) Measure the resistance of the sensor.
   Standard resistance



Tester Connection	Condition	Specified Condition
1 - 2	Cold	1.630 to 2.740 Ω
1 - 2	Hot	2.065 to 3.225 Ω

If the result is not as specified, replace the camshaft position sensor.

DTC	P0550	Power Steering Pressure Sensor Circuit Malfunction

DTC	P0552	Power Steering Pressure Sensor Circuit Low Input

DTC	P0553	Power Steering Pressure Sensor Circuit High Input

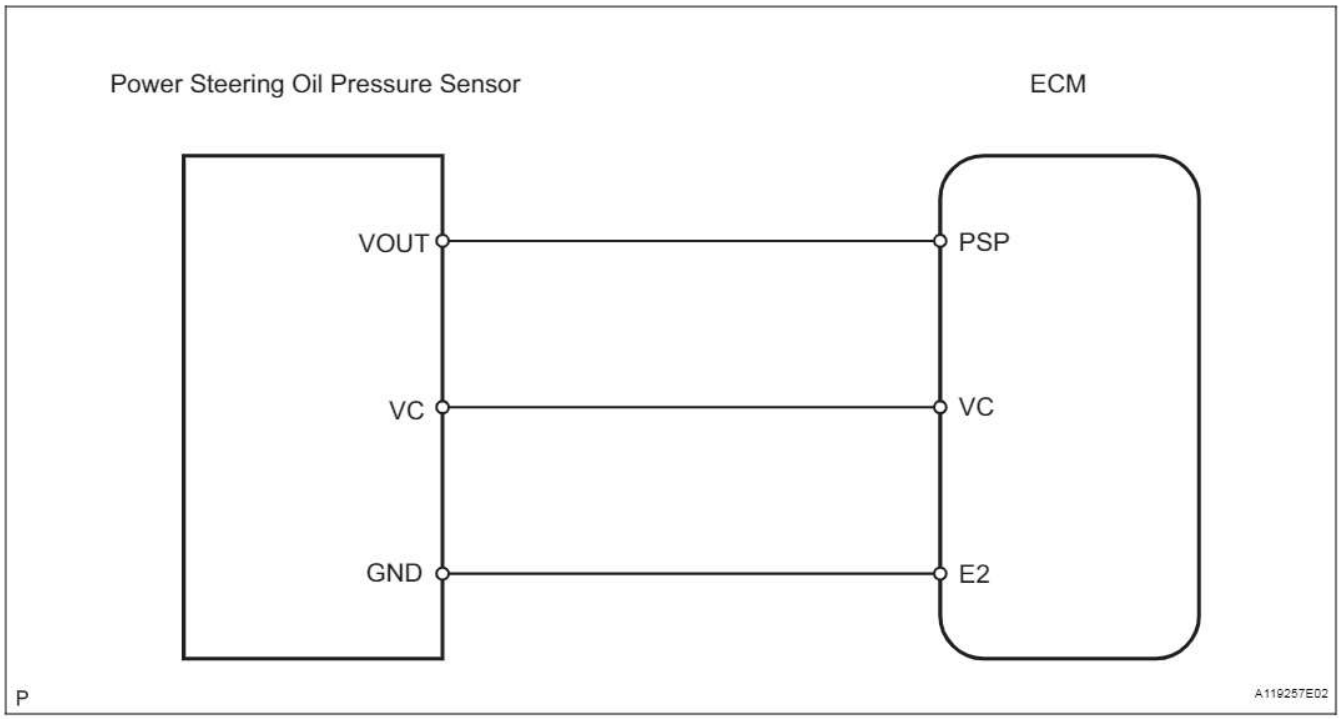
DESCRIPTION

ES

The power steering oil pressure sensor is turned ON when a power steering wheel load occurs by turning the steering wheel. The ECM regulates the engine idling RPM according to the voltage output of the sensor.

DTC No.	DTC Detection Condition	Trouble Area
P0550	Open or short in power steering oil pressure sensor circuit detected for more than 3 seconds after ignition switch turned ON. (1 trip detection logic)	• Open or short in power steering oil pressure sensor circuit • Power steering oil pressure sensor • ECM
P0552	Open in power steering oil pressure sensor circuit detected for more than 3 seconds after ignition switch turned ON.	• Open in power steering oil pressure sensor circuit • Power steering oil pressure sensor • ECM
P0553	Short in power steering oil pressure sensor circuit detected for more than 3 seconds after ignition switch turned ON.	• Short in power steering oil pressure sensor circuit • Power steering oil pressure sensor • ECM

WIRING DIAGRAM



MONITOR DESCRIPTION

The ECM monitors the sensor voltage and uses this value to regulate the engine idling speed. When the sensor output voltage deviates from the normal operating range, the ECM determines that there is a malfunction in the power steering oil pressure sensor and sets a DTC.

MONITOR STRATEGY

Related DTCs	P0550: Power steering pressure sensor range check (Chattering) P0552: Power steering pressure sensor range check (Low Resistance) P0553: Power steering pressure sensor range check (High Resistance)
Required sensors/components (Main)	Power steering pressure sensor
Frequency of operation	Continuous
Duration	0.5 seconds
MIL operation	Immediate
Sequence of operation	None

ES

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	None
Time after starter signal ON to OFF	2 seconds or more

TYPICAL MALFUNCTION THRESHOLDS

P0550:

Power steering pressure sensor voltage	Less than 0.28 V, or more than 4.9 V

P0552:

Power steering pressure sensor voltage	Less than 0.28 V

P0553:

Power steering pressure sensor voltage	More than 4.9 V

INSPECTION PROCEDURE

HINT:

- If other DTCs relating to different systems that have terminal E2 as the ground terminal are output simultaneously, terminal E2 may have an open circuit.
- Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	CHECK POWER STEERING OIL PRESSURE SENSOR

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Start the engine.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / PS SIGNAL.
(e) Read the value displayed on the tester.

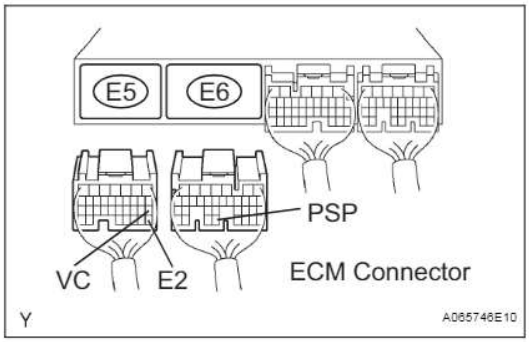
OK

Condition	Power steering oil pressure sensor
Steering wheel locked	ON
Engine is idling	OFF

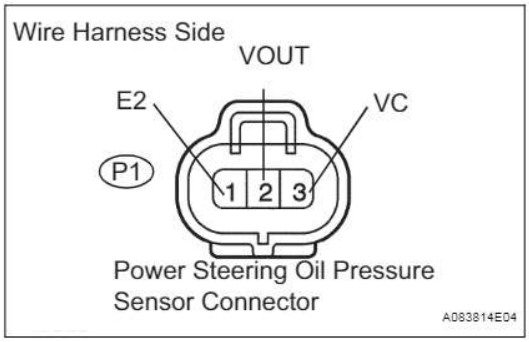
OK → CHECK FOR INTERMITTENT PROBLEMS

NG

2 CHECK HARNESS AND CONNECTOR (ECM - POWER STEERING OIL PRESSURE SENSOR)



(a) Disconnect the E5 and E6 ECM connectors.



(b) Disconnect the P1 power steering oil pressure sensor connector.

(c) Measure the resistance of the wire harness side connectors.

Standard resistance (Check for open)

Tester Connection	Specified Condition
DUTY (P1-2) - PSP (E6-32)	Below 1 Ω
VC (P1-3) - VC (E5-18)	
E2 (P1-1) - E2 (E5-28)	

Standard resistance (Check for short)

Tester Connection	Specified Condition
DUTY (P1-2) or PSP (E6-32) - Body ground	10 kΩ or higher
E2 (P1-1) or E2 (E5-28) - Body ground	

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE POWER STEERING OIL PRESSURE SENSOR

DTC	P0560	System Voltage

MONITOR DESCRIPTION

The battery supplies electricity to the ECM even when the ignition switch is in the OFF position. This power allows the ECM to store data such as DTC history, freeze frame data and fuel trim values. If the battery voltage falls below a minimum level, the memory is cleared and the ECM determines that there is a malfunction in the power supply circuit. When the engine is next started, the ECM illuminates the MIL and sets the DTC.

DTC No.	DTC Detection Condition	Trouble Area
P0560	Open in ECM back up power source circuit (1 trip detection logic)	• Open in back up power source circuit • EFI fuse • ECM

ES

HINT:
If DTC P0560 is set, the ECM does not store other DTCs.

MONITOR STRATEGY

Related DTCs	P0560: ECM system voltage
Required Sensors/Components (Main)	ECM
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	3 seconds
MIL Operation	Immediate (MIL will be illuminated after next engine start)
Sequence of Operation	None

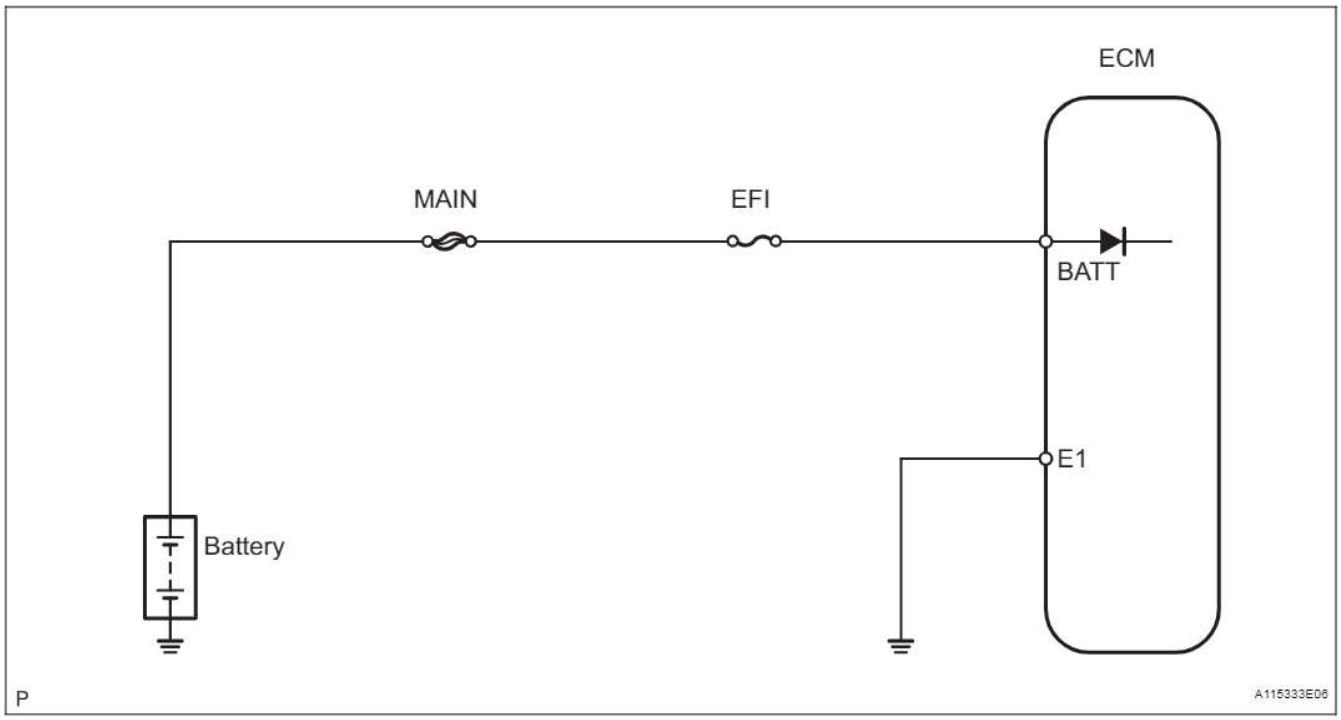
TYPICAL ENABLING CONDITIONS

Monitor runs whenever these DTCs not present	None

TYPICAL MALFUNCTION THRESHOLDS

ECM power source	Less than 3.5 V

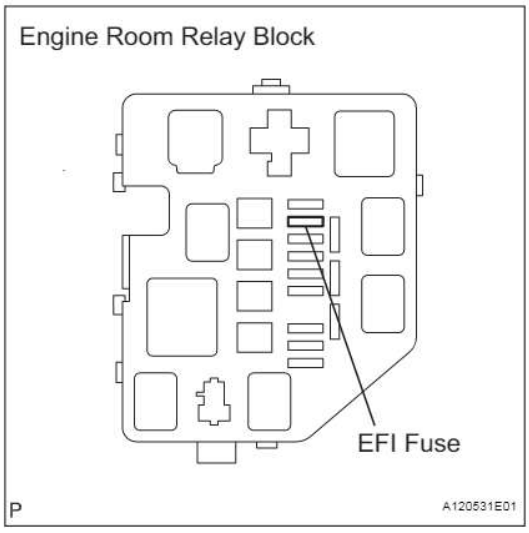
WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:
Read freeze frame data using the intelligent tester. Freeze frame data records the engine conditions when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was running or stopped, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	CHECK FUSE (EFI)

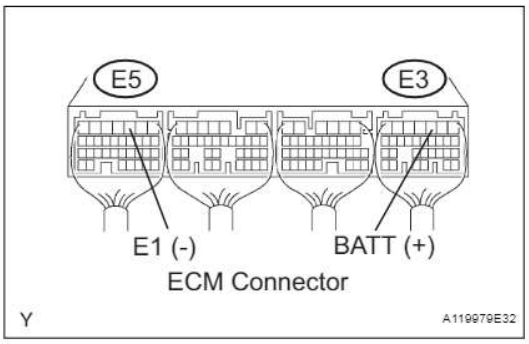


(a) Remove the EFI fuse from the engine room relay block.
(b) Measure the resistance of the EFI fuse.
Standard resistance:
Below 1 Ω

NG → **CHECK FOR SHORT IN ALL HARNESSES AND COMPONENTS CONNECTED TO FUSE**

OK

2	INSPECT ECM (BATT VOLTAGE)



(a) Measure the voltage of the E3 and E5 ECM connectors.
Standard voltage

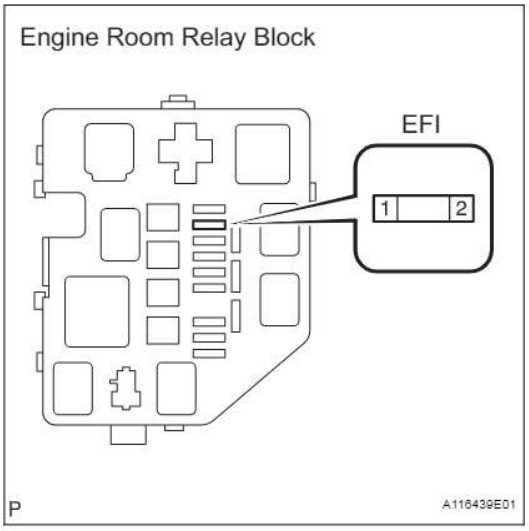
Tester Connection	Specified Condition
BATT (E3-3) - E1 (E5-3)	9 to 14 V

NG → Go to step 3

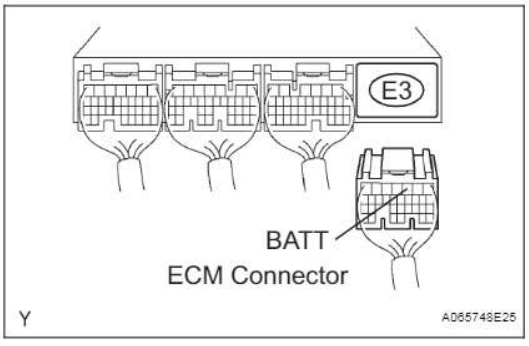
OK

REPLACE ECM

3	CHECK HARNESS AND CONNECTOR (ECM - EFI FUSE, EFI FUSE - BATTERY)



(a) Check the harness and connector between the EFI fuse and ECM.
(1) Remove the EFI fuse from the engine room relay block.



(2) Disconnect the E3 ECM connector.
(3) Measure the resistance of the wire harness side connectors.
Standard resistance (Check for open)

Tester Connection	Specified Condition
Engine room relay block (EFI relay terminal 2) - BATT (E3-3)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
Engine room relay block (EFI relay terminal 2) or BATT (E3-3) - Body ground	10 kΩ or higher

(b) Check the harness and connector between the EFI fuse and battery.
(1) Remove the EFI fuse from the engine room relay block.
(2) Disconnect the positive (+) battery terminal.
(3) Measure the resistance of the wire harness side connectors.

Standard resistance (Check for open)

Tester Connection	Specified Condition
Battery positive terminal - Engine room relay block (EFI relay terminal 1)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
Battery positive terminal or Engine room relay block (EFI relay terminal 1) - Body ground	10 kΩ or higher

ES

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

4	INSPECT BATTERY

(a) Check that the battery is not depleted.

NG → REPLACE BATTERY

OK

CHECK AND REPLACE ENGINE ROOM RELAY BLOCK ASSEMBLY

DTC	P0606	ECM / PCM Processor

MONITOR DESCRIPTION

The ECM continuously monitors its own internal circuits. This self-checking ensures that the ECM is functioning properly.
The 2 CPUs, main and sub, inside the ECM perform continuous mutual monitoring. If the outputs from the 2 CPUs differ or deviate from the standard levels, the ECM determines that the internal circuits are malfunctioning. The ECM then illuminates the MIL and set the DTCs.

DTC No.	DTC Detection Condition	Trouble Area
P0606	ECM internal error (1 trip detection logic)	ECM

ES

MONITOR STRATEGY

Related DTCs	P0606: ECM CPU malfunction
Required Sensors/Components (Main)	ECM
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	Within 1 second
MIL Operation	Immediate
Sequence of Operation	None

MONITOR STRATEGY

Monitor runs whenever following DTCs not present	

TYPICAL MALFUNCTION THRESHOLDS

RAM	RAM check failure

INSPECTION PROCEDURE

1	CHECK OTHER DTC OUTPUT (IN ADDITION P0606)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed to
P0606	A
P0606 and other DTCs	B

B → GO TO RELEVANT DTC CHART

A

REPLACE ECM

DTC	P0617	Starter Relay Circuit High

MONITOR DESCRIPTION

While the engine being cranked, the positive battery voltage is applied to terminal STA of the ECM. If the ECM detects the Starter Control (STA) signal while the vehicle is being driven, it determines that there is a malfunction in the STA circuit. The ECM then illuminates the MIL and sets the DTC. This monitor runs when the vehicle is driven at 20 km/h (12.4 mph) for over 20 seconds.

DTC No.	DTC Detection Condition	Trouble Area
P0617	When conditions (a), (b) and (c) met when battery (+B) voltage 10.5 V or more applied for 20 seconds (1 trip detection logic): (a) Vehicle speed greater than 12.4 mph (20 km/h) (b) Engine revolution greater than 1,000 rpm (c) STA signal ON	• Park/Neutral Position (PNP) switch switch (A/T)* • Clutch start switch (M/T)* • ST relay circuit • ECM

*: A/T denotes Automatic Transaxle models and M/T denotes Manual Transaxle models.

MONITOR STRATEGY

Related DTCs	P0617: Starter signal
Required Sensors/Components (Main)	ST relay, Park/Neutral position switch and Ignition switch
Required Sensors/Components (Related)	Vehicle Speed Sensor (VSS), Crankshaft Position (CKP) sensor
Frequency of Operation	Continuous
Duration	20 seconds
MIL Operation	Immediate
Sequence of Operation	None

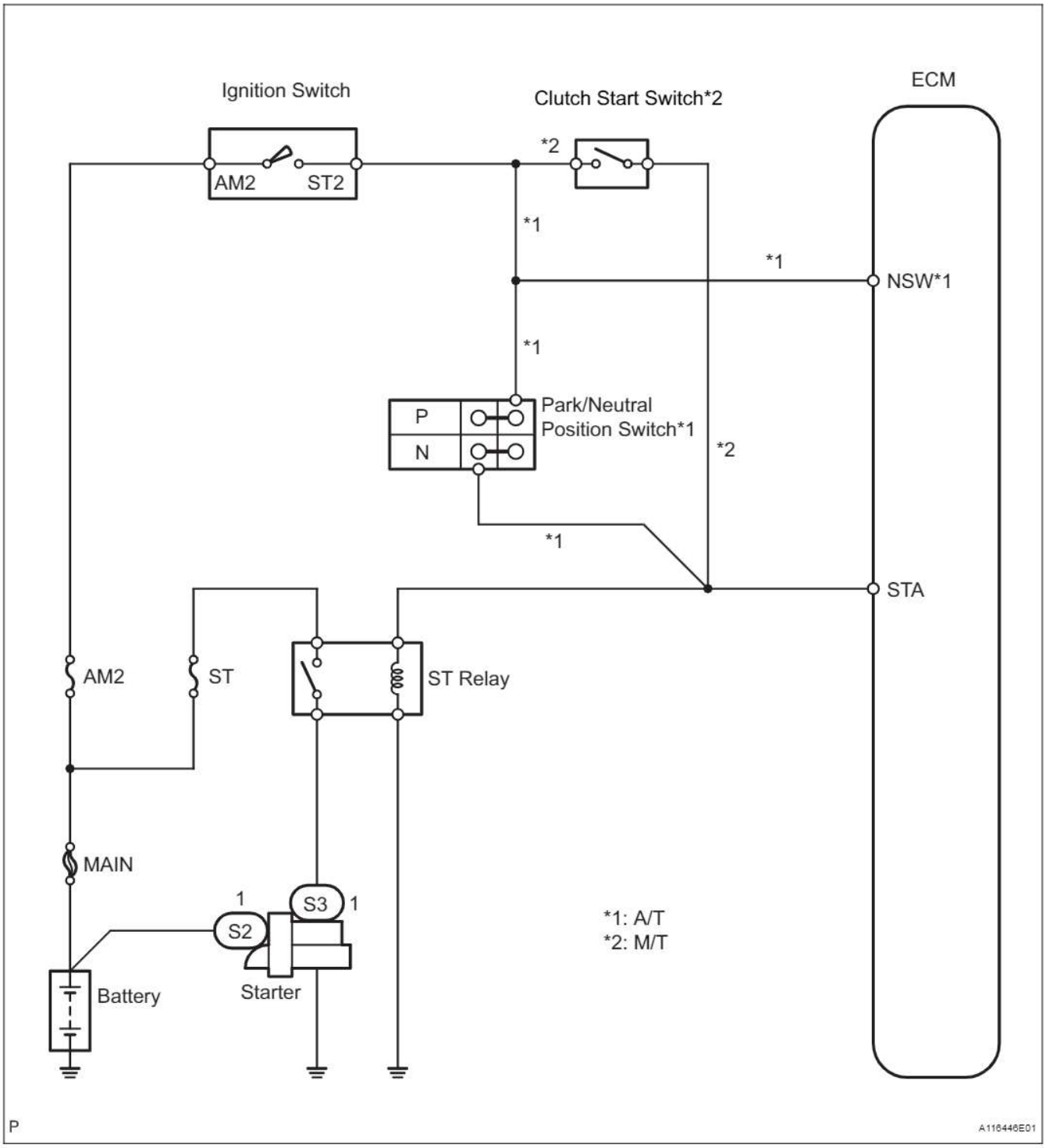
TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTCs not present	None
Battery voltage	10.5 V or more
Vehicle speed	20 km/h (12.4 mph) or more
Engine speed	1,000 rpm or more

TYPICAL MALFUNCTION THRESHOLDS

Starter signal	ON

WIRING DIAGRAM



INSPECTION PROCEDURE

HINT:

- The following troubleshooting flowchart is based on the premise that the engine is cranked normally. If the engine will not crank, proceed to the problem symptoms table on page ES-28.
- Read freeze frame data using the intelligent tester. Freeze frame data records the engine condition when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1 **READ VALUE OF INTELLIGENT TESTER (STARTER SIGNAL)**

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / STARTER SIG.
(d) Check the value displayed on the tester when the ignition switch is turned to the ON and START positions.

OK

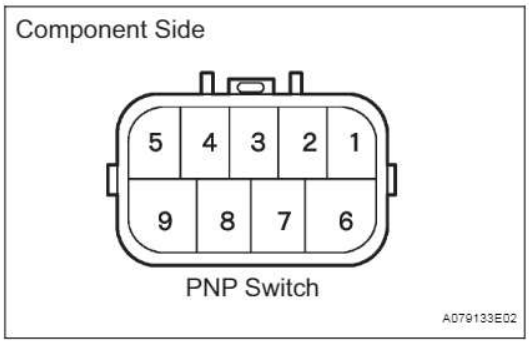
Ignition Switch Position	STARTER SIG
ON	OFF
START	ON

ES

OK → **CHECK FOR INTERMITTENT PROBLEMS**

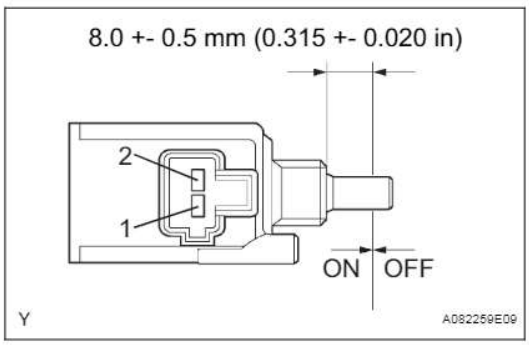
NG

2 **INSPECT PARK/NEUTRAL POSITION SWITCH OR CLUTCH START SWITCH**



(a) Inspect the Park/Neutral Position (PNP) switch (for A/T models).
(1) Disconnect the A3 PNP switch connector.
(2) Measure the resistance when the transmission gear selector lever is moved to each position.
Standard resistance

Gear Selector Lever Position	Tester Connection	Specified Condition
P	1 - 3, 6 - 9	Below 1 Ω
N	3 - 5, 6 - 9	Below 1 Ω



(b) Inspect the clutch start switch (for M/T models).
(1) Disconnect the C5 clutch start switch connector.
(2) Measure the resistance when the clutch start switch is ON and OFF.
Standard resistance

Ignition Switch Position	Tester Connection	Specified Condition
ON (pushed)	1 - 2	Below 1 Ω
OFF (free)	1 - 2	10 kΩ or higher

NG → **REPLACE PARK/NEUTRAL POSITION SWITCH OR CLUTCH START SWITCH (GO TO NEXT STEP AFTER REPLACEMENT)**

OK

3 **READ VALUE OF INTELLIGENT TESTER (STARTER SIGNAL)**

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.

(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / STARTER SIG.
(d) Check the value displayed on the tester when the ignition switch is turned to the ON and START positions.

OK

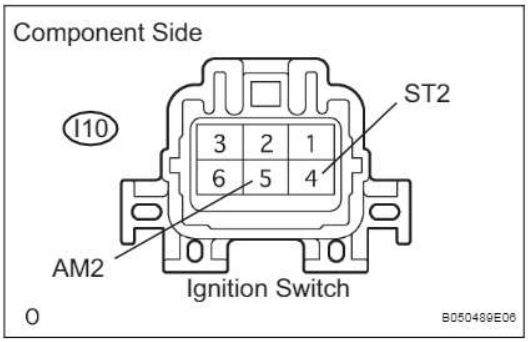
Ignition Switch Position	STARTER SIG
ON	OFF
START	ON

OK → SYSTEM OK

NG

ES

4 INSPECT IGNITION SWITCH ASSEMBLY



(a) Disconnect the I10 ignition switch connector.
(b) Measure the resistance of the ignition switch.

Switch Position	Tester Connection	Specified Condition
LOCK	All Terminals	10 kΩ or higher
START	ST2 (4) - AM2 (5)	Below 1 Ω

NG → REPLACE IGNITION SWITCH ASSEMBLY (GO TO NEXT STEP AFTER REPLACEMENT)

NG

5 READ VALUE OF INTELLIGENT TESTER (STARTER SIGNAL)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / STARTER SIG.
(d) Check the value displayed on the tester when the ignition switch is turned to the ON and START positions.

OK

Ignition Switch Position	STARTER SIG
ON	OFF
START	ON

OK → SYSTEM OK

NG

REPAIR OR REPLACE HARNESS OR CONNECTOR

DTC	P0630	VIN not Programmed or Mismatch - ECM / PCM

DESCRIPTION

DTC P0630 is set if the Vehicle Identification Number (VIN) is not stored in the ECM or the input VIN is not accurate. Input the VIN with the intelligent tester (see page ES-15).

DTC No.	DTC Detection Condition	Trouble Area
P0630	• VIN not stored in ECM • Input VIN in ECM not accurate	ECM

MONITOR STRATEGY

Related DTCs	P0630: VIN not programmed
Required Sensors/Components (Main)	ECM
Required Sensors/Components (Related)	-
Frequency of Operation	Continuous
Duration	0.5 seconds
MIL Operation	Immediate
Sequence of Operation	None

ES

TYPICAL ENABLING CONDITIONS

The monitor will run whenever this DTC is not present	None
Battery voltage	8 V or more
Ignition switch	ON
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

VIN code	Not programmed

COMPONENT OPERATING RANGE

VIN code	Programmed

INSPECTION PROCEDURE

1	READ CURRENT DTC

(a) Connect the intelligent tester to the CAN VIM. Then connect the CAN VIM to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DAC INFO / CURRENT CODES.
(d) Read DTCs.

Result

Display (DTC Output)	Proceed to
P0630	A
P0630 and other DTCs	B

If any DTCs other than P0630 are output, troubleshoot those DTCs first.

NOTICE:
If P0630 is set, the VIN must be input to the ECM using the intelligent tester. However, all DTCs are cleared automatically by the tester when inputting the VIN. If DTCs other than P0630 are set, check them first.

B	GO TO DTC CHART

A

2	INPUT VIN WITH INTELLIGENT TESTER

(a) Input the VIN with the intelligent tester (see page ES-15).

ES

NEXT

END

DTC	P2401	Evaporative Emission Leak Detection Pump Stuck OFF

DTC	P2402	Evaporative Emission Leak Detection Pump Stuck ON

DTC SUMMARY

DTC No.	Monitoring Item	Malfunction Detection Condition	Trouble Area	Detection Timing	Detection Logic
P2401	Leak detection pump stuck OFF	P043E, P043F, P2401, P2402 and P2419 are present when one of the following conditions is met during key-off EVAP monitor: • EVAP pressure just after reference pressure measurement greater than -1 kPa-g (755 mmHg-a) • Reference pressure less than -4.85 kPa-g (726 mmHg-a) • Reference pressure greater than -1 kPa-g (755 mmHg-a) • Reference pressure is not saturated • Reference pressure difference between first and second is 0.7 kPa-g (5 mmHg-g) or more HINT: These values are typical	• Canister pump module (reference orifice, leak detection pump, vent valve) • Connector/wire harness (canister pump module - ECM) • EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) • ECM	Ignition switch OFF	2 trip

ES

DTC No.	Monitoring Item	Malfunction Detection Condition	Trouble Area	Detection Timing	Detection Logic
P2402	Leak detection pump stuck ON	P043E, P043F, P2401, P2402 and P2419 are present when one of the following conditions is met during key-off EVAP monitor: • EVAP pressure just after reference pressure measurement greater than -1 kPa-g (755 mmHg-a) • Reference pressure less than -4.85 kPa-g (726 mmHg-a) • Reference pressure greater than -1 kPa-g (755 mmHg-a) • Reference pressure is not saturated • Reference pressure difference between first and second is 0.7 kPa-g (5 mmHg-g) or more HINT: These values are typical	• Canister pump module (reference orifice, leak detection pump, vent valve) • Connector/wire harness (canister pump module - ECM) • EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) • ECM	Ignition switch OFF	2 trip

DESCRIPTION

The circuit description can be found in the Evaporative Emission (EVAP) system (see page ES-273).

INSPECTION PROCEDURE

Refer to the EVAP system (see page ES-273).

MONITOR DESCRIPTION

5 hours* after the ignition switch is turned OFF, the leak detection pump creates negative pressure (vacuum) in the EVAP system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

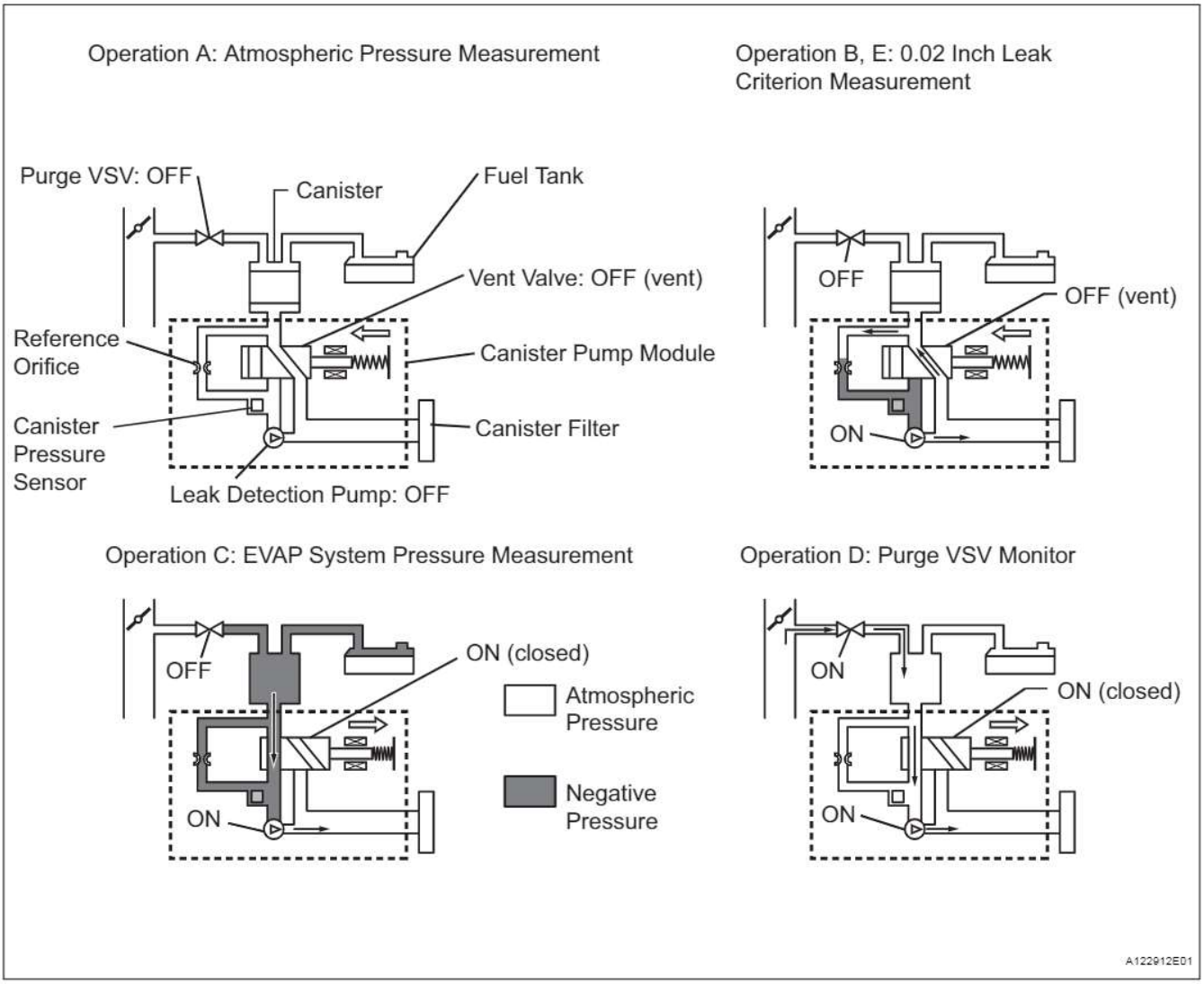
HINT:

*: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the ignition switch is turned OFF, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the ignition switch is turned OFF, the monitor check starts 2.5 hours later.

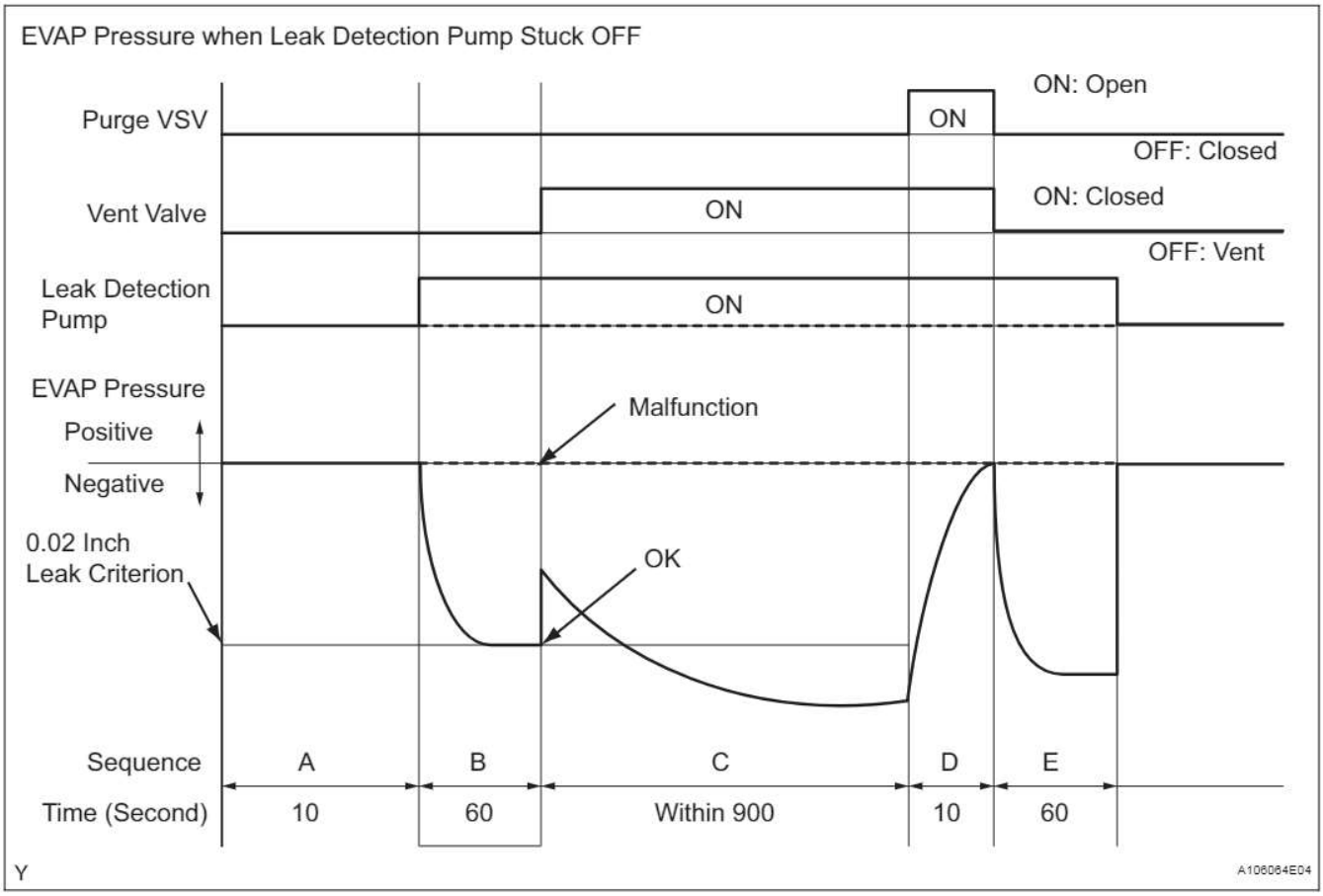
Sequence	Operation	Description	Duration
-	ECM activation	Activated by soak timer 5, 7 or 9.5 hours after ignition switch OFF.	-

Sequence	Operation	Description	Duration
A	Atmospheric pressure measurement	Vent valve turned OFF (vent) and EVAP system pressure measured by ECM in order to register atmospheric pressure. If pressure in EVAP system not between 70 kPa and 110 kPa (525 mmHg and 825 mmHg), ECM cancels EVAP system monitor.	10 seconds
B	First 0.02 inch leak criterion measurement	In order to determine 0.02 inch leak criterion, leak detection pump creates negative pressure (vacuum) through reference orifice and then ECM checks if leak detection pump and vent valve operate normally.	60 seconds
C	EVAP system pressure measurement	Vent valve turned ON (closed) to shut EVAP system. Negative pressure (vacuum) created in EVAP system, and EVAP system pressure then measured. Write down measured value as it will be used in leak check. If EVAP pressure does not stabilize within 900 seconds, ECM cancels EVAP system monitor.	900 seconds*
D	Purge VSV monitor	Purge VSV opened and then EVAP system pressure measured by ECM. Large increase indicates normal.	10 seconds
E	Second 0.02 inch leak criterion measurement	After second 0.02 inch leak criterion measurement, leak check performed by comparing first and second 0.02 inch leak criterion. If stabilized system pressure higher than second 0.02 inch leak criterion, ECM determines that EVAP system leaking.	60 seconds
F	Final check	Atmospheric pressure measured and then monitoring result recorded by ECM.	-

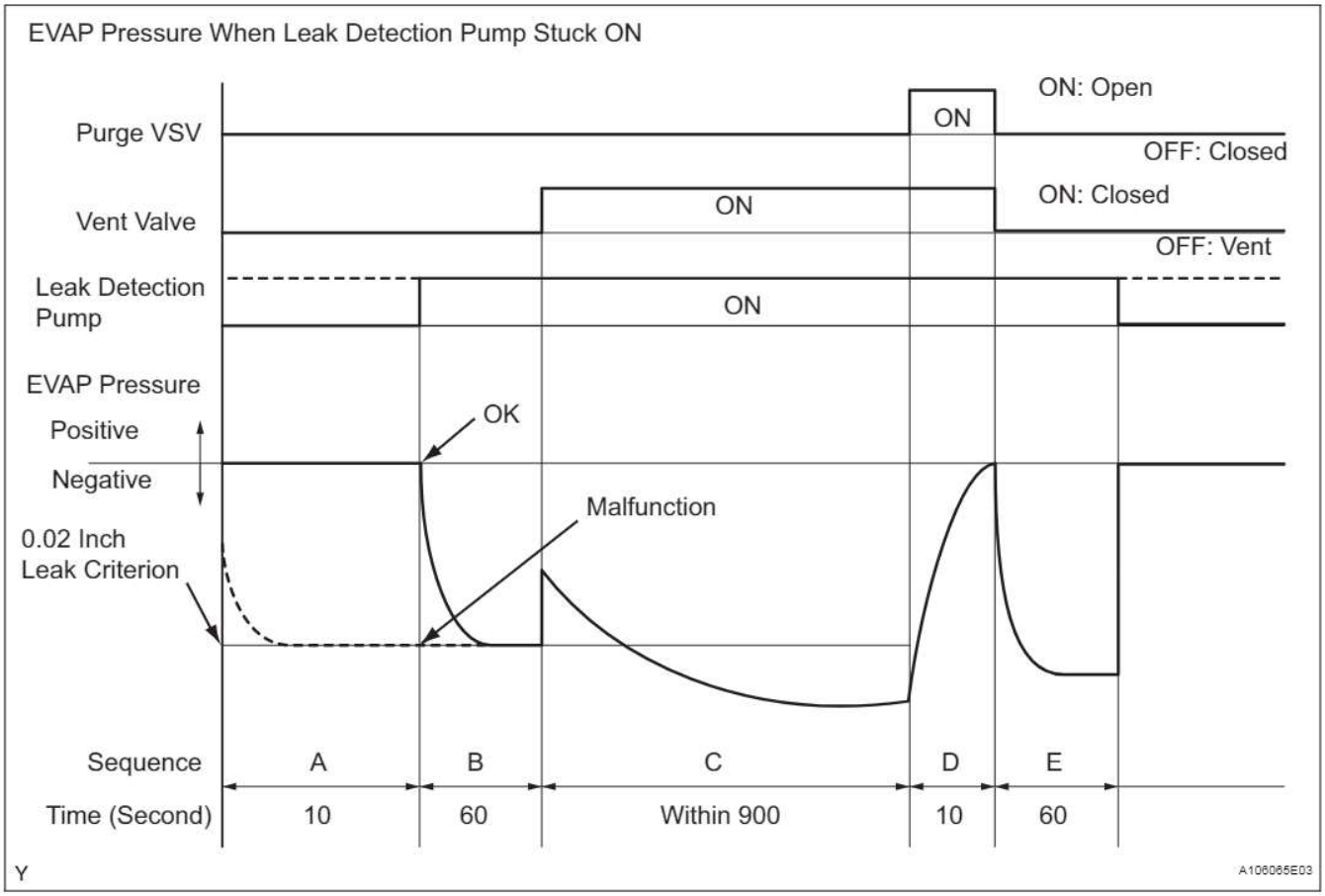
*: If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.


Operation A: Atmospheric Pressure Measurement
Purge VSV: OFF
Canister
Fuel Tank
Vent Valve: OFF (vent)
Reference Orifice
Canister Pump Module
Canister Pressure Sensor
Canister Filter
Leak Detection Pump: OFF
Operation B, E: 0.02 Inch Leak Criterion Measurement
OFF
OFF (vent)
ON
Operation C: EVAP System Pressure Measurement
OFF
ON (closed)
Atmospheric Pressure
Negative Pressure
ON
Operation D: Purge VSV Monitor
ON
ON (closed)
ON
A122912E01

1. P2401: Leak detection pump stuck OFF
   In operation B, the leak detection pump creates negative pressure (vacuum) through the reference orifice. The EVAP system pressure is then measured by the ECM using the canister pressure sensor to determine the 0.02 inch leak criterion. If the pressure is higher than -1.06 kPa (-7.95 mmHg)* or lower than -4.85kPa (-36.38 mmHg)*, the ECM interprets this as the leak detection pump being stuck OFF (not operating). The ECM then illuminates the MIL and sets the DTC (2 trip detection logic).
   *: The threshold varies according to the atmospheric pressure measured in operation A. The values described above are based on an atmospheric pressure of 100 kPa (750.1 mmHg): absolute pressure.



2. P2402: Leak detection pump stuck ON
   In operation B, the leak detection pump creates negative pressure (vacuum) through the reference orifice. The EVAP system pressure is then measured by the ECM using the canister pressure sensor to determine the 0.02 inch leak criterion. If the pressure is higher than -1.06 kPa (-7.95 mmHg)* or lower than -4.85 kPa (-36.38 mmHg)*, the ECM interprets this as the leak detection pump being stuck ON (operating all the time). The ECM illuminates the MIL and sets the DTC (2 trip detection logic).
   *: The threshold varies according to the atmospheric pressure measured in operation A. The values described above are based on an atmospheric pressure of 100 kPa (750.1 mmHg): absolute pressure.



HINT:
The detection logic of DTCs P2401 and P2402 is the same because in both cases the 0.02 inch leak criterion measured in operation B is compared to the atmospheric pressure registered in operation A. The ECM calculates the difference between these pressures by deducting [the 0.02 inch leak criterion] from [the stored atmospheric pressure], and uses this to monitor the EVAP system pressure change.

MONITOR STRATEGY

Required Sensors/Components	Purge VSV and canister pump module
Frequency of Operation	Once per driving cycle
Duration	Within 2 minutes
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Enabling conditions of EVAP key-OFF monitor	
P043E (Reference orifice - low flow) P043F (Reference orifice - high flow) P0441 (Purge VSV - stuck open) P0441 (Purge VSV - stuck closed) P0451 (Canister pressure sensor - noise) P0455 (EVAP gross leak) P0456 (EVAP 0.02 inch leak) P2401 (Leak detection pump - stuck OFF) P2402 (Leak detection pump - stuck ON) P2419 (Vent valve - stuck ON) P2420 (Vent valve - stuck OFF)	
Atmospheric pressure	70 to 110 kPa (525 to 825 mmHg)

Battery voltage	10.5 V or higher
Vehicle speed	4 km/h (2.5 mph) or less
Ignition switch	OFF
Time after key off	5 or 7 or 9.5 hours
Canister pressure sensor malfunction (P0450, P0452, P0453)	Not detected
Purge VSV	Not operated by scan tool
Vent valve	Not operated by scan tool
Leak detection pump	Not operated by scan tool
Both of the following conditions 1 and 2 are met before key off	-
1. Duration that vehicle has been driven	5 minutes or more
2. EVAP purge operation	Performed
ECT	4.4 to 35°C (40 to 95°F)
IAT	4.4 to 35°C (40 to 95°F)

ES

1. Key-off monitor sequence 1 to 8

1. Atmospheric pressure measurement

Next sequence is run if the following condition is met	-
Atmospheric pressure change	Within 0.3 kPa (2.25 mmHg) in 1 second

2. First reference pressure measurement

Next sequence is run if the following conditions are met	-
EVAP pressure just after reference pressure measurement start	-1 kPa (-7.5 mmHg) or lower
Reference pressure	-4.85 to -1.05 kPa (726 to 754 mmHg)
Reference pressure	Saturated

3. Vent valve stuck closed check

Next sequence is run if the following condition is met	-
EVAP pressure change after vent valve is ON	0.3 kPa (2.25 mmHg) or more

4. Vacuum introduction

Next sequence is run if the following condition is met	-
EVAP pressure	Saturated within 900 seconds

5. Purge VSV stuck closed check

Next sequence is run if the following condition is met	-
EVAP pressure change after purge VSV is open	0.3 kPa (2.25 mmHg) or more

6. Second reference pressure measurement

Next sequence is run if the following conditions are met	-
EVAP pressure just after reference pressure measurement	-1 kPa (-7.5 mmHg) or lower
Reference pressure	-4.85 to -1.05 kPa (726 to 754 mmHg)
Reference pressure	Saturated
Reference pressure difference between first and second	Less than 0.7 kPa (5.25 mmHg)

7. Leak check

Next sequence is run if the following condition is met	-
EVAP pressure when vacuum introduction is complete	Lower than second reference pressure

8. Atmospheric pressure measurement

EVAP monitor is complete if the following condition is met	-
Atmospheric pressure difference between sequence 1 and 8	Within 0.3 kPa (2.25 mmHg)

TYPICAL MALFUNCTION THRESHOLDS

"Saturated" indicates that the EVAP pressure change is less than 0.1 kPa (0.75 mmHg) in 30 seconds.

One of following conditions met	-
FTP when just after reference pressure measurement began	-1 kPa (755 mmHg) or higher
Reference pressure	Less than -4.85 kPa (726 mmHg)
Reference pressure	-1.05 kPa (754 mmHg) or higher
Reference pressure	Not saturated
Reference pressure difference between first and second	0.7 kPa (5.25 mmHg) or more

MONITOR RESULT

Refer to CHECKING MONITOR STATUS (see page ES-19).

ES

DTC	P2419	Evaporative Emission Pressure Switching Valve Stuck ON

DTC	P2420	Evaporative Emission Pressure Switching Valve Stuck OFF

DTC SUMMARY

DTC No.	Monitoring Items	Malfunction Detection Conditions	Trouble Areas	Detection Timing	Detection Logic
P2419	Vent valve stuck closed	P043E, P043F, P2401, P2402 and P2419 are present when one of the following conditions is met during key-off EVAP monitor: • EVAP pressure just after reference pressure measurement greater than -1 kPa-g (755 mmHg-a) • Reference pressure less than -4.85 kPa-g (726 mmHg-a) • Reference pressure greater than -1 kPa-g (755 mmHg-a) • Reference pressure is not saturated • Reference pressure difference between first and second is 0.7 kPa-g (5 mmHg-g) or more HINT: These values are typical	• Canister pump module (reference orifice, leak detection pump, vent valve) • Connector/wire harness (canister pump module - ECM) • EVAP system hose (pipe from air inlet port to canister pump module, canister filter, fuel tank vent hose) • ECM	Ignition switch OFF	2 trip
P2420	Vent valve stuck open (vent)	The following condition is met during key-off EVAP monitor: • EVAP pressure change when vent valve is closed (ON) less than 0.3 kPa-g (2.25 mmHg-g)	• Canister pump module (reference orifice, leak detection pump, vent valve) • Connector/wire harness (canister pump module - ECM) • ECM	Ignition switch OFF	2 trip

DESCRIPTION

The circuit description can be found in the Evaporative Emission (EVAP) system (see page ES-273).

INSPECTION PROCEDURE

Refer to the EVAP system (see page ES-273).

MONITOR DESCRIPTION

5 hours* after the ignition switch is turned OFF, the leak detection pump creates negative pressure (vacuum) in the EVAP system. The ECM monitors for leaks and actuator malfunctions based on the EVAP pressure.

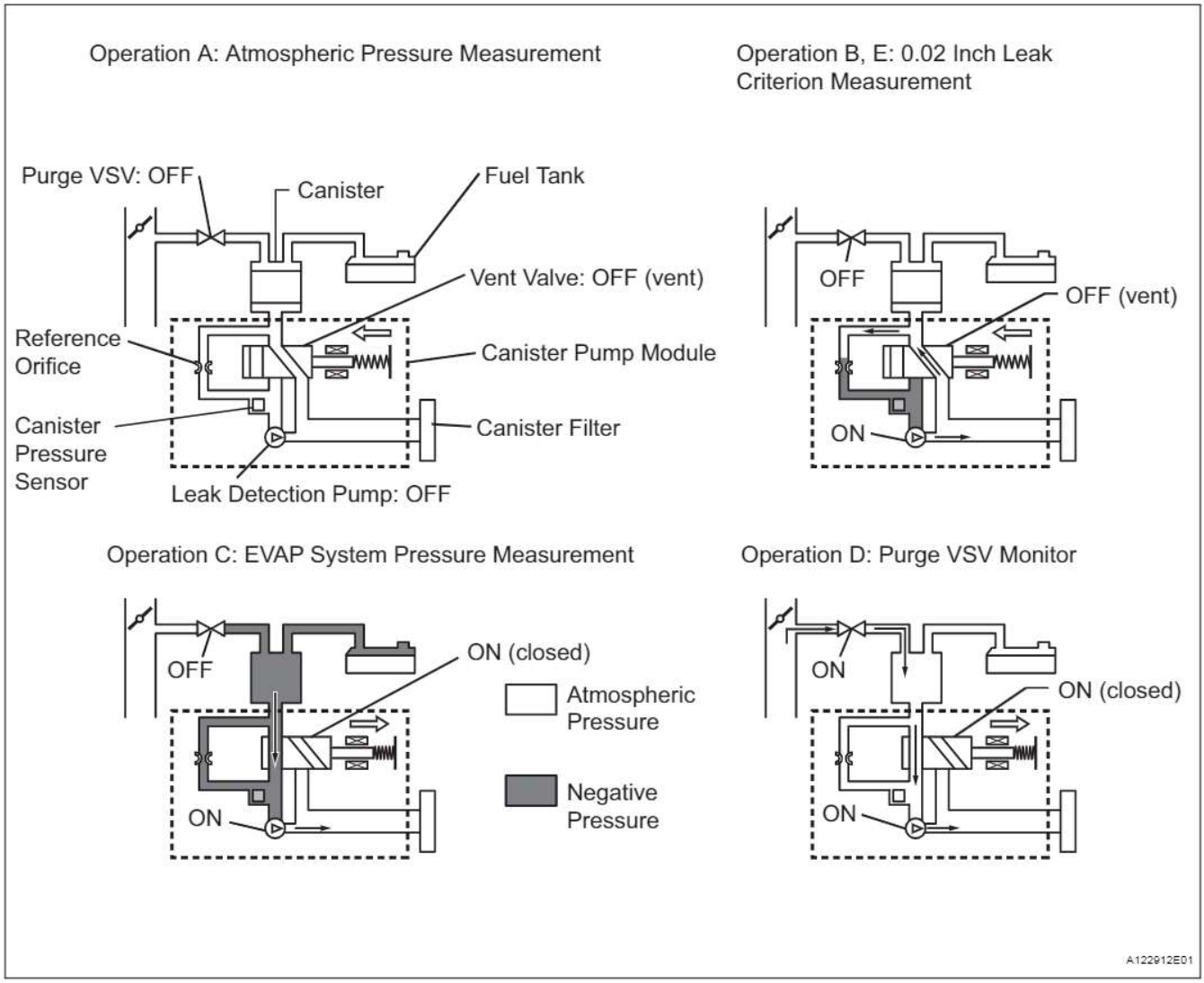
HINT:

*: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the ignition switch is turned OFF, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the ignition switch is turned OFF, the monitor check starts 2.5 hours later.

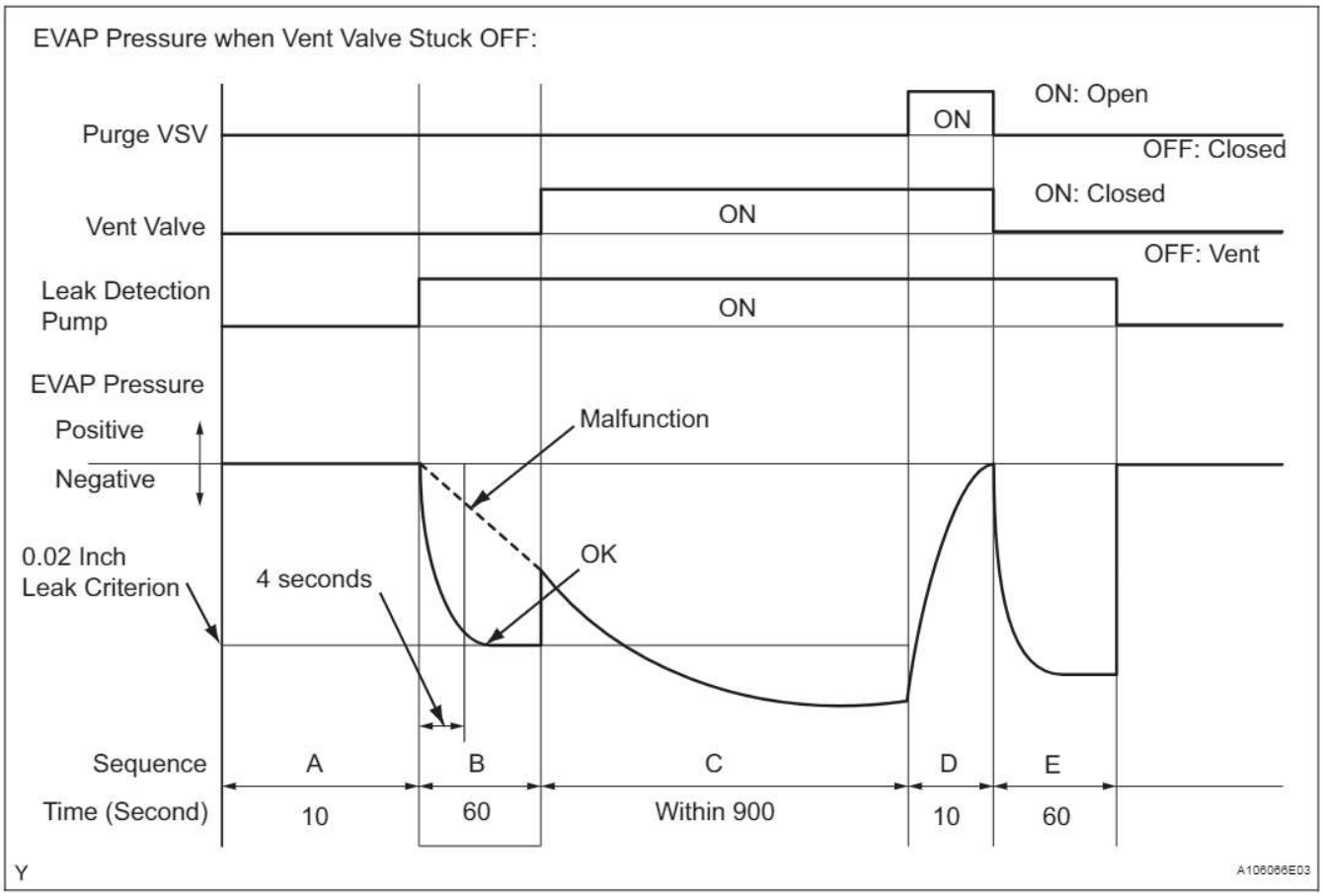
ES

Sequence	Operations	Descriptions	Duration
-	ECM activation	Activated by soak timer 5, 7 or 9.5 hours after ignition switch OFF.	-
A	Atmospheric pressure measurement	Vent valve turned OFF (vent) and EVAP system pressure measured by ECM in order to register atmospheric pressure. If pressure in EVAP system not between 70 kPa and 110 kPa (525 mmHg and 825 mmHg), ECM cancels EVAP system monitor.	10 seconds
B	First 0.02 inch leak criterion measurement	In order to determine 0.02 inch leak criterion, leak detection pump creates negative pressure (vacuum) through reference orifice and then ECM checks if leak detection pump and vent valve operate normally.	60 seconds
C	EVAP system pressure measurement	Vent valve turned ON (closed) to shut EVAP system. Negative pressure (vacuum) created in EVAP system, and EVAP system pressure then measured. Write down measured value as it will be used in leak check. If EVAP pressure does not stabilize within 900 seconds, ECM cancels EVAP system monitor.	900 seconds*
D	Purge VSV monitor	Purge VSV opened and then EVAP system pressure measured by ECM. Large increase indicates normal.	10 seconds
E	Second 0.02 inch leak criterion measurement	After second 0.02 inch leak criterion measurement, leak check performed by comparing first and second 0.02 inch leak criterion. If stabilized system pressure higher than second 0.02 inch leak criterion, ECM determines that EVAP system leaking.	60 seconds
F	Final check	Atmospheric pressure measured and then monitoring result recorded by ECM.	-

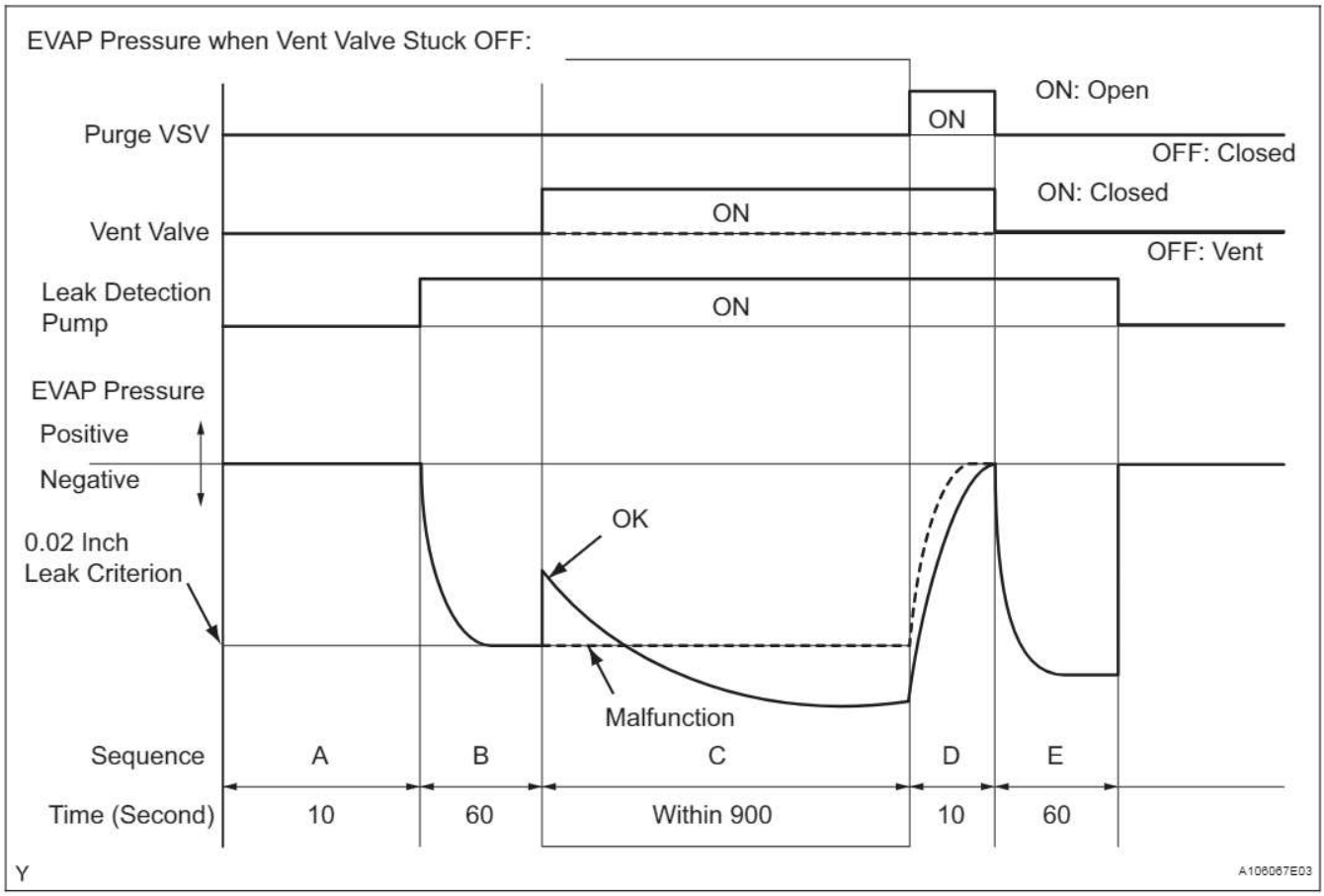
*: If only a small amount of fuel is in the fuel tank, it takes longer for the EVAP pressure to stabilize.


Operation A: Atmospheric Pressure Measurement
Purge VSV: OFF
Canister
Fuel Tank
Vent Valve: OFF (vent)
Reference Orifice
Canister Pump Module
Canister Pressure Sensor
Canister Filter
Leak Detection Pump: OFF
Operation B, E: 0.02 Inch Leak Criterion Measurement
OFF
OFF (vent)
ON
Operation C: EVAP System Pressure Measurement
OFF
ON (closed)
Atmospheric Pressure
Negative Pressure
ON
Operation D: Purge VSV Monitor
ON
ON (closed)
ON
A122912E01

1. P2419: Vent valve stuck closed
   In operation B, the leak detection pump creates negative pressure (vacuum) through the reference orifice. The EVAP system pressure is then measured by the ECM using the canister pressure sensor to determine the 0.02 inch leak criterion. If the pressure exceeds -1.06 kPa (-7.95 mmHg)* 4 seconds after the leak detection pump is turned ON, the ECM interprets this as the vent valve being stuck closed. The ECM illuminates the MIL and sets the DTC (2 trip detection logic).
   *: The threshold varies according to the atmospheric pressure measured in operation A. The values described above is based on an atmospheric pressure of 100 kPa (750.1 mmHg): absolute pressure.



2. P2420: Vent valve stuck open (vent)
In operation C, the vent valve turns ON (closes) and the EVAP system pressure is then measured by the ECM using the canister pressure sensor to conduct an EVAP leak check. If pressure does not drop when the vent valve is open, the ECM interprets this as the vent valve being stuck open. The ECM illuminates the MIL and sets the DTC.



MONITOR STRATEGY

Required Sensors/Components	Purge VSV and canister pump module
Frequency of Operation	Once per driving cycle
Duration	2 minutes
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Enabling conditions of EVAP key-OFF monitor	
P043E (Reference orifice - low flow) P043F (Reference orifice - high flow) P0441 (Purge VSV - stuck open) P0441 (Purge VSV - stuck closed) P0451 (Canister pressure sensor - noise) P0455 (EVAP gross leak) P0456 (EVAP 0.02 inch leak) P2401 (Leak detection pump - stuck OFF) P2402 (Leak detection pump - stuck ON) P2419 (Vent valve - stuck ON) P2420 (Vent valve - stuck OFF)	
Atmospheric pressure	70 to 110 kPa (525 to 825 mmHg)

Battery voltage	10.5 V or higher
Vehicle speed	4 km/h (2.5 mph) or less
Ignition switch	OFF
Time after key off	5, 7 or 9.5 hours
Canister pressure sensor malfunction (P0450, P0452, P0453)	Not detected
Purge VSV	Not operated by scan tool
Vent valve	Not operated by scan tool
Leak detection pump	Not operated by scan tool
Both of the following conditions 1 and 2 are met before key off	-
1. Duration that vehicle has been driven	5 minutes or more
2. EVAP purge operation	Performed
ECT	4.4 to 35°C (40 to 95°F)
IAT	4.4 to 35°C (40 to 95°F)

ES

1. Key-off monitor sequence 1 to 8

1. Atmospheric pressure measurement

Next sequence is run if the following condition is met	-
Atmospheric pressure change	Within 0.3 kPa (2.25 mmHg) in 1 second

2. First reference pressure measurement

Next sequence is run if the following conditions are met	-
EVAP pressure just after reference pressure measurement start	1 kPa (7.5 mmHg) or lower
Reference pressure	-4.85 to -1.05 kPa (726 to 754 mmHg)
Reference pressure	Saturated

3. Vent valve stuck closed check

Next sequence is run if the following condition is met	-
EVAP pressure change after vent valve is ON	0.3 kPa (2.25 mmHg) or more

4. Vacuum introduction

Next sequence is run if the following condition is met	-
EVAP pressure	Saturated within 900 seconds

5. Purge VSV stuck closed check

Next sequence is run if the following condition is met	-
EVAP pressure change after purge valve is open	0.3 kPa (2.25 mmHg) or more

6. Second reference pressure measurement

Next sequence is run if the following conditions are met	-
EVAP pressure just after reference pressure measurement	1 kPa (7.5 mmHg) or lower
Reference pressure	-4.85 to -1.05 kPa (726 to 754 mmHg)
Reference pressure	Saturated
Reference pressure difference between first and second	Less than 0.7 kPa (5.25 mmHg)

7. Leak check

Next sequence is run if the following condition is met	-
EVAP pressure when vacuum introduction is complete	Lower than second reference pressure

8. Atmospheric pressure measurement

EVAP monitor is complete if the following condition is met	-
Atmospheric pressure difference between sequence 1 and 8	Within 0.3 kPa (2.25 mmHg)

TYPICAL MALFUNCTION THRESHOLDS

1. P2419: Vent valve stuck closed
   "Saturated" indicates that the EVAP pressure change is less than 0.1 kPa (0.75 mmHg) in 30 seconds.

One of following conditions met	-
FTP when just after reference pressure measurement began	-1 kPa (755 mmHg) or higher
Reference pressure	Less than -4.85 kPa (726 mmHg)
Reference pressure	-1.05 kPa (754 mmHg) or higher
Reference pressure	Not saturated within 60 seconds
Reference pressure difference between first and second	0.7 kPa (5.25 mmHg) or more

2. P2420: Vent valve stuck open (vent)

EVAP pressure change after EVAP canister vent valve is ON	Less than 0.3 kPa (2.25 mmHg)

ES

MONITOR RESULT

Refer to CHECKING MONITOR STATUS (see page ES-304).

DTC	P2610	ECM / PCM Internal Engine Off Timer Performance

DTC SUMMARY

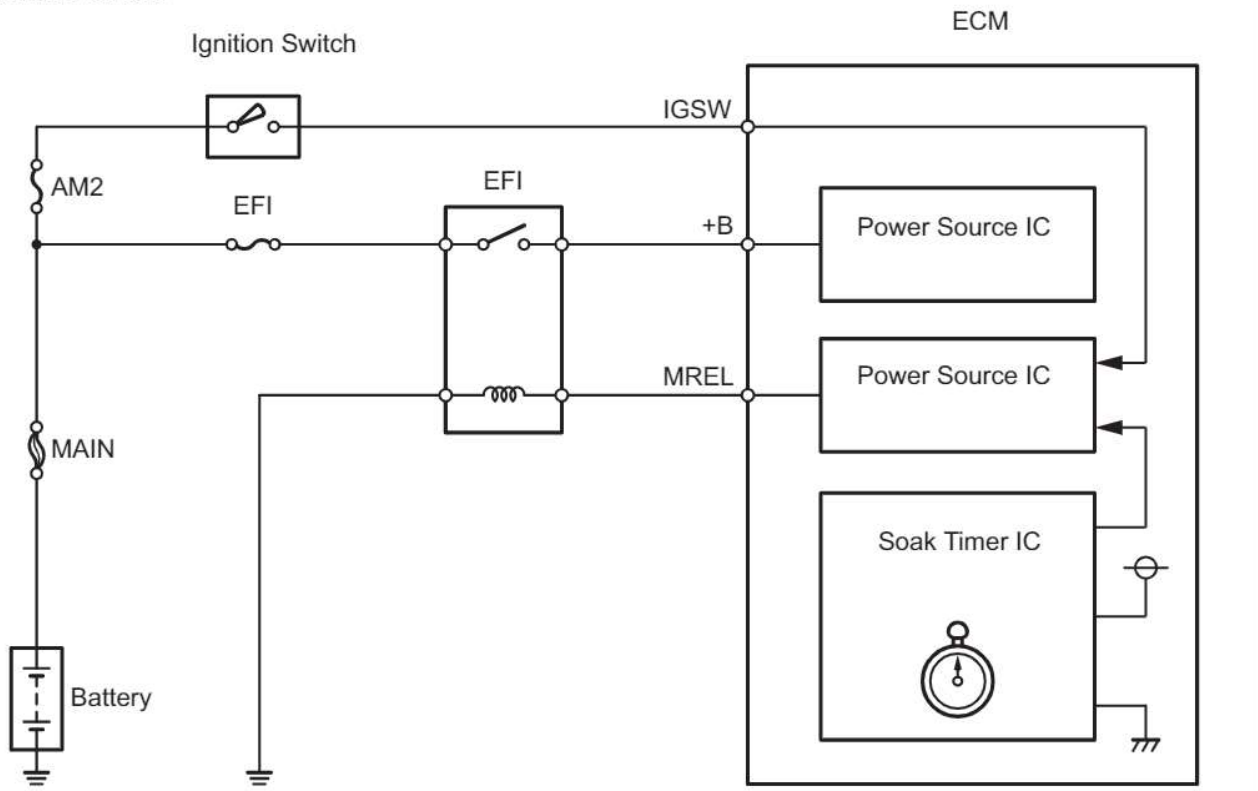
DTC No.	Monitoring Item	Malfunction Detection Condition	Trouble Area	Detection Timing	Detection Logic
P2610	Soak timer (built into ECM)	ECM internal malfunction	ECM	Engine running	2 trip

DESCRIPTION

ES

The soak timer is built into the ECM. To ensure that the Evaporative Emission (EVAP) monitor values will be accurate, the soak timer counts 5 hours (+-15 minutes) from when the ignition switch is turned OFF. This allows the fuel to cool down, which stabilizes the Fuel Tank Pressure (FTP). When approximately 5 hours have passed, the ECM turns ON.

Soak Timer Circuit:



MONITOR DESCRIPTION

5 hours after the ignition switch is turned OFF, the soak timer activates the ECM to begin the EVAP system monitor. While the engine is running, the ECM monitors the synchronization of the soak timer and the CPU clock. If the soak timer and CPU clock are not synchronized, the ECM interprets this as a malfunction, illuminates the MIL and sets the DTC (2 trip detection logic).

MONITOR STRATEGY

Required Sensors/Components	ECM
Frequency of Operation	Once per driving cycle

Duration	10 minutes
MIL Operation	2 driving cycles
Sequence of Operation	None

TYPICAL ENABLING CONDITIONS

Monitor runs whenever following DTC not present	None
Ignition switch	ON
Engine	Running
Battery voltage	8 V or more
Starter	OFF

TYPICAL MALFUNCTION THRESHOLDS

Soak timer measurement when ECM CPU clock counts 10 minutes	Less than 7 minutes or more than 13 minutes

INSPECTION PROCEDURE

HINT:

- DTC P2610 is set if an internal ECM problem is detected. Diagnostic procedures are not required. ECM replacement is required.
- Read freeze frame data using the intelligent tester. Freeze frame data records the engine conditions when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	REPLACE ECM

(a) Replace the ECM (see page ES-363).

NEXT

2	CHECK WHETHER DTC OUTPUT RECURS

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the intelligent tester ON.
(c) Clear DTCs (see page ES-37).
(d) Start the engine and wait for 10 minutes or more.
(e) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / PENDING CODES.
(f) If no pending DTC is displayed, the repair has been successfully completed.

NEXT

END

EVAP System

RELATED DTCS

DTC No.	Monitoring Items	See procedure
P043E	Reference orifice clogged (built into canister pump module)	ES-200
P043F	Reference orifice high-flow (built into canister pump module)	
P0441	• Purge VSV stuck closed • Purge VSV stuck open • Purge flow	ES-208
P0450	Canister pressure sensor (built into canister pump module) voltage abnormal fluctuation	ES-216
P0451	• Canister pressure sensor noise • Canister pressure sensor signal becomes fixed/flat	
P0452	Canister pressure sensor (built into canister pump module) voltage low	
P0453	Canister pressure sensor (built into canister pump module) voltage high	
P0455	EVAP gross leak	ES-226
P0456	EVAP small leak	
P2401	Leak detection pump stuck OFF (built into canister pump module)	ES-256
P2402	Leak detection pump stuck ON (built into canister pump module)	
P2419	Vent valve stuck closed (built into canister pump module)	ES-264
P2420	Vent valve stuck open (vent) (built into canister pump module)	
P2610	Soak timer (built into ECM)	ES-271

If any EVAP system DTCs are set, the malfunctioning area can be determined using the table below.

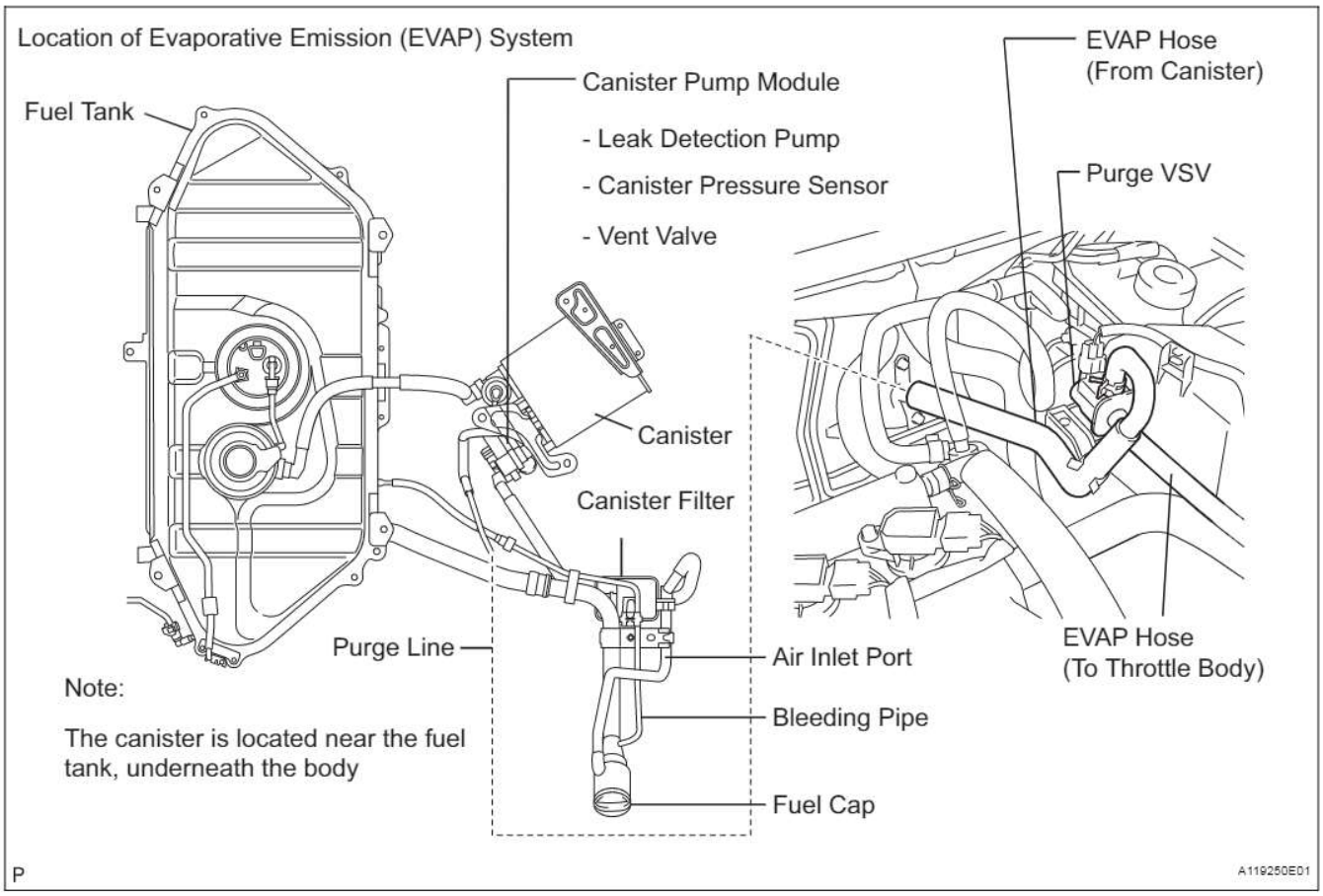
DTCs / Malfunctioning Areas	P043E P043F	P0441	P0450	P0451	P0452	P0453	P0455	P0456	P2401 P2402	P2419	P2420
Reference orifice clogged	●								●	●	
Reference orifice high-flow	●								●	●	
Purge VSV stuck open		●					●				
Purge VSV stuck closed		●									
Canister pressure sensor stuck				●							
Canister pressure sensor noise				●							
Canister pressure sensor low output			●		●						
Canister pressure sensor high output			●			●					
Gross leak		●					●				
Small leak								●			
Leak detection pump stuck OFF	●								●	●	
Leak detection pump stuck ON	●								●	●	
Vent valve stuck closed	●								●	●	
Vent valve stuck open (vent)											●

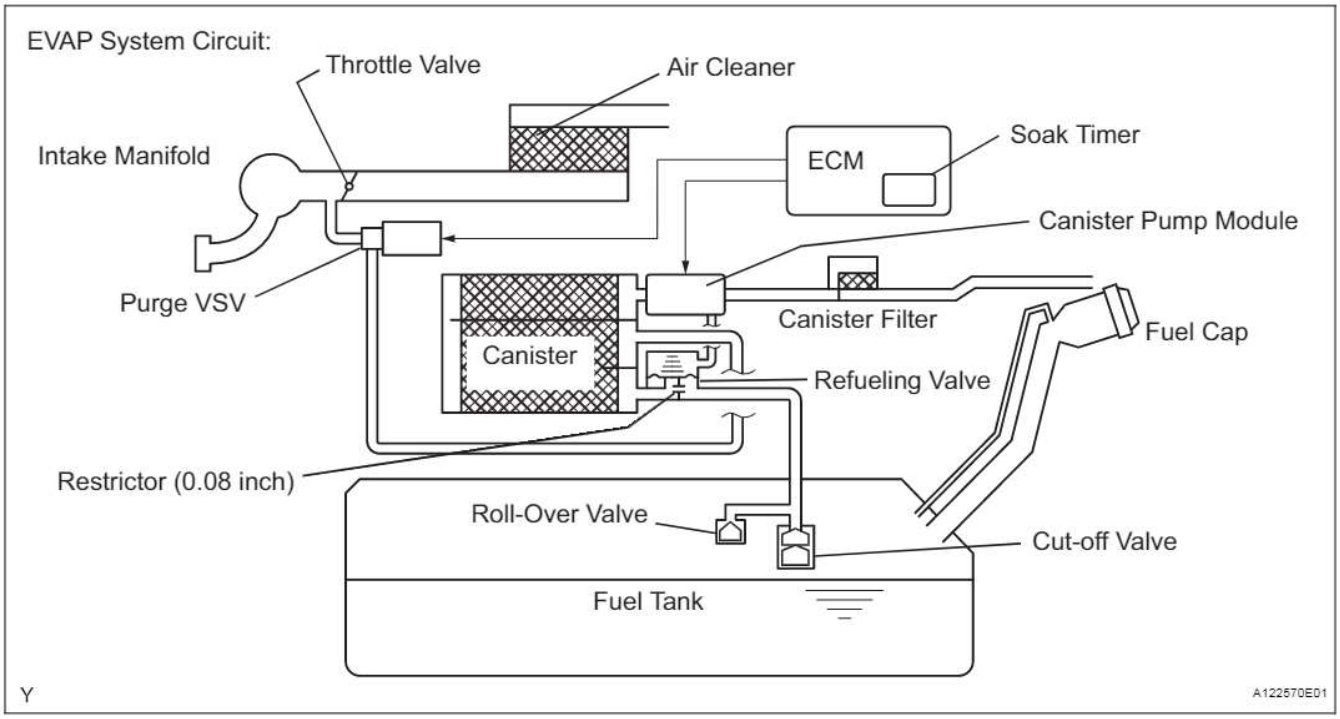
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NOTICE:
If the 0.02 inch reference pressure difference between the first and second checks is greater than the specification, the DTCs corresponding to the reference pressure (P043E, P043F, P0441, P0455, P0456, P2401 and P2420) will all be stored.

DESCRIPTION





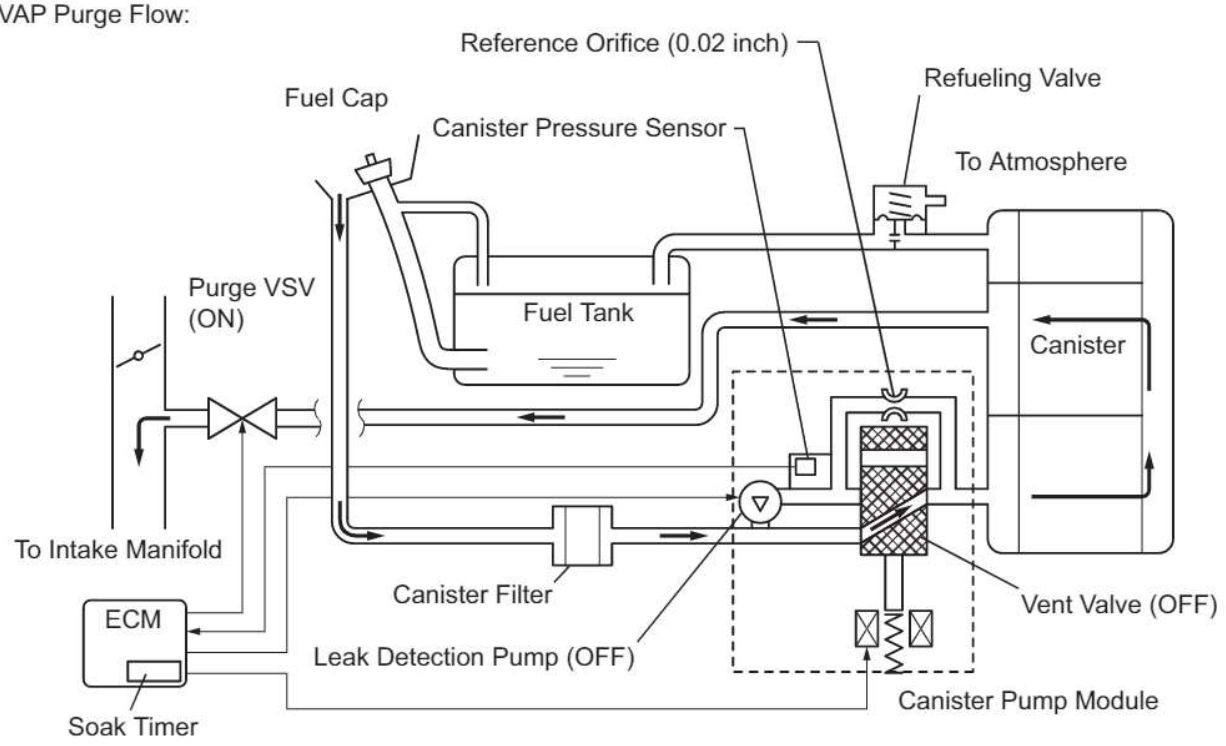
NOTICE:
In this vehicle's EVAP system, turning ON the vent valve does not seal off the EVAP system. To check for leaks in the EVAP system, disconnect the air inlet vent hose and apply pressure from the atmosphere side of the canister.

While the engine is running, if a predetermined condition (closed loop, etc.) is met, the purge VSV is opened by the ECM and stored fuel vapors in the canister are purged to the intake manifold. The ECM changes the duty cycle ratio of the purge VSV to control purge flow volume.
The purge flow volume is also determined by the intake manifold pressure. Atmospheric pressure is allowed into the canister through the vent valve to ensure that the purge flow is maintained when the negative pressure (vacuum) is applied to the canister.
The following 2 monitors run to confirm appropriate EVAP system operation.

1. **Key-off monitor**
   This monitor checks for Evaporative Emission (EVAP) system leaks and canister pump module malfunctions. The monitor starts 5 hours* after the ignition switch is turned OFF. More than 5 hours are required to allow the fuel to cool down to stabilize the Fuel Tank Pressure (FTP), thus making the EVAP system monitor more accurate.
   The leak detection pump creates negative pressure (vacuum) in the EVAP system and the pressure is measured. Finally, the ECM monitors for leaks from the EVAP system and malfunctions in both the canister pump module and purge VSV, based on the EVAP pressure.
   HINT:
   *: If the engine coolant temperature is not below 35°C (95°F) 5 hours after the ignition switch is turned OFF, the monitor check starts 2 hours later. If it is still not below 35°C (95°F) 7 hours after the ignition switch is turned OFF, the monitor check starts 2.5 hours later.
2. **Purge flow monitor**
   The purge flow monitor consists of the 2 monitors. The 1st monitor is conducted every time and the 2nd monitor is conducted if necessary.
   - The 1st monitor
     While the engine is running and the purge Vacuum Switching Valve (VSV) is ON (open), the ECM monitors the purge flow by measuring the EVAP pressure change. If negative pressure is not created, the ECM begins the 2nd monitor.
   - The 2nd monitor
     The vent valve turned OFF (open) and the EVAP pressure is then measured. If the variation in the pressure is less than 0.5 kPa (3.75 mmHg), the ECM interprets this as the purge VSV being stuck closed, and illuminates the MIL and sets DTC P0441 (2 trip detection logic).

Atmospheric pressure check:
In order to ensure reliable malfunction detection, the variation between the atmospheric pressures, before and after conduction of the purge flow monitor, is measured by the ECM.

EVAP Purge Flow:



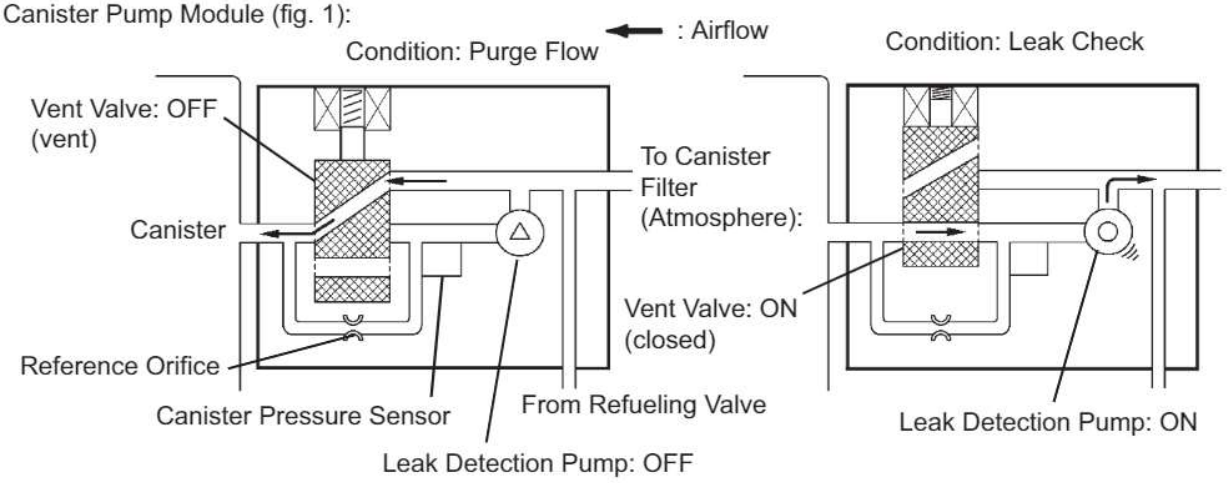
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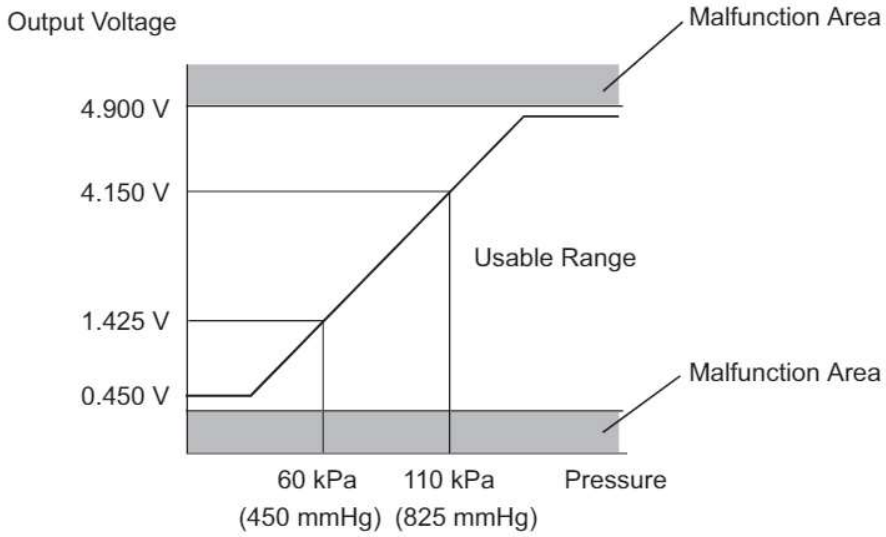
Components	Operations
Canister	Contains activated charcoal to absorb EVAP generated in fuel tank.
Cut-off valve	Located in fuel tank. Valve floats and closes when fuel tank 100% full.
Purge Vacuum Switching Valve (VSV)	Opens or closes line between canister and intake manifold. ECM uses purge VSV to control EVAP purge flow. In order to discharge EVAP absorbed by canister to intake manifold, ECM opens purge VSV. EVAP discharge volume to intake manifold controlled by purge VSV duty cycle ratio (current-carrying time) (open: ON; closed: OFF).
Refueling valve	Controls EVAP pressure from fuel tank to canister. Valve consists of diaphragm, spring and restrictor (diameter: 0.08 inch). When fuel vapor and pressure inside fuel tank increase, valve opens. While EVAP purged, valve closes and restrictor prevents large amount of vacuum from affecting pressure in fuel tank. Valve opens while refueling.
Roll-over valve	Located in fuel tank. Valve closes by its own weight when vehicle overturns to prevent fuel from spilling out.
Soak timer	Built into ECM. To ensure accurate EVAP monitor, measures 5 hours (+-15 min) after ignition switch OFF. This allows fuel to cool down, stabilizing Fuel Tank Pressure (FTP). When approximately 5 hours elapsed, ECM activates.
Canister pump module	Consists of (a) to (d) below. Canister pump module cannot be disassembled.
(a) Vent valve	Vents and closes EVAP system. When ECM turns valve ON, EVAP system closed. When ECM turns valve OFF, EVAP system vented. Negative pressure (vacuum) created in EVAP system to check for EVAP leaks by closing purge VSV, turning vent valve ON (closed) and operating leak detection pump (refer to fig. 1).
(b) Canister pressure sensor	Indicates pressure as voltage. ECM supplies regulated 5 V to canister pressure sensor, and uses feedback from sensor to monitor EVAP system pressure (refer to fig. 2).
(c) Leak detection pump	Creates negative pressure (vacuum) in EVAP system for leak check.

Components	Operations
(d) Reference orifice	Has opening with 0.02 inch diameter. Vacuum produced through orifice by closing purge VSV, turning vent valve OFF and operating leak detection pump to monitor 0.02 inch leak criterion. 0.02 inch leak criterion indicates small leak of EVAP.

Canister Pump Module (fig. 1):



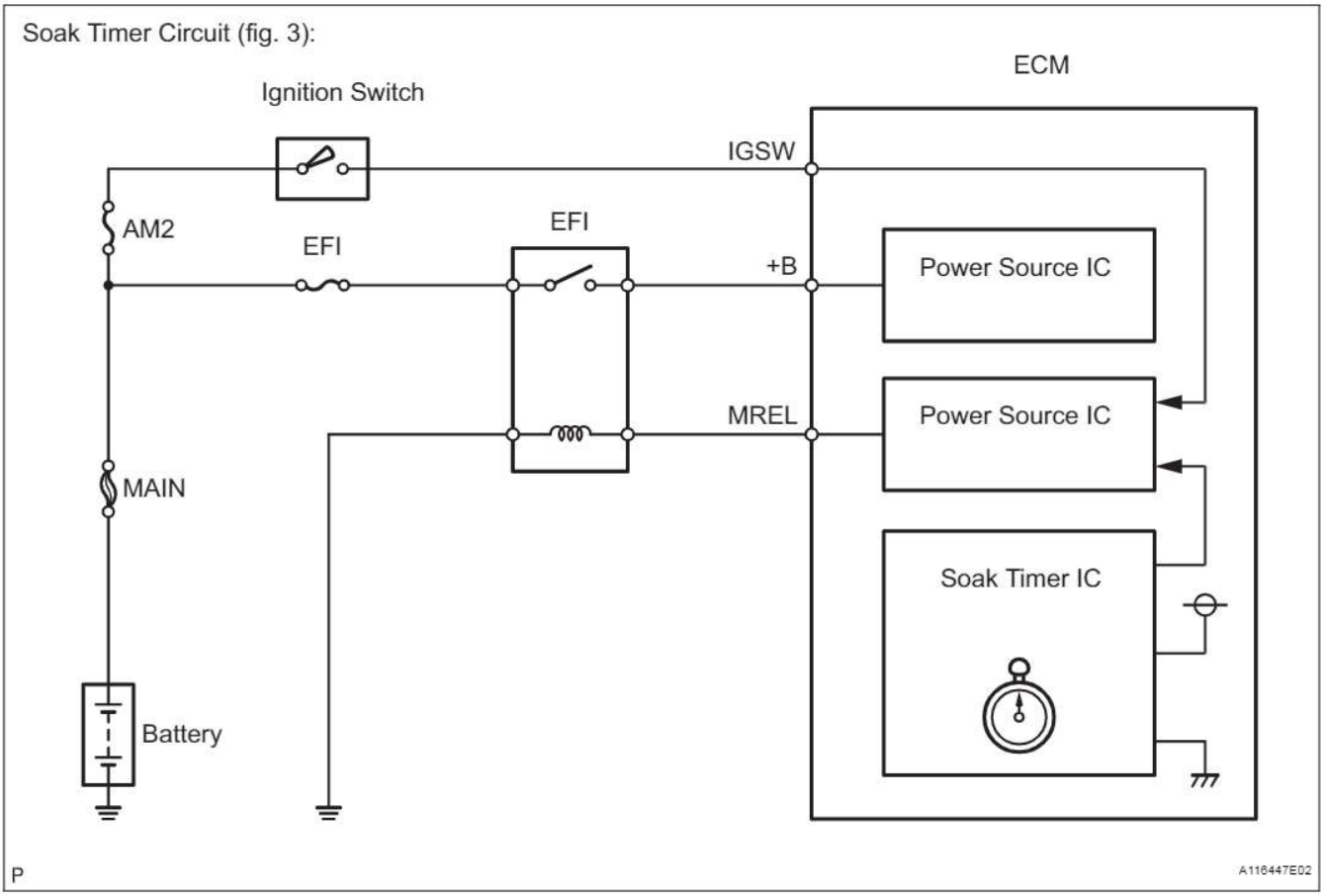
Canister Pressure Sensor Specification (fig. 2):



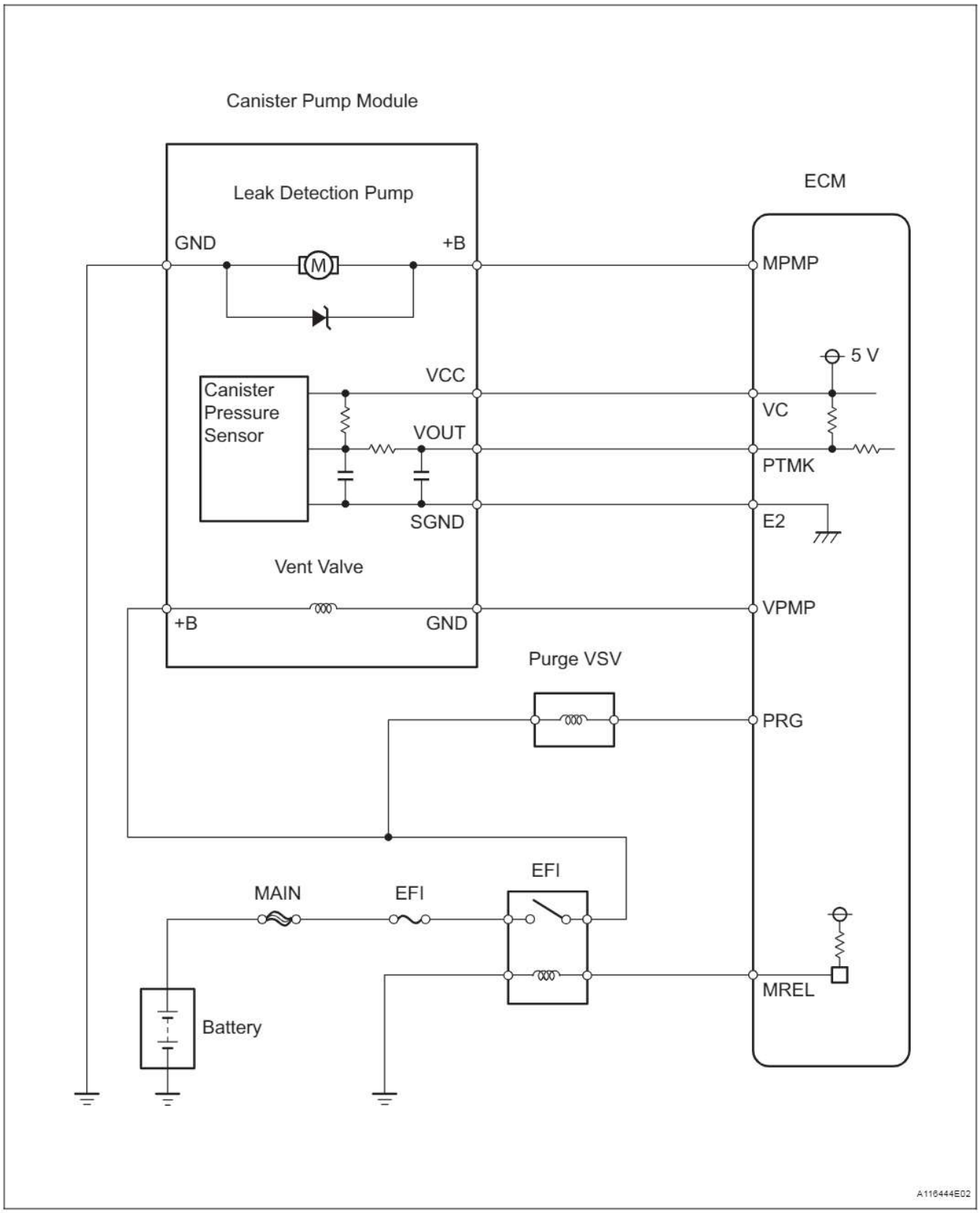
HINT:

Standard atmospheric pressure is 101.3 kPa (759.8mmHg)

Soak Timer Circuit (fig. 3):



WIRING DIAGRAM



ES

INSPECTION PROCEDURE

NOTICE:

The intelligent tester is required to conduct the following diagnostic troubleshooting procedure.

HINT:

- Using the intelligent tester monitor results enable the EVAP system to be confirmed.
- Read freeze frame data using the intelligent tester. Freeze frame data records the engine conditions when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

1	**CONFIRM DTC**

(a) Turn the ignition switch OFF and wait for 10 seconds.
(b) Turn the ignition switch ON.
(c) Turn the ignition switch OFF and wait for 10 seconds.
(d) Connect the intelligent tester to the DLC3.
(e) Turn the ignition switch ON.
(f) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(g) Confirm DTCs and freeze frame data.
If any EVAP system DTCs are set, the malfunctioning area can be determined using the table below.
NOTICE:
If the 0.02 inch reference pressure difference between the first and second checks is greater than the specification, the DTCs corresponding to the reference pressure (P043E, P043F, P0441, P0455, P0456, P2401 and P2420) will all be stored.

DTCs / Malfunctioning Areas	P043E P043F	P0441	P0450	P0451	P0452	P0453	P0455	P0456	P2401 P2402	P2419	P2420
Reference orifice clogged	●								●	●	
Reference orifice high-flow	●								●	●	
Purge VSV stuck open		●					●				
Purge VSV stuck closed		●									
Canister pressure sensor stuck				●							
Canister pressure sensor noise				●							
Canister pressure sensor low output			●		●						
Canister pressure sensor high output			●			●					
Gross leak		●					●				
Small leak								●			
Leak detection pump stuck OFF	●								●	●	
Leak detection pump stuck ON	●								●	●	
Vent valve stuck closed	●								●	●	
Vent valve stuck open (vent)											●

Y A106731E06

NEXT

2	PERFORM EVAP SYSTEM CHECK (AUTO OPERATION)

NOTICE:

- **The EVAP SYSTEM CHECK (AUTO OPERATION) consists of five steps performed automatically by the intelligent tester. It takes a maximum of approximately 18 minutes.**
- **Do not perform the EVAP SYSTEM CHECK when the fuel tank is more than 90% full because the cut-off valve may be closed, making the leak check of the fuel tank not possible.**
- **Do not run the engine in this step.**
- **When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing the EVAP SYSTEM CHECK, keep the temperature below 35°C (95°F).**

(a) Clear the DTCs (see page ES-37).

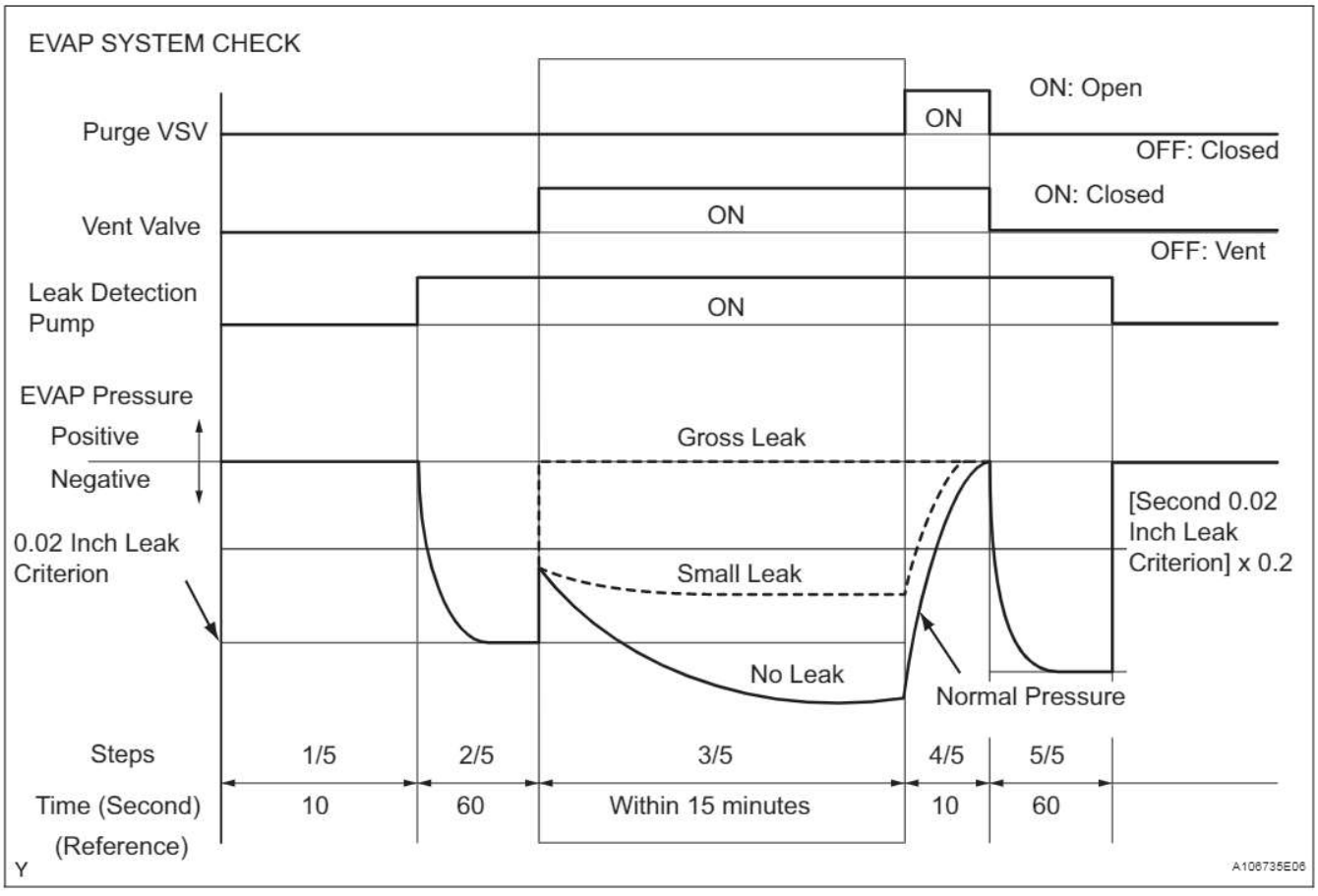
(b) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / SYSTEM CHECK / EVAP SYS CHECK / AUTO OPERATION.

(c) After the EVAP SYSTEM CHECK is completed, check for pending DTCs by entering the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / PENDING CODES.
HINT:
If no pending DTC is displayed, perform the CONFIRMATION DRIVING PATTERN (see " Diagnostic Help" menu). After this confirmation check for pending DTCs. If no DTC is displayed, the EVAP system is normal.

ES

NEXT

3	PERFORM EVAP SYSTEM CHECK (MANUAL OPERATION)



NOTICE:

- **In the EVAP SYSTEM CHECK (MANUAL OPERATION), the series of 5 EVAP SYSTEM CHECK steps are performed manually by the intelligent tester.**
- **Do not perform the EVAP SYSTEM CHECK when the fuel tank is more than 90% full because the cut-off valve may be closed, making the leak check of the fuel tank not possible.**
- **Do not run the engine in this step.**

- **When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing the EVAP SYSTEM CHECK, keep the temperature below 35°C (95°F).**

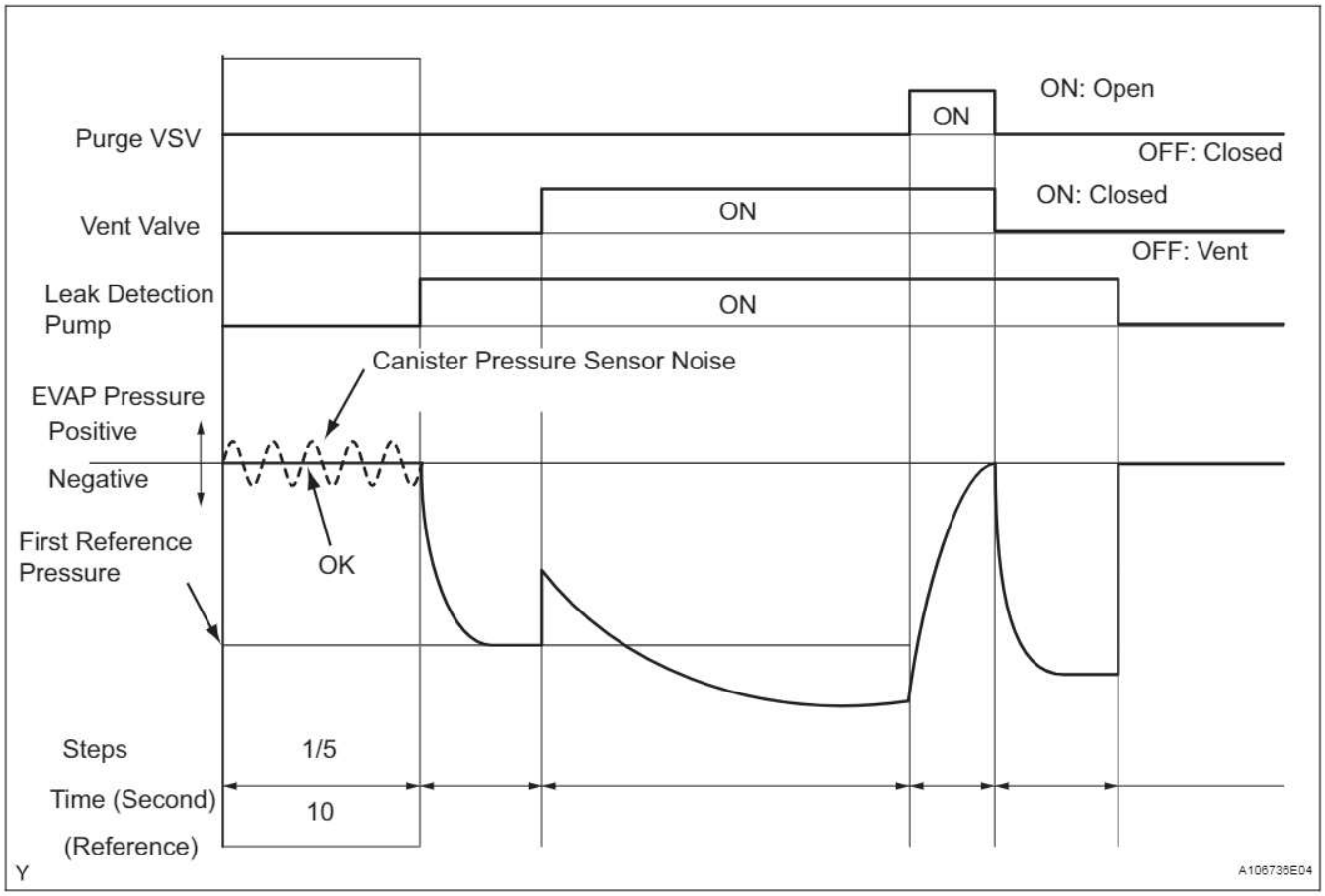
(a) Clear the DTCs (see page ES-37).

(b) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / SYSTEM CHECK / EVAP SYS CHECK / MANUAL OPERATION.

NEXT

4	PERFORM EVAP SYSTEM CHECK (STEP 1/5)

ES



(a) Check the EVAP pressure in step 1/5.

Result

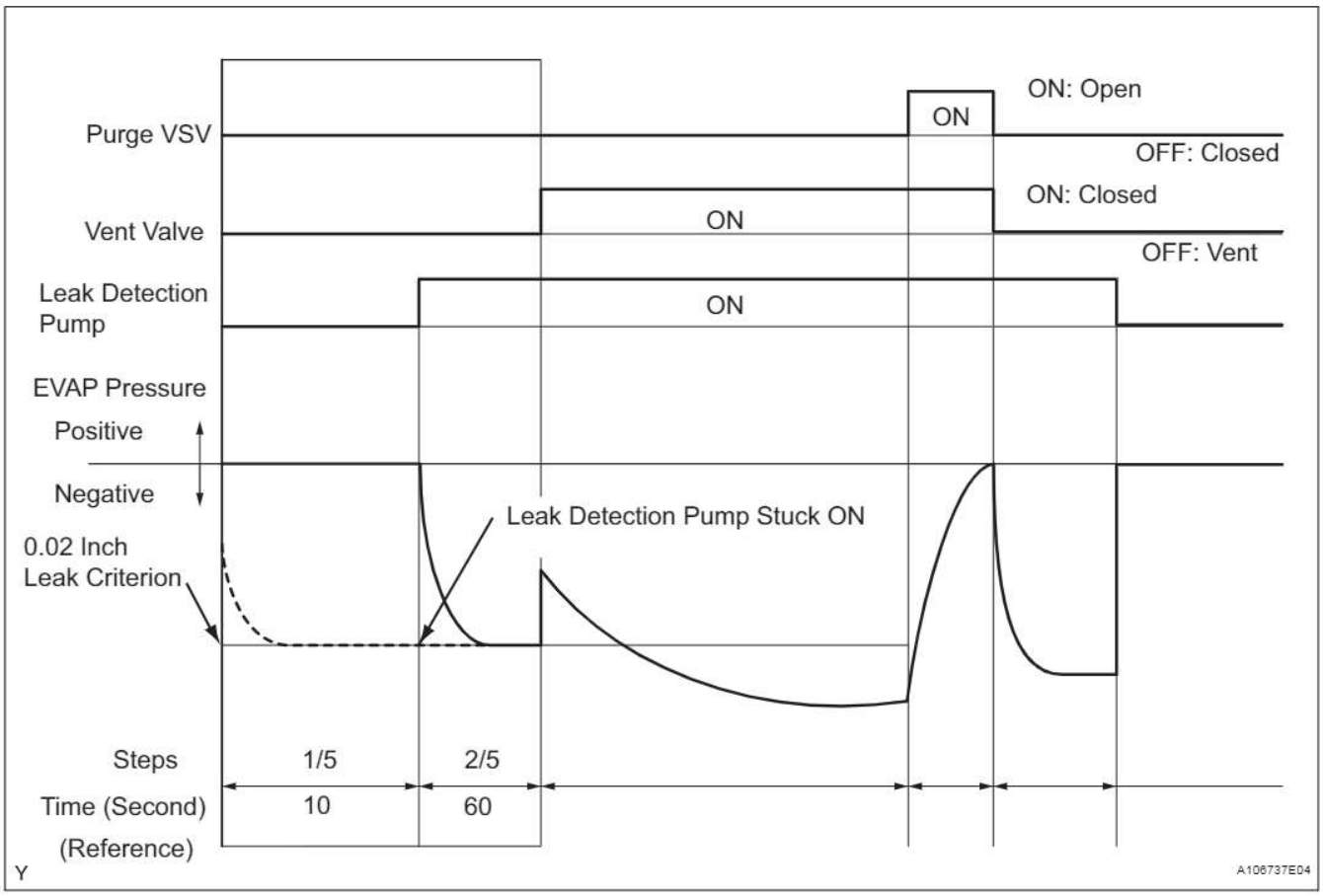
DTC No.*	Test Results	Suspected Trouble Areas	Proceed to
-	Virtually no variation in EVAP pressure	Not yet determined	A
P0451	EVAP pressure fluctuates by +-0.3 kPa (2.25 mmHg) or more	Canister pressure sensor noising	B

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in step 1.

B → Go to step 30

A

5	PERFORM EVAP SYSTEM CHECK (STEP 1/5 TO 2/5)



(a) Check the EVAP pressure in step 1/5 and 2/5.

Result

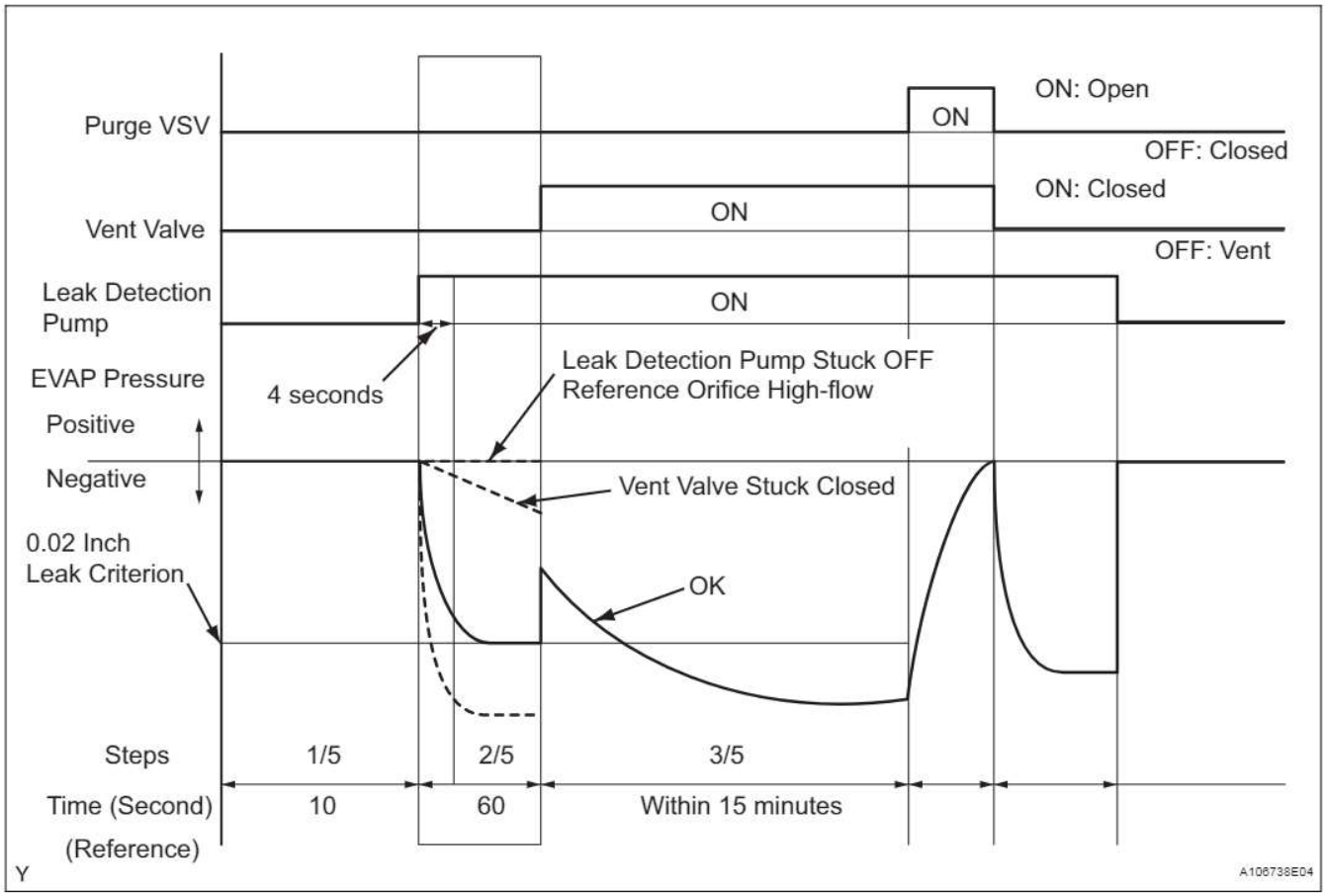
DTC No.*	Test Results	Suspected Trouble Areas	Proceed to
-	Virtually no variation in EVAP pressure during step 1/5. Then decreases to 0.02 inch leak criterion	Not yet determined	A
P2402	Small difference between EVAP pressures during steps 1/5 and 2/5	Leak detection pump stuck ON	B

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in step 1.
HINT:
The first 0.02 inch leak criterion is the value determined in step 2/5.

B → Go to step 23

A

6	PERFORM EVAP SYSTEM CHECK (STEP 2/5)



HINT:
Make a note of the pressures checked in the steps below.
(a) Check the EVAP pressure 4 seconds after the leak detection pump is activated*.
*: The leak detection pump begins to operate as step 1/5 proceeds to step 2/5.
(b) Check the EVAP pressure again when it has stabilized. This pressure is the 0.02 inch leak criterion.

Result

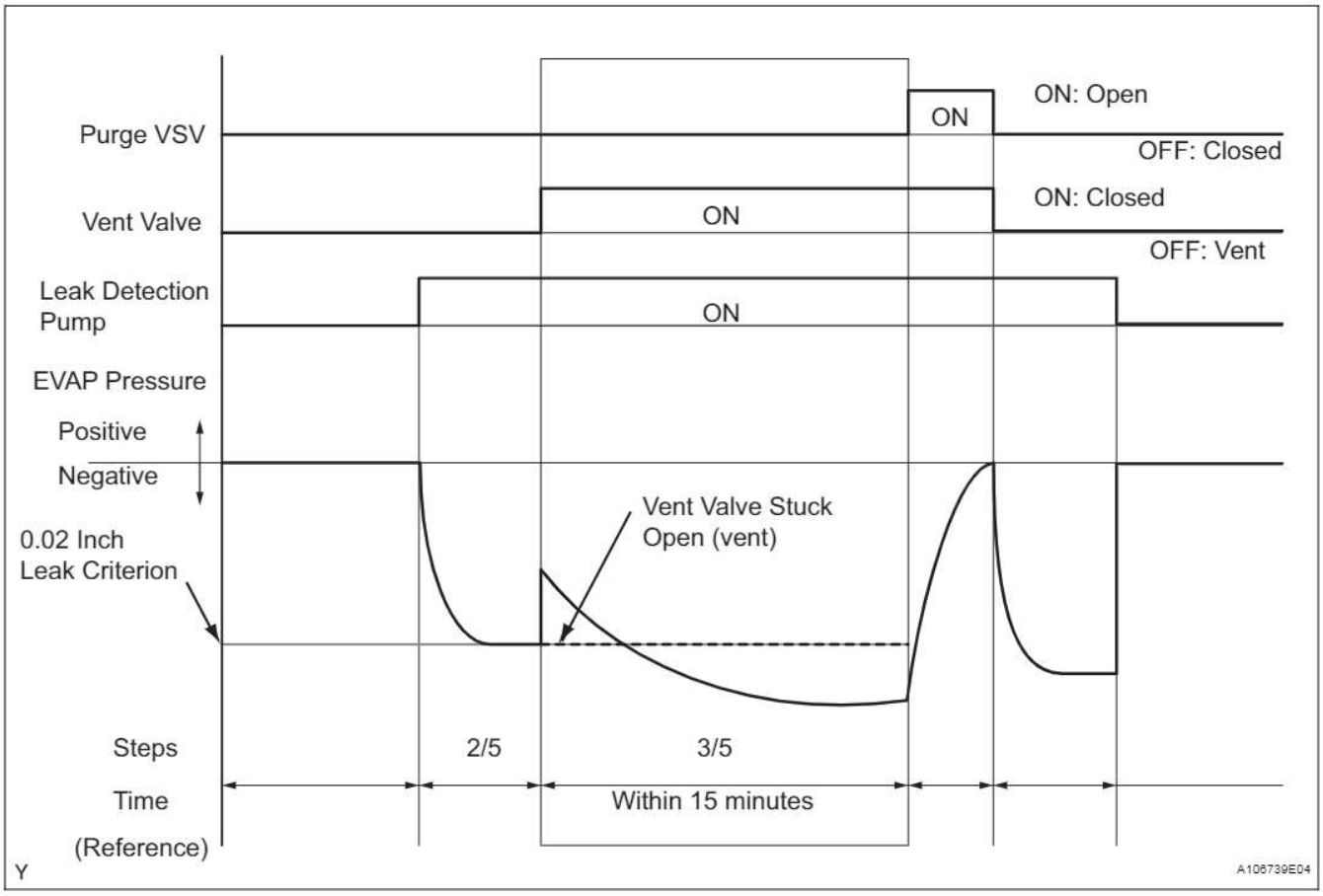
DTC No.*	Test Results	Suspected Trouble Areas	Proceed to
-	EVAP pressure in step (b) between -4.85 kPa and -1.06 kPa (-36.38 mmHg and -7.95 mmHg)	Not yet determined	A
P043F and P2401	EVAP pressure in step (b) -1.06 kPa (-7.95 mmHg) or more	• Reference orifice high-flow • Leak detection pump stuck OFF	B
P043E	EVAP pressure in step (b) below -4.85 kPa (-36.38 mmHg)	Reference orifice clogged	C
P2419	EVAP pressure in step (a) more than -1.06 kPa (-7.95 mmHg)	Vent valve stuck closed	D

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in step 1.

B	Go to step 11
C	Go to step 30
D	Go to step 19

A

7	PERFORM EVAP SYSTEM CHECK (STEP 2/5 TO 3/5)



(a) Check the EVAP pressure in step 3/5.

Result

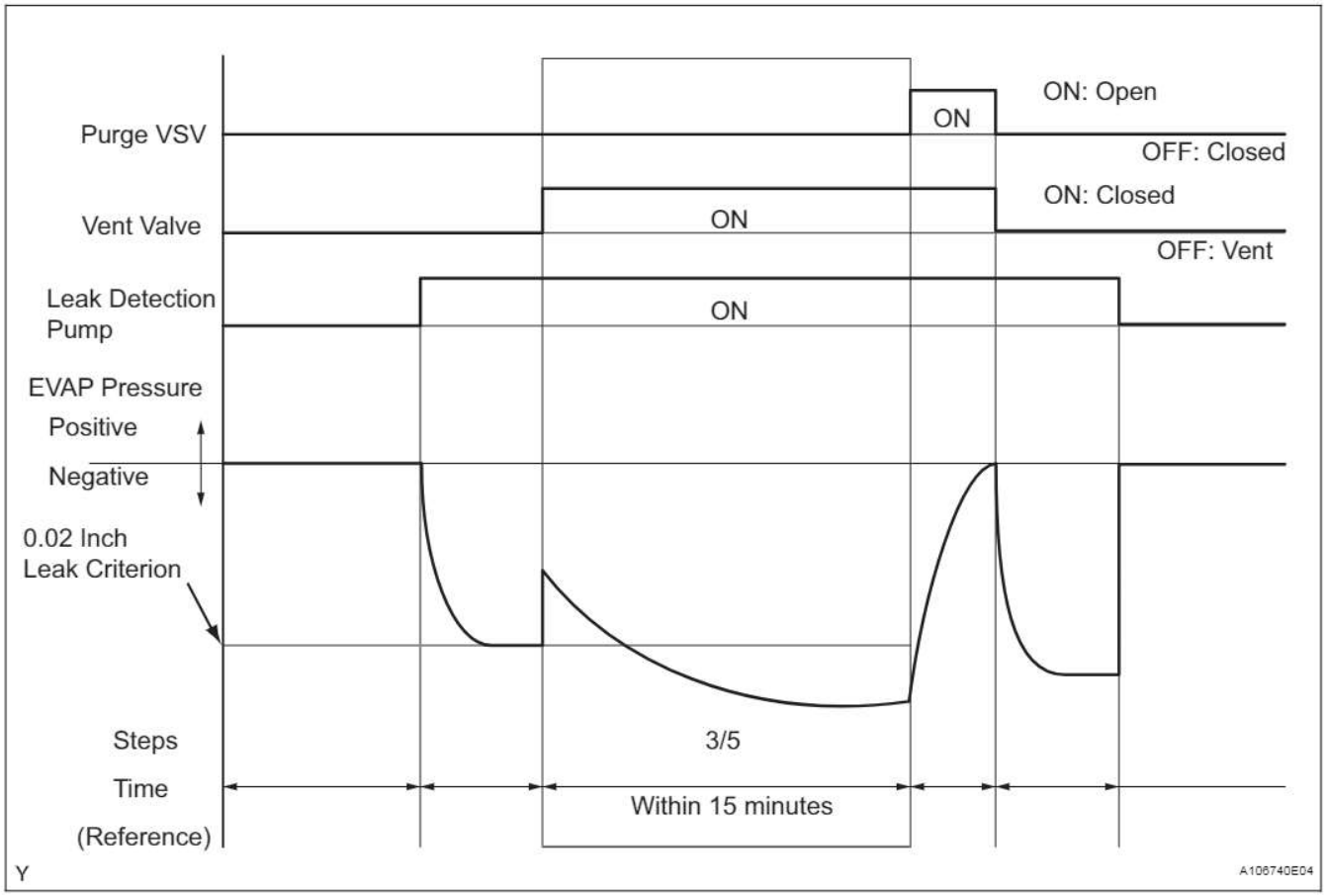
DTC No.*	Test Results	Suspected Trouble Areas	Proceed to
-	EVAP pressure increases by 0.3 kPa (2.25 mmHg) or more within 10 seconds of proceeding from step 2/5 to step 3/5	Not yet determined	A
P2420	No variation in EVAP pressure despite proceeding from step 2/5 to step 3/5	Vent valve stuck open (vent)	B
P0451	No variation in EVAP pressure during steps 1/5 through 3/5	Canister pressure sensor malfunction (stuck)	C

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in step 1.

B	Go to step 20
C	Go to step 30

A

8	PERFORM EVAP SYSTEM CHECK (STEP 3/5)

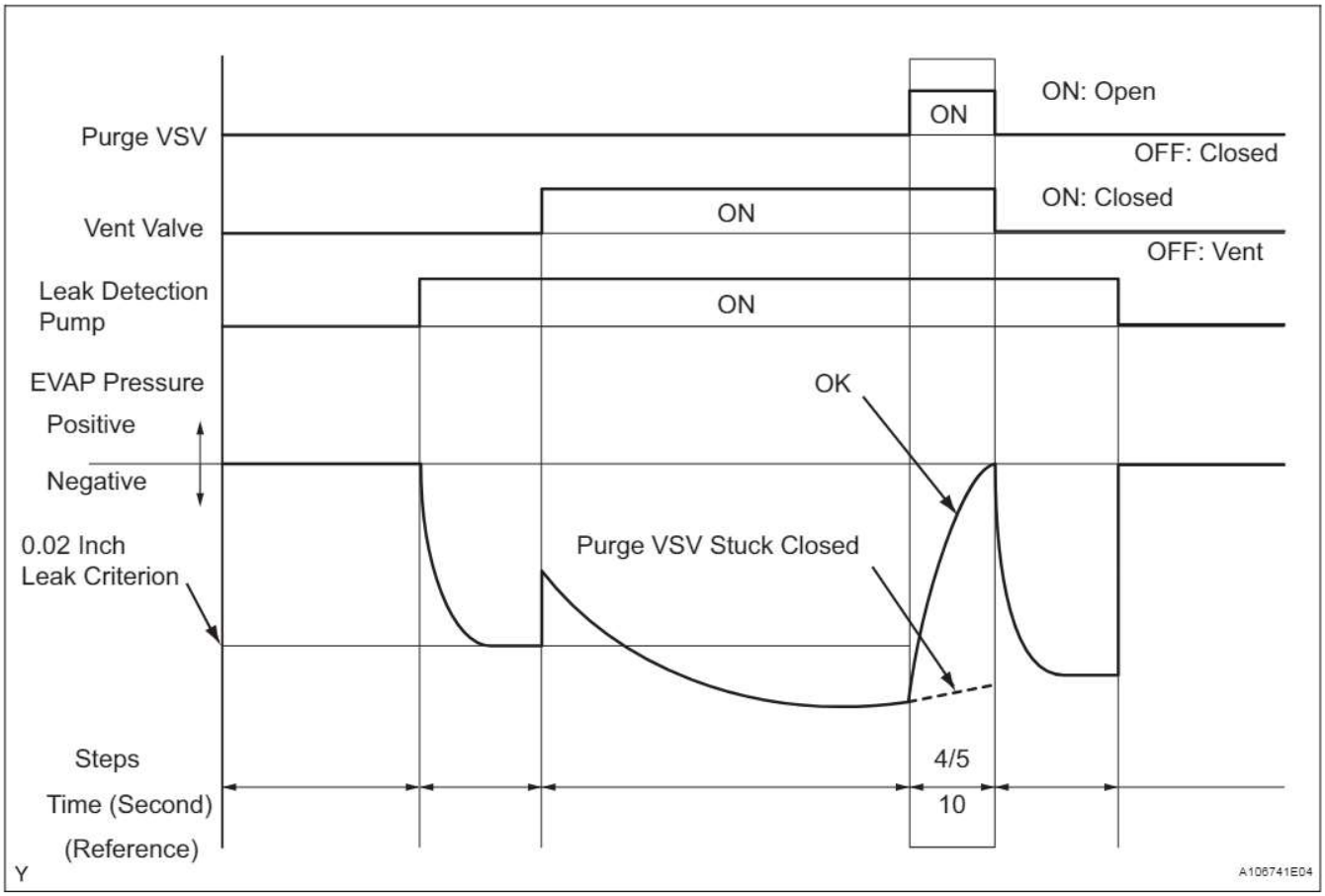


(a) Wait until the EVAP pressure change is less than 0.1 kPa (0.75 mmHg) for 30 seconds.

(b) Measure the EVAP pressure and record it.
HINT:
A few minutes are required for the EVAP pressure to become saturated. When there is little fuel in the fuel tank, it takes up to 15 minutes.

NEXT

9	PERFORM EVAP SYSTEM CHECK (STEP 4/5)



(a) Check the EVAP pressure in step 4/5.

Result

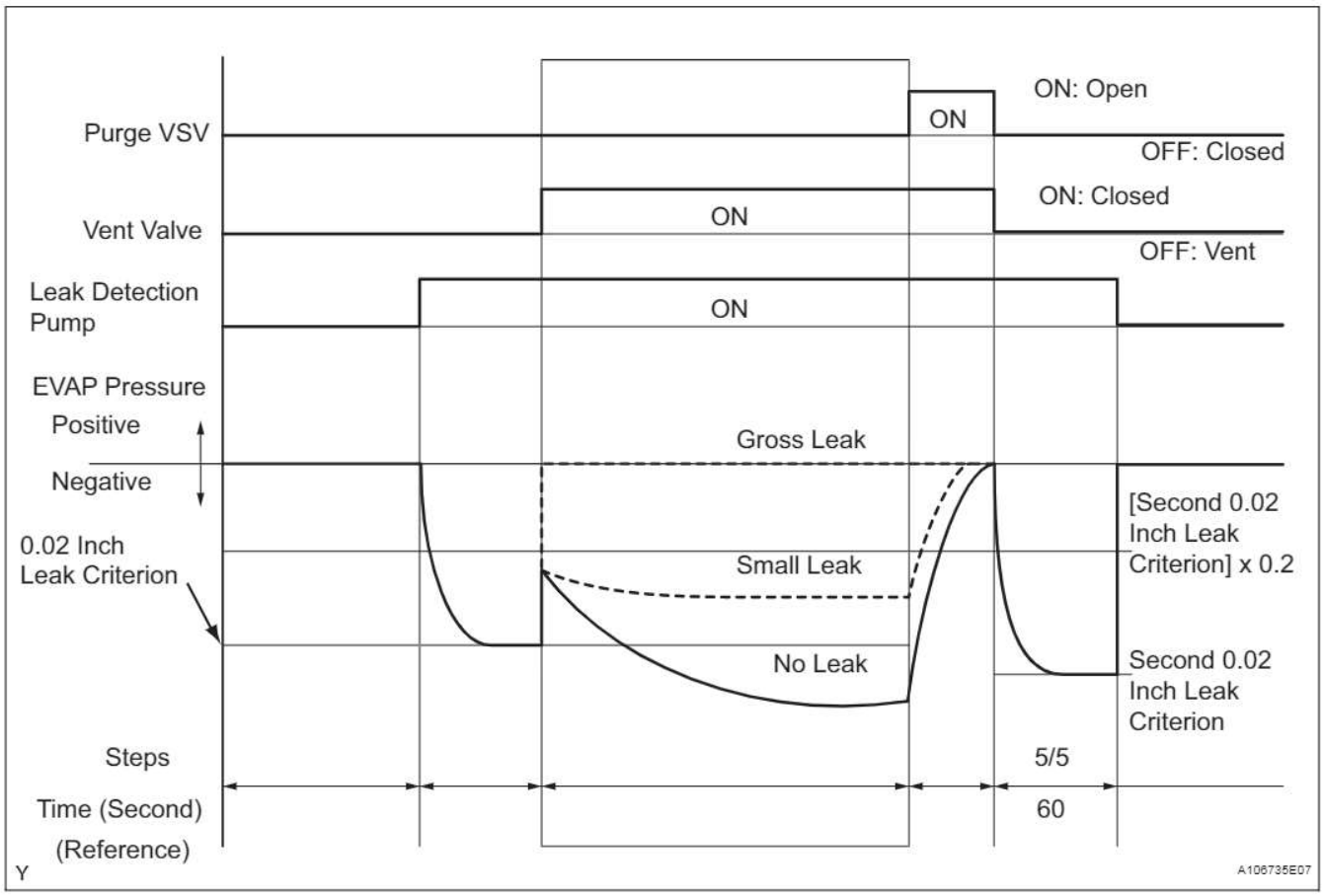
DTC No.*	Test Results	Suspected Trouble Areas	Proceed to
-	EVAP pressure increases by 0.3 kPa (2.25 mmHg) or more within 10 seconds of proceeding from step 3/5 to step 4/5	Not yet determined	A
P0441	EVAP pressure increases by 0.3 kPa (2.25 mmHg) or more within 10 seconds of proceeding from step 3/5 to step 4/5	Problems in EVAP hose between purge VSV and intake manifold	B
P0441	Variation in EVAP pressure less than 0.3 kPa (2.25 mmHg) for 10 seconds, after proceeding from step 3/5 to step 4/5	Purge VSV stuck closed	C

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in step 1.

B	Go to step 15
C	Go to step 12

A

10	PERFORM EVAP SYSTEM CHECK (STEP 5/5)



(a) Check the EVAP pressure in step 5/5.
(b) Compare the EVAP pressure in step 3/5 and the second 0.02 inch leak criterion (step 5/5).

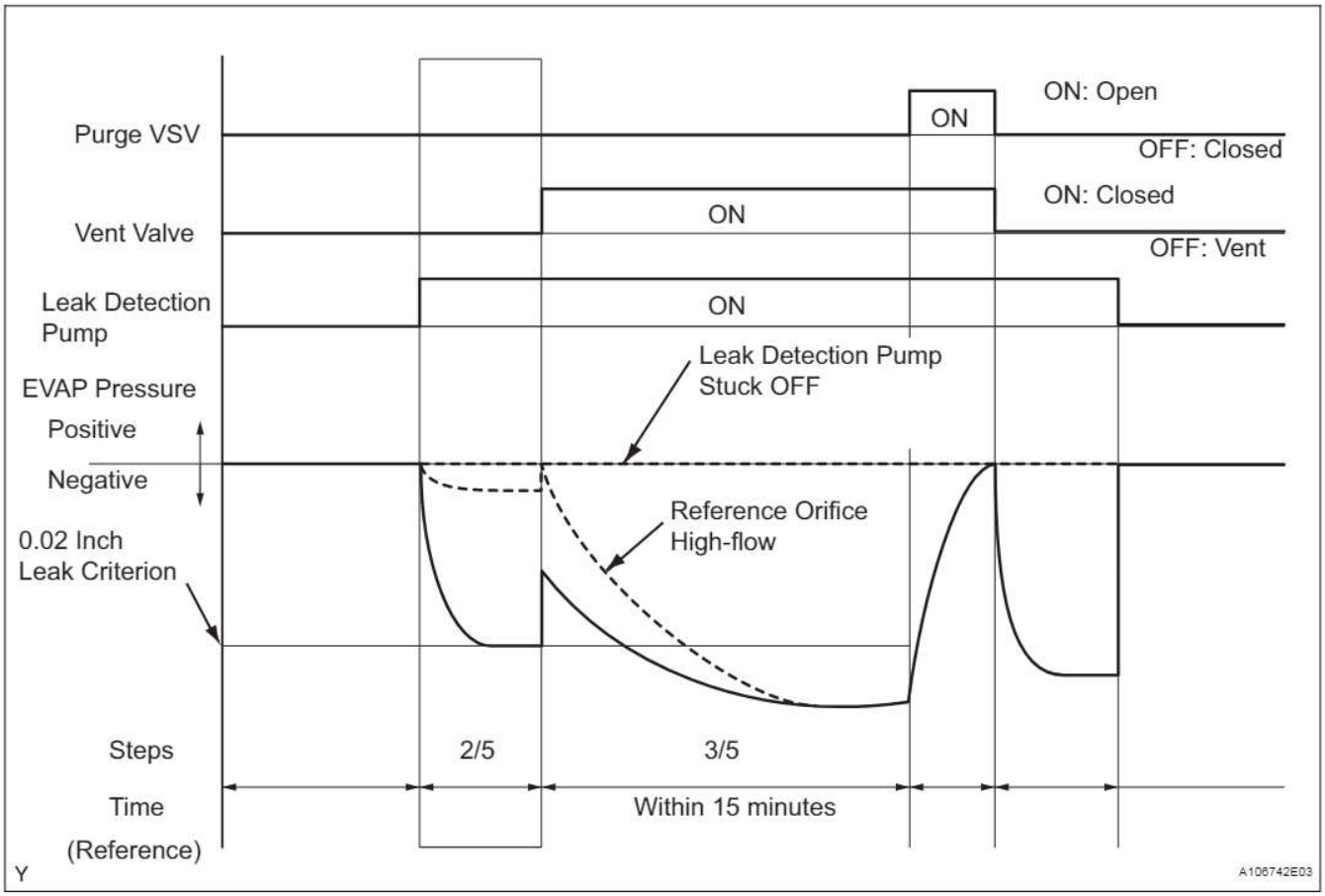
Result

DTC No.*	Test Results	Suspected Trouble Areas	Proceed to
-	EVAP pressure (step 3/5) lower than second 0.02 inch leak criterion (step 5/5)	Not yet determined	A
P0441 and P0455	EVAP pressure (step 3/5) higher than [second 0.02 inch leak criterion (step 5/5) x 0.2]	• Purge VSV stuck open • EVAP gross leak	B
P0456	EVAP pressure (step 3/5) higher than second 0.02 inch leak criterion (step 5/5)	EVAP small leak	B

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in step 1.

A	Go to step 36
B	Go to step 12

11	PERFORM EVAP SYSTEM CHECK (STEP 3/5)



(a) Check the EVAP pressure in step 3/5.

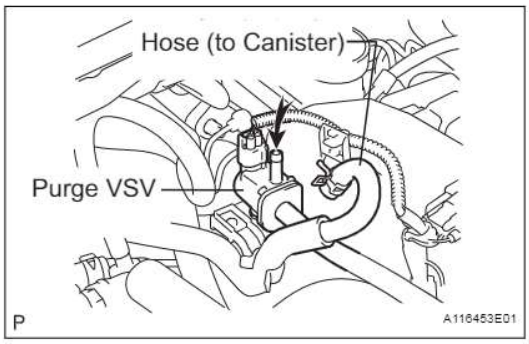
Result

DTC No.*	Test Results	Suspected Trouble Areas	Proceed to
P043F	EVAP pressure less than [0.02 inch leak criterion] measured at 2/5	Reference orifice high-flow	A
P2401	EVAP pressure almost same as [0.02 inch leak criterion] measured at 2/5	Leak detection pump stuck OFF	B

*: These DTCs are already present in the ECM when the vehicle arrives and are confirmed in step 1.
HINT:
The first 0.02 inch leak criterion is the value determined in step 2/5.

A	Go to step 30
B	Go to step 23

12 PERFORM ACTIVE TEST BY INTELLIGENT TESTER (PURGE VSV)



(a) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / EVAP VSV.
(b) Disconnect the hose (connected to the canister) from the purge VSV.
(c) Turn the ignition switch ON.
(d) Using the tester, turn the purge VSV OFF.
(e) Use your finger to confirm that the purge VSV has no suction.
(f) Using the tester, turn the purge VSV ON.
(g) Use your finger to confirm that the purge VSV has suction.

ES

Result

Test Results	Suspected Trouble Areas	Proceed to
No suction when purge VSV turned OFF, and suction applied when turned ON	Purge VSV normal	A
Suction applied when purge VSV turned OFF	Purge VSV stuck open	B
No suction when purge VSV turned ON	• Purge VSV stuck closed • Problems with EVAP hose between purge VSV and intake manifold	C

B → Go to step 14

C → Go to step 15

A

13 CHECK FUEL TANK CAP

(a) Check that the fuel tank cap is correctly installed and confirm the fuel cup meets OEM specification.
  (1) Tighten the fuel tank cap until a few click sounds are heard.
  HINT:
  If an EVAP tester is available, use the tester to check the fuel tank cap.
(b) Remove the fuel tank cap and install it onto the fuel tank cap adaptor.
(c) Connect an EVAP tester pump hose to the adaptor, and pressurize the cap to 3.2 to 3.7 kPa (24 to 28 mmHg) using an EVAP tester pump.
(d) Seal the adaptor and wait for 2 minutes.
(e) Check the pressure. If the pressure is 2 kPa (15 mmHg) or more, the fuel tank cap is normal.

Result

Test Results	Suspected Trouble Areas	Proceed to
Fuel tank cap correctly installed	-	A
Fuel tank cap loose	• Fuel tank cap improperly installed • Defective fuel tank cap • Fuel tank cap does not meet OEM specifications	B

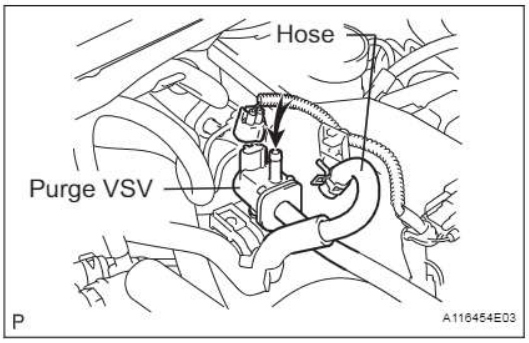
Test Results	Suspected Trouble Areas	Proceed to
No fuel tank cap	-	C

A → Go to step 29

B → Go to step 27

C → Go to step 28

14 INSPECT PURGE VSV



(a) Turn the ignition switch OFF.
(b) Disconnect the V1 purge VSV connector.
(c) Disconnect the hose (connected to the canister) from the purge VSV.
(d) Turn the ignition switch ON.
(e) Start the engine.
(f) Use your finger to confirm that the purge VSV has no suction.

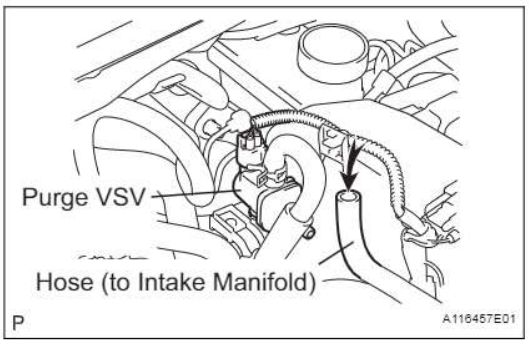
Result

Test Results	Suspected Trouble Areas	Proceed to
No suction	ECM	A
Suction applied	Purge VSV	B

A → Go to step 35

B → Go to step 31

15 CHECK EVAP HOSE (PURGE VSV - INTAKE MANIFOLD)



(a) Disconnect the hose (connected to the intake manifold) from the purge VSV.
(b) Turn the ignition switch ON.
(c) Start the engine.
(d) Use your finger to confirm that the hose has suction.

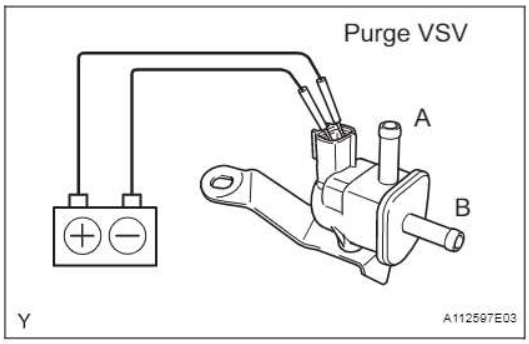
Result

Test Results	Suspected Trouble Areas	Proceed to
Suction applied	EVAP hose between purge VSV and intake manifold normal	A
No suction	• Intake manifold port • EVAP hose between purge VSV and intake manifold	B

B → Go to step 26

A

16 INSPECT DUTY PURGE VSV



(a) Remove the purge VSV connector.
(b) Apply battery voltage to the terminals of the purge VSV.
(c) Using an air gun, confirm that air flows from port A to port B.

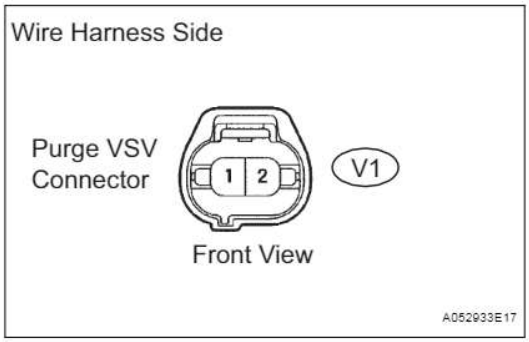
Result

Test Results	Suspected Trouble Areas	Proceed to
Air flows	Purge VSV normal	A
No air flows	Purge VSV	B

B → Go to step 31

A

17 CHECK HARNESS AND CONNECTOR (POWER SOURCE OF PURGE VSV)



(a) Disconnect the V1 purge VSV connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage between terminal 1 of the purge VSV connector and the body ground.

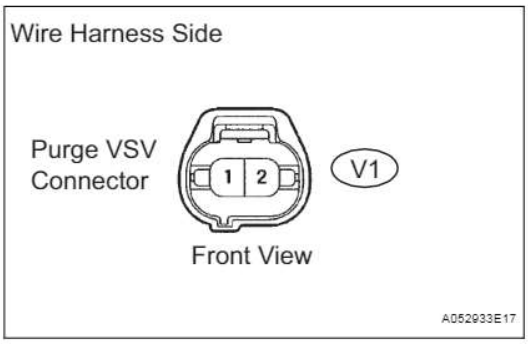
Result

Test Results	Suspected Trouble Areas	Proceed to
11 to 14 V	Normal	A
Other than result above	Wire harness or connectors between purge VSV and ECM	B

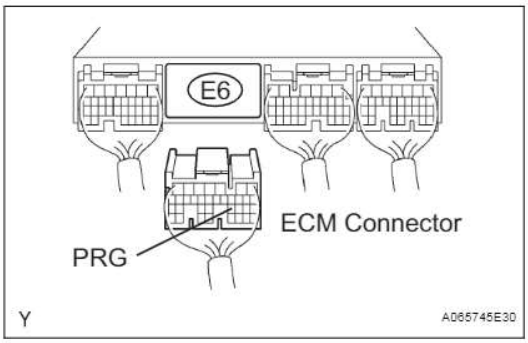
B → Go to step 32

A

18 CHECK HARNESS AND CONNECTOR (PURGE VSV - ECM)



(a) Disconnect the V1 purge VSV connector.



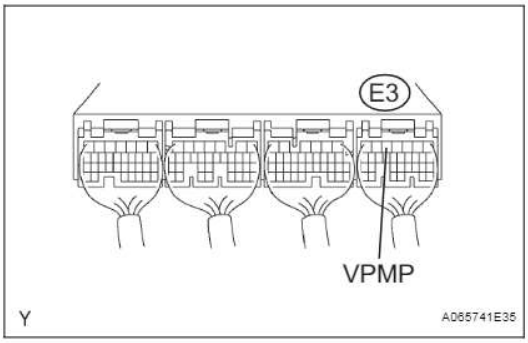
(b) Disconnect the E6 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

Standard resistance

Tester Connection	Specified Condition
V1-1 - PRG (E6-23)	Below 1 Ω
V1-1 or PRG (E6-23) - Body ground	10 kΩ or higher

OK	Go to step 35
NG	Go to step 32

19 PERFORM ACTIVE TEST BY INTELLIGENT TESTER (FOR VENT VALVE)



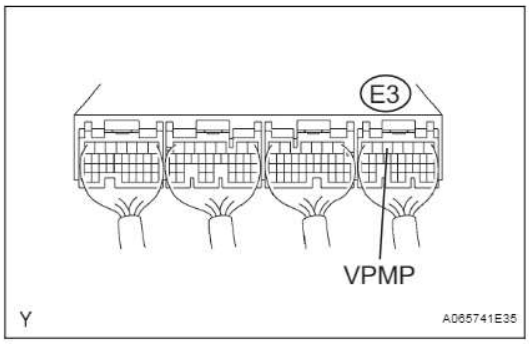
(a) Turn the ignition switch ON.
(b) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / VENT VALVE (ALONE).
(c) Measure the voltage between terminal VPMP (E3-5) of the ECM connector and the body ground when the vent valve is turned ON (closed) and OFF (vent) using the tester.

Result

Test Results	Suspected Trouble Areas	Proceed to
9 to 14 V when OFF Below 3 V when ON	Vent valve	A
Below 3 V when OFF and ON	ECM	B

A	Go to step 22
B	Go to step 35

20 PERFORM ACTIVE TEST BY INTELLIGENT TESTER (FOR VENT VALVE)



(a) Turn the ignition switch ON.
(b) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / VENT VALVE (ALONE).
(c) Measure the voltage between terminal VPMP (E3-5) of the ECM connector and the body ground when the vent valve is turned ON (closed) and OFF (vent) using the tester.

ES

Result

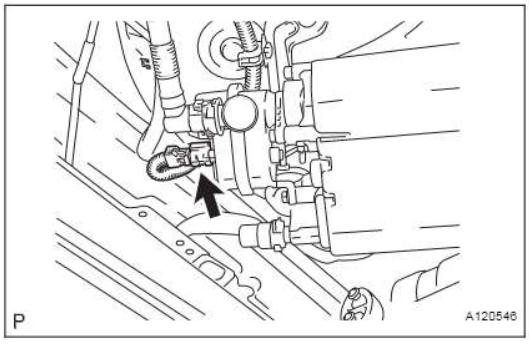
Test Results	Suspected Trouble Areas	Proceed to
Below 3 V when OFF and ON	Power source of vent valve	A
9 to 14 V when OFF Below 3 V when ON	Vent valve	B
9 to 14 V when OFF and ON	ECM	C

B → Go to step 22

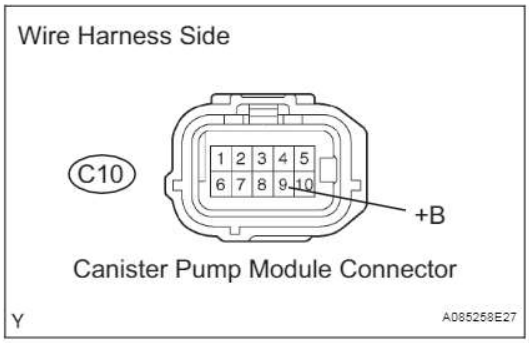
C → Go to step 35

A

21 INSPECT CANISTER PUMP MODULE (POWER SOURCE FOR VENT VALVE)



(a) Turn the ignition switch OFF.
(b) Disconnect the C10 canister connector.
(c) Turn the ignition switch ON.



(d) Measure the voltage between +B terminal of the canister connector and the body ground.

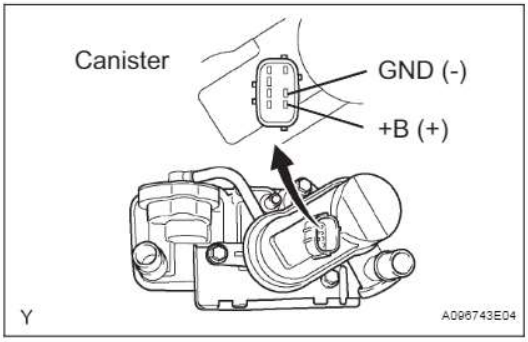
Result

Test Results	Suspected Trouble Areas	Proceed to
9 to 14 V	Normal	A
0 to 3 V	Power source wire harness of vent valve	B

B → Go to step 32

A

22 INSPECT CANISTER PUMP MODULE (VENT VALVE OPERATION)



(a) Turn the ignition switch OFF.
(b) Disconnect the C10 canister connector.
(c) Apply battery voltage to +B and GND of the canister pump module.
(d) Touch the canister pump module to confirm the vent valve operation.

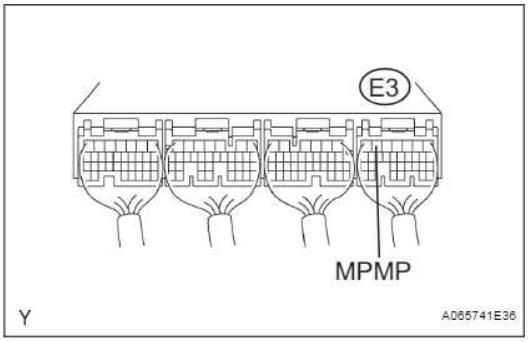
Result

Test Results	Suspected Trouble Areas	Proceed to
Operating	Wire harness between vent valve and ECM	A
Not operating	Vent valve	B

A → Go to step 32

B → Go to step 30

23 PERFORM ACTIVE TEST BY INTELLIGENT TESTER (FOR CANISTER PUMP MODULE [LEAK DETECTION PUMP])



(a) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / VACUUM PUMP (ALONE).
(b) Measure the voltage between the MPMP (E3-6) terminal of the ECM connector and the body ground when the leak detection pump is turned ON and OFF using the tester.

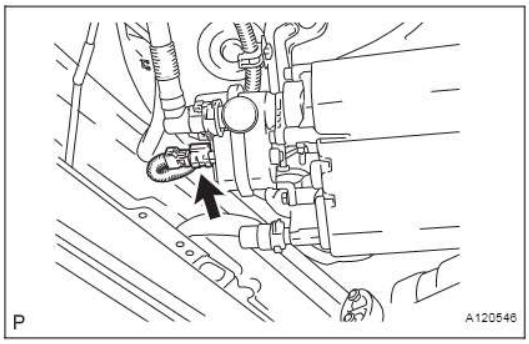
Result

Test Results	Suspected Trouble Areas	Proceed to
0 to 3 V when OFF 9 to 14 V when ON	ECM normal	A
9 to 14 V when OFF 0 V to 3 V when ON	ECM	B

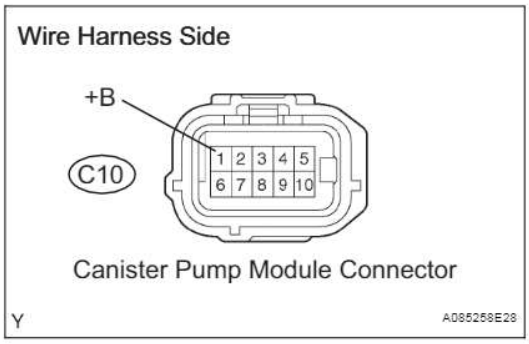
B → Go to step 35

A

24 CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - ECM)



(a) Turn the ignition switch OFF.
(b) Disconnect the C10 canister connector.
(c) Turn the ignition switch ON.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / VACUUM PUMP (ALONE).
(e) Turn the leak detection pump ON.



(f) Measure the voltage between +B terminal of the canister connector and the body ground.

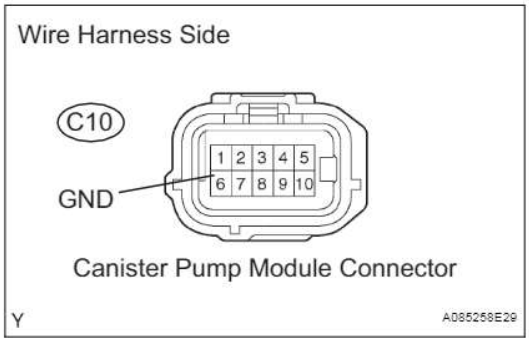
Result

Test Results	Suspected Trouble Areas	Proceed to
9 to 14 V	Normal	A
0 to 3 V	Wire harness between ECM and leak detection pump	B

B → Go to step 32

A

25 CHECK HARNESS AND CONNECTOR (CANISTER PUMP MODULE - GROUND)



(a) Disconnect the C10 canister connector.
(b) Turn the ignition switch OFF.
(c) Measure the resistance of the wire harness side connectors between GND terminal of the canister connector and the body ground.

Result

Test Results	Suspected Trouble Areas	Proceed to
Below 1 Ω	Leak detection pump	A
10 kΩ or higher	Wire harness between leak detection pump and body ground	B

A → Go to step 30

B → Go to step 32

26 INSPECT INTAKE MANIFOLD (EVAP PURGE PORT)

(a) Turn the ignition switch OFF.
(b) Disconnect the EVAP hose from the intake manifold.
(c) Turn the ignition switch ON.
(d) Use your finger to confirm that the port of the intake manifold has suction.

Result

Test Results	Suspected Trouble Areas	Proceed to
Suction applied	EVAP hose between intake manifold and purge VSV	A
No suction	Intake manifold	B

A → Go to step 33

B → Go to step 34

27 CORRECTLY REINSTALL OR REPLACE FUEL TANK CAP

HINT:
- When reinstalling the fuel tank cap, tighten it until a few click sounds are heard.
- When replacing the fuel tank cap, use a fuel tank cap that meets OEM specifications, and tighten it until a few click sounds are heard.

NEXT → Go to step 37

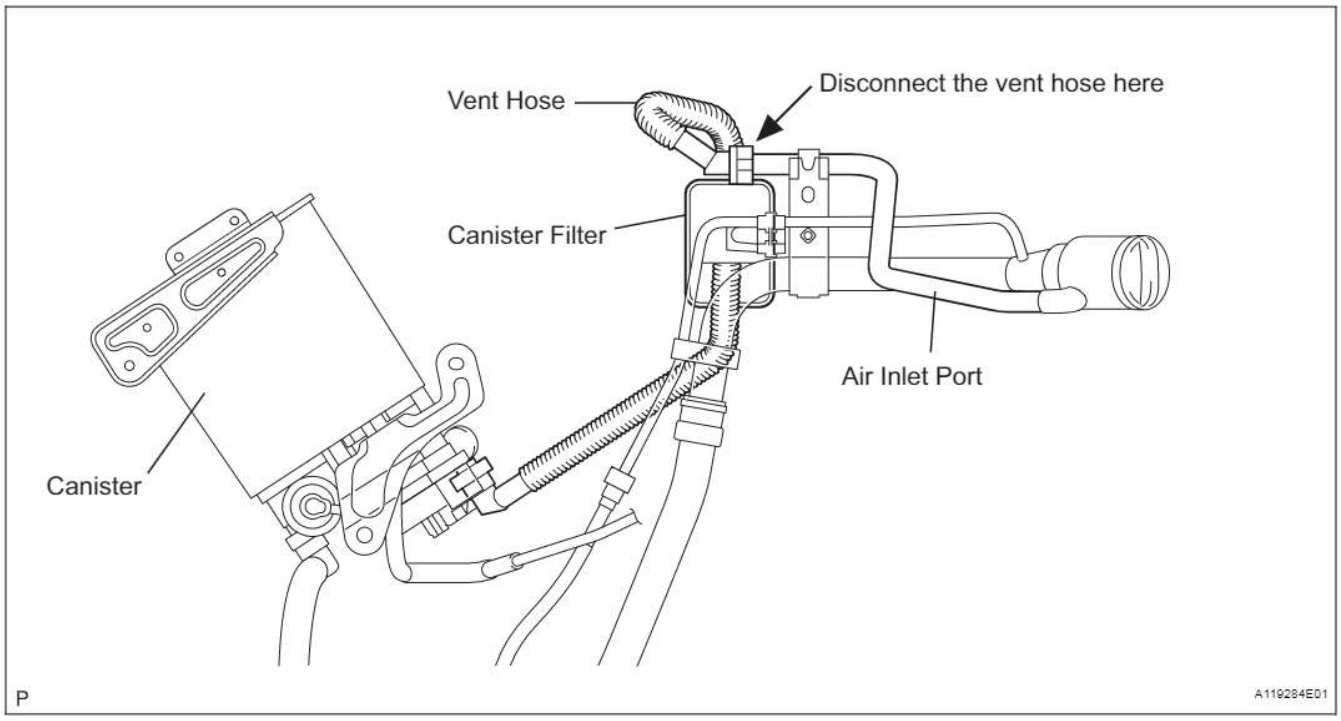
28 REPLACE FUEL TANK CAP

HINT:
When installing the fuel tank cap, tighten it until a few click sounds are heard.

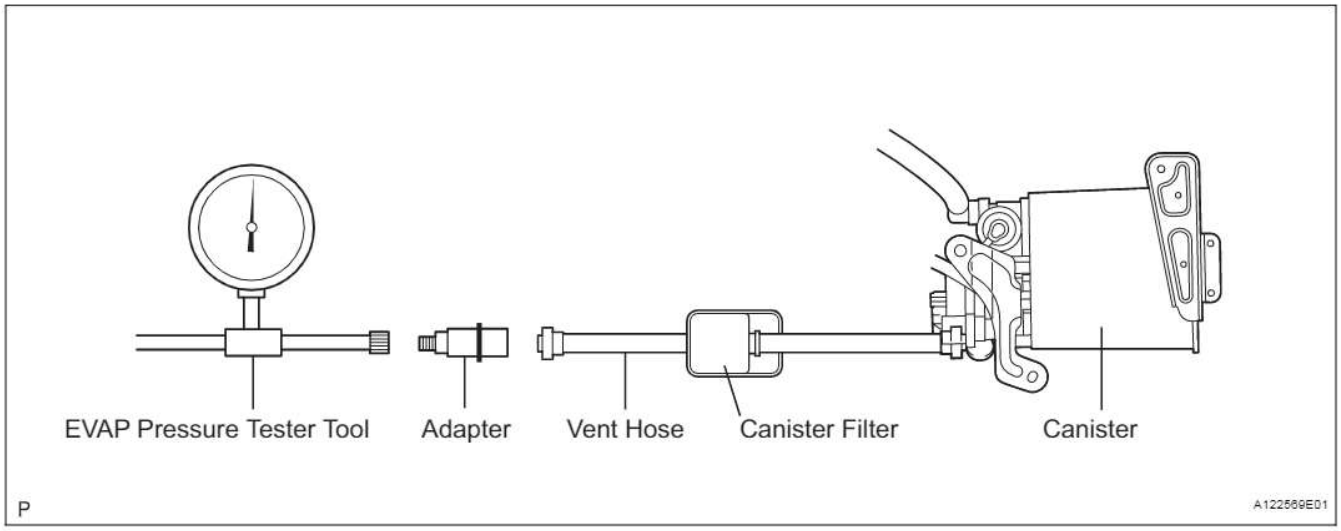
NEXT → Go to step 37

29 LOCATE EVAP LEAK

(a) Disconnect the vent hose.



(b) Connect the EVAP pressure tester tool to the canister with the adapter.



(c) Pressurize the EVAP system by 3.2 to 3.7 kPa (24 to 28 mmHg).
(d) Apply soapy water to the piping and connecting parts of the EVAP system.
(e) Look for areas where bubbles appear. This indicates leak point.
(f) Repair or replace the leak point.

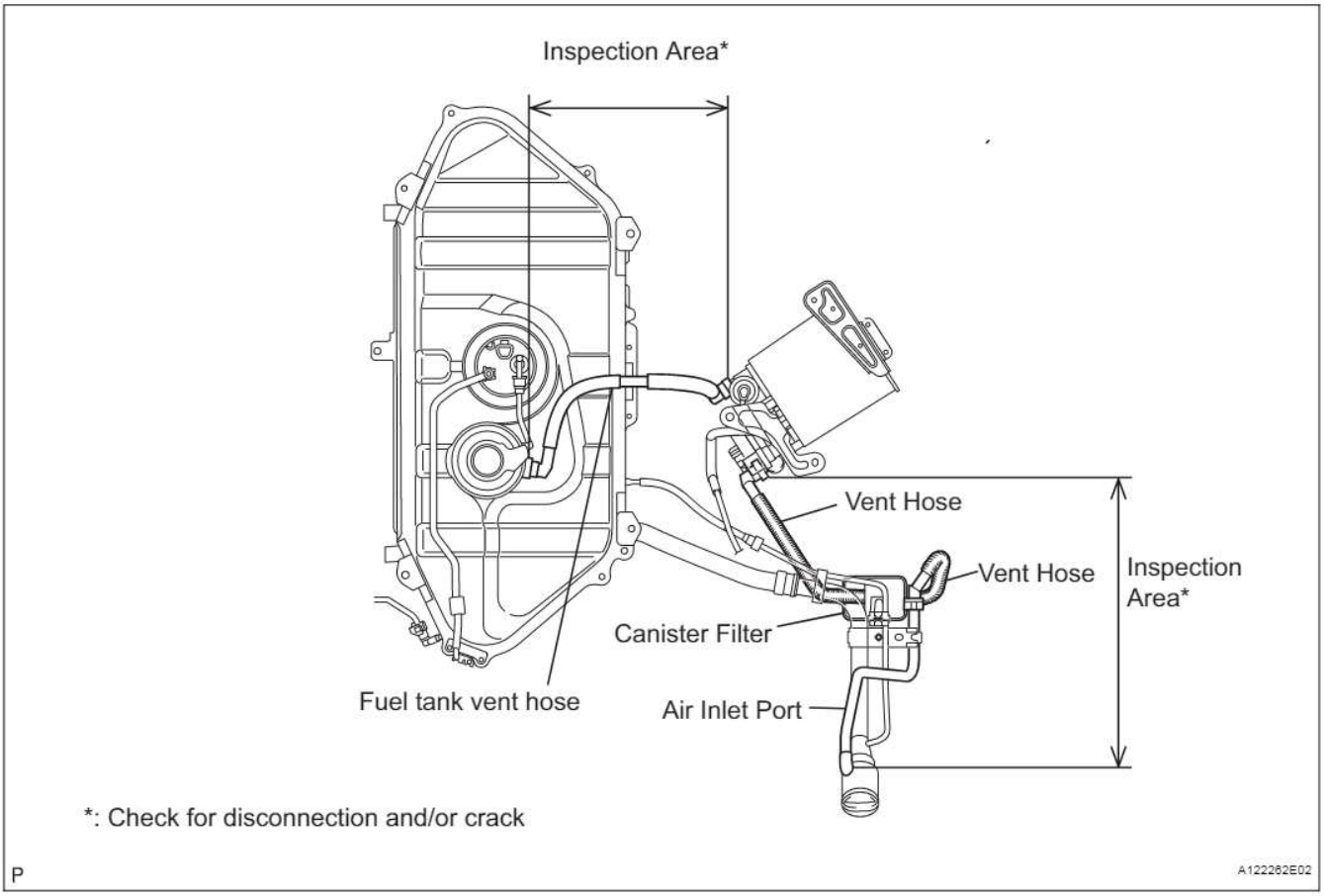
HINT:
Disconnect the hose between the canister and the fuel tank from the canister. Block the canister side and conduct an inspection. In this way, the fuel tank can be excluded as an area suspected of causing fuel leaks.

NEXT	Go to step 37

30	REPLACE CANISTER ASSEMBLY

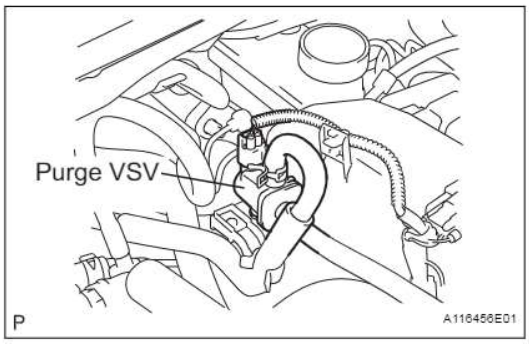
(a) Replace the canister assembly (see page EC-9).
NOTICE:
When replacing the canister, check the canister pump module interior and related pipes for water, fuel or other liquids. If liquids are present, check for disconnections and/or cracks in the following: 1) the pipe from the air inlet port to the canister pump module; 2) the canister filter; and 3) the fuel tank vent hose.

ES



NEXT Go to step 37

31	REPLACE PURGE VSV



(a) Disconnect the connector and hoses from the purge VSV.
(b) Remove the purge VSV.
(c) Install a new purge VSV.

NEXT → Go to step 37

32	REPAIR OR REPLACE HARNESS AND CONNECTOR

NEXT → Go to step 37

33	REPLACE EVAP HOSE (INTAKE MANIFOLD - PURGE VSV)

NEXT → Go to step 37

34	INSPECT INTAKE MANIFOLD (EVAP PURGE PORT)

(a) Check that the EVAP purge port of the intake manifold is not clogged. If necessary, replace the intake manifold.

NEXT → Go to step 37

35	REPLACE ECM

(a) Replace the ECM (see page ES-363).

NEXT → Go to step 37

36	REPAIR OR REPLACE PARTS AND COMPONENTS INDICATED BY OUTPUT DTCS

(a) Repair the malfunctioning areas indicated by the DTCs that had been confirmed when the vehicle was brought in.

NEXT → Go to step 37

37	PERFORM EVAP SYSTEM CHECK (AUTO OPERATION)

NOTICE:

- **The EVAP SYSTEM CHECK (AUTO OPERATION) consists of five steps performed automatically by the intelligent tester. It takes a maximum of approximately 18 minutes.**
- **Do not perform the EVAP SYSTEM CHECK when the fuel tank is more than 90% full because the cut-off valve may be closed, making the leak check of the fuel tank not possible.**
- **Do not run the engine in this step.**
- **When the temperature of the fuel is 35°C (95°F) or more, a large amount of vapor forms and any check results become inaccurate. When performing an EVAP SYSTEM CHECK, keep the temperature below 35°C (95°F).**

(a) Clear the DTCs (see page ES-37).

(b) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / SYSTEM CHECK / EVAP SYS CHECK / AUTO OPERATION.

(c) After the SYSTEM CHECK is completed, check for pending DTCs by entering the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / PENDING CODES.
HINT:
If no pending DTC is found, the repair has been successfully completed.

NEXT

COMPLETED

CONFIRMATION DRIVING PATTERN

HINT:
After a repair, check Monitor Status by performing the key-off monitor confirmation and purge flow monitor confirmation described below.

1. Key-off monitor confirmation

(a) Preconditions
The monitor will not run unless:
- The vehicle has been driven for 10 minutes or more (in a city area or on a freeway)
- The fuel tank is less than 90% full
- The altitude is less than 8,000 ft (2,400 m)
- The Engine Coolant Temperature (ECT) is between 4.4 to 35°C (40 to 95°F)
- The Intake Air Temperature (IAT) is between 4.4 to 35°C (40 to 95°F)
- The vehicle remains stationary (the vehicle speed is 0 km/h [0 mph])

(b) Monitor Conditions
1. Allow the engine to idle for at least 5 minutes.
2. Turn the ignition switch OFF and wait for 10 hours.
HINT:
Do not turn the ignition switch ON until CHECKING MONITOR STATUS. If the engine is started, the steps described above must be repeated.

(c) Monitor Status
1. Connect the intelligent tester to the DLC3.
2. Turn the ignition switch ON.
3. Enter the following menus: DIAGNOSIS / ENHANCED OBD II / MONITOR STATUS.
4. Check the Monitor Status displayed on the tester.
HINT:
If INCMP is displayed, the monitor is not completed. Make sure that the preconditions have been met, and perform the Monitor Conditions again.

2. Purge flow monitor confirmation (P0441)

HINT:
Perform this monitor confirmation after the key-off monitor confirmation shows COMPL (complete).

(a) Preconditions
The monitor will not run unless:
- The vehicle has been driven for 10 minutes or more (in a city area or on a freeway)
- The ECT is between 4.4 to 35°C (40 to 95°F)
- The IAT is between 4.4 to 35°C (40 to 95°F)

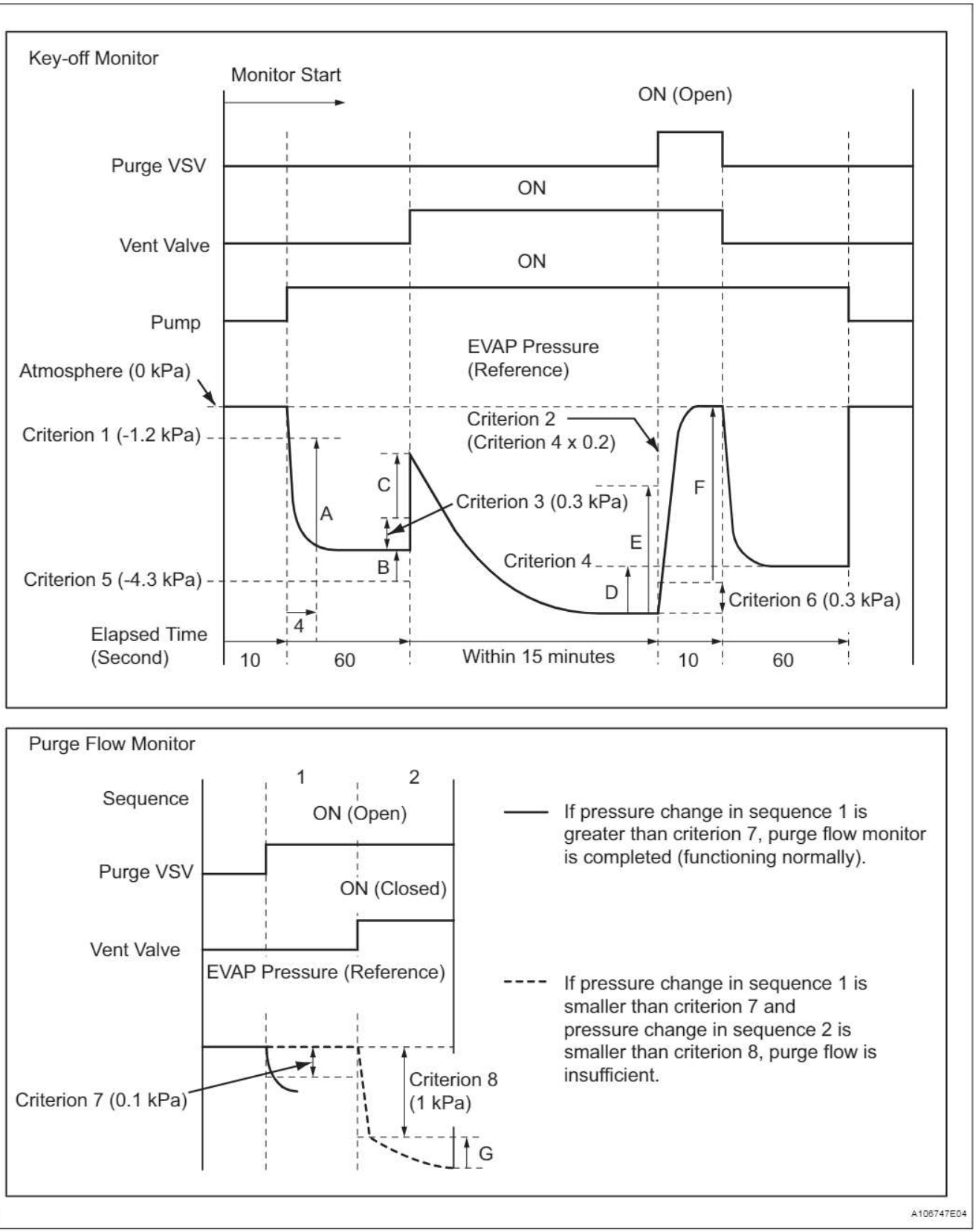
(b) Monitor Conditions
1. Release the pressure from the fuel tank by removing and reinstalling the fuel cap.
2. Warm the engine up until the ECT reaches more than 75°C (167°F).
3. Increase the engine speed to 3,000 rpm once.
4. Allow the engine to idle and turn the A/C ON for 1 minute.

(c) Monitor Status
1. Turn the ignition switch OFF (if ON or the engine is running).
2. Connect the intelligent tester to the DLC3.
3. Turn the ignition switch ON.
4. Enter the following menus: DIAGNOSIS / ENHANCED OBD II / MONITOR STATUS.
5. Check the Monitor Status displayed on the tester.
HINT:
If INCMP is displayed, the monitor is not completed. Make sure that the preconditions have been met, and perform the "Monitor Conditions" procedures again.

MONITOR RESULT

Refer to CHECKING MONITOR STATUS (see page ES-19).

ES



Y

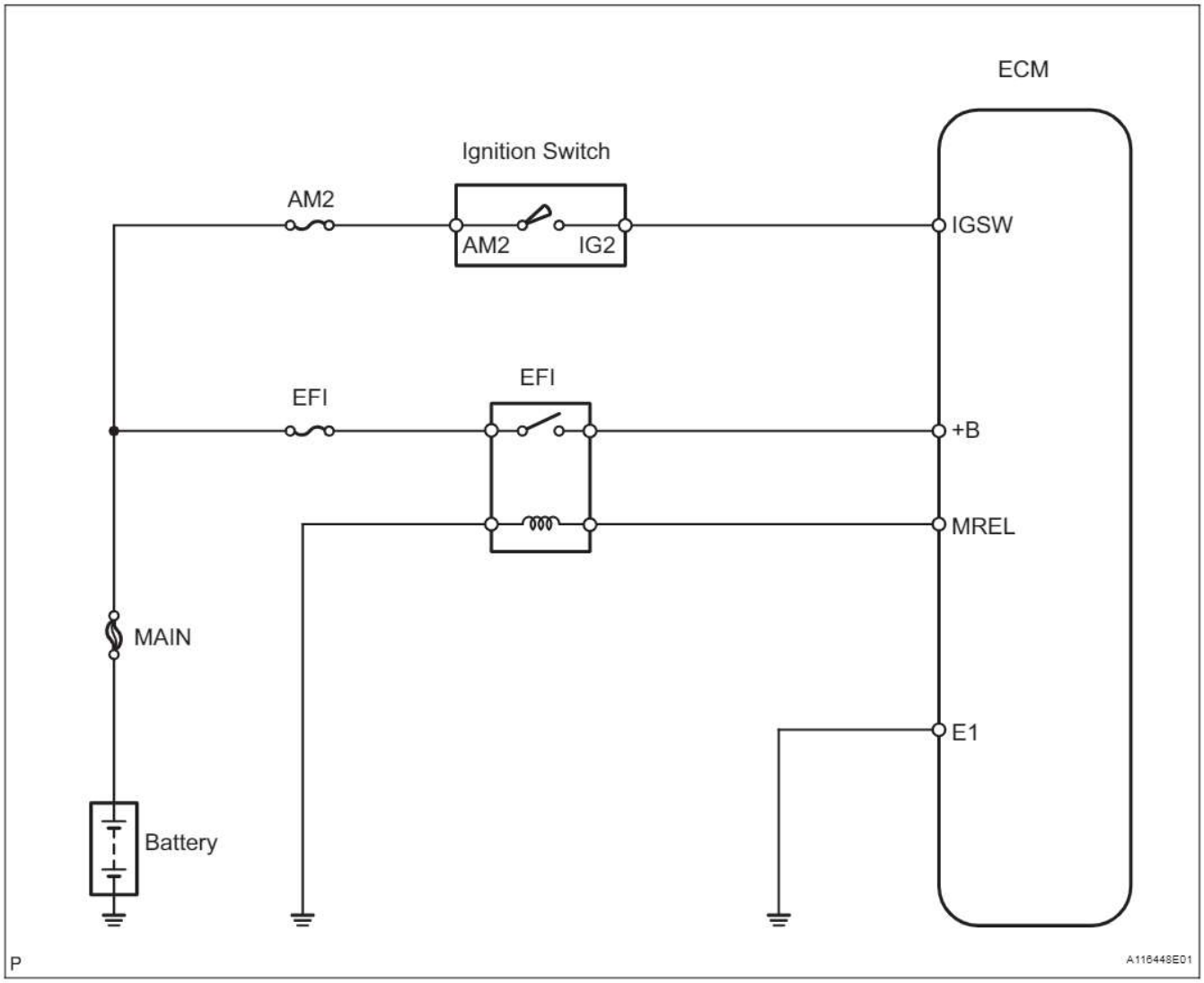
A106747E04

ECM Power Source Circuit

DESCRIPTION

When the ignition switch is turned ON, the positive battery voltage is applied to terminal IGSW of the ECM. The ECM MREL output signal causes a current to flow to the coil, closing the contacts of the EFI relay (Marking: EFI) and supplies power to terminal +B of the ECM.
If the ignition switch is turned OFF, the ECM continues to switch on the EFI relay for a maximum of 2 seconds for the initial setting of the throttle valve.

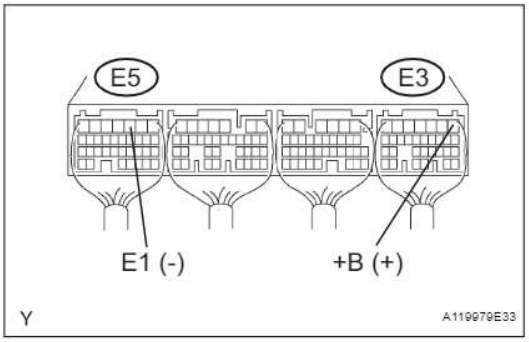
WIRING DIAGRAM



ES

INSPECTION PROCEDURE

1 INSPECT ECM (+B VOLTAGE)



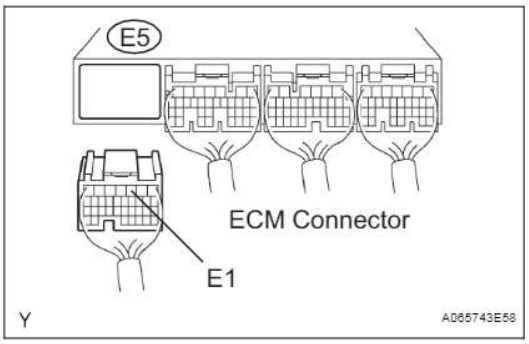
(a) Turn the ignition switch ON.
(b) Measure the voltage between the terminals of the ECM connectors.
Standard voltage

Tester Connection	Specified Condition
+B (E3-1) - E1 (E5-3)	9 to 14 V

OK → **PROCEED TO NEXT CIRCUIT INSPECTION SHOWN IN PROBLEM SYMPTOMS TABLE**

NG

2 CHECK HARNESS AND CONNECTOR (ECM - BODY GROUND)



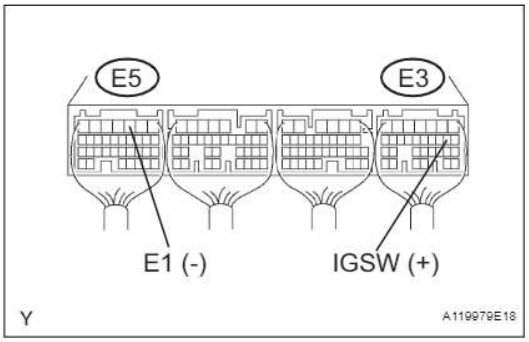
(a) Disconnect the negative (-) battery cable.
(b) Disconnect the E5 ECM connector.
(c) Measure the resistance of the wire harness side connector.
Standard resistance (Check for open)

Tester Connection	Specified Condition
E1 (E5-3) - Body ground	Below 1 Ω

NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

3 INSPECT ECM (IGSW VOLTAGE)



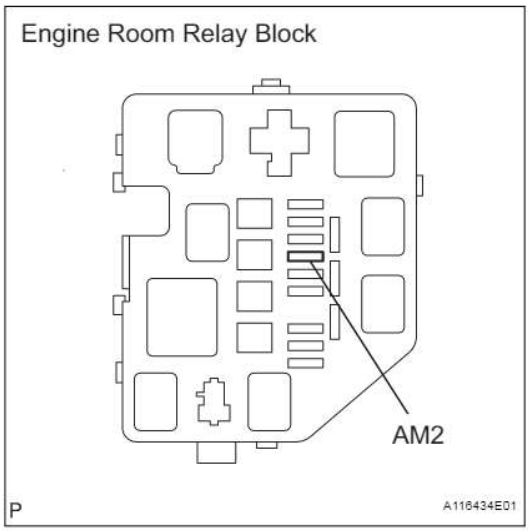
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.
Standard voltage

Tester Connection	Specified Condition
IGSW (E3-9) - E1 (E5-3)	9 to 14 V

OK → **Go to step 6**

NG

4 CHECK FUSE (AM2)

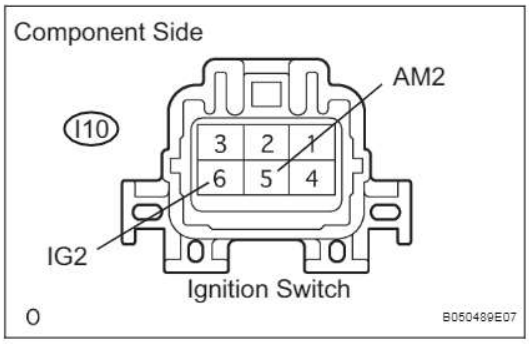


(a) Remove the AM2 fuse from the engine room relay block.
(b) Measure the resistance of the AM2 fuse.
Standard resistance:
Below 1 Ω

NG → **CHECK FOR SHORT IN ALL HARNESSES AND COMPONENTS CONNECTED TO FUSE**

OK

5 INSPECT IGNITION SWITCH ASSEMBLY



(a) Disconnect the I10 ignition switch connector.
(b) Measure the resistance of the ignition switch.
Standard resistance

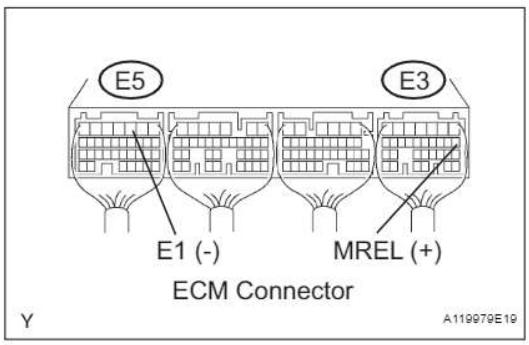
Ignition Switch Position	Tester Connection	Specified Condition
LOCK	All Terminals	10 kΩ or higher
ON	AM2 (5) - IG2 (6)	Below 1 Ω

NG → **REPLACE IGNITION SWITCH ASSEMBLY**

OK

CHECK HARNESS OR CONNECTOR (BATTERY - IGNITION SWITCH, IGNITION SWITCH - ECM)

6 INSPECT ECM (MREL VOLTAGE)



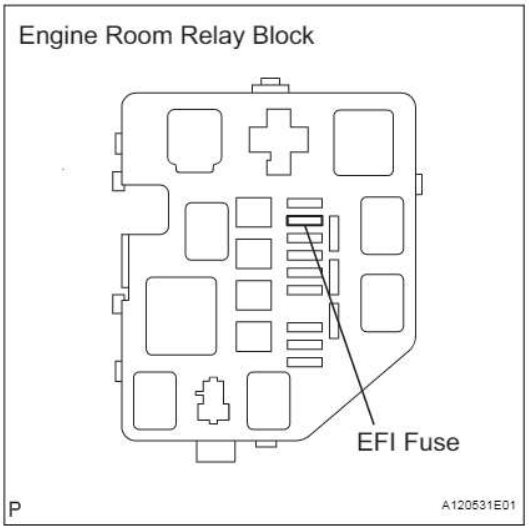
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.
Standard voltage

Tester Connection	Specified Condition
MREL (E3-8) - E1 (E5-3)	9 to 14 V

NG → **REPLACE ECM**

OK

7	CHECK FUSE (EFI)



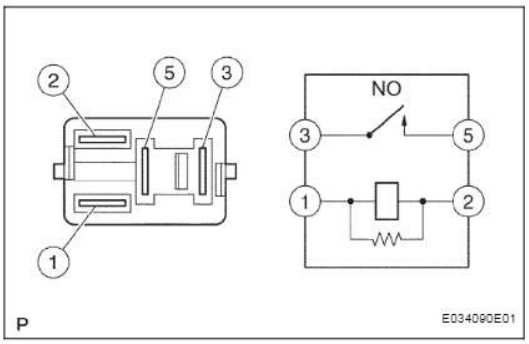
(a) Remove the EFI fuse from the engine room relay block.
(b) Measure the resistance of the EFI fuse.
Standard resistance:
Below 1 Ω

NG → **CHECK FOR SHORT IN ALL HARNESSES AND COMPONENTS CONNECTED TO FUSE**

ES

OK

8	INSPECT EFI RELAY (Marking: EFI)



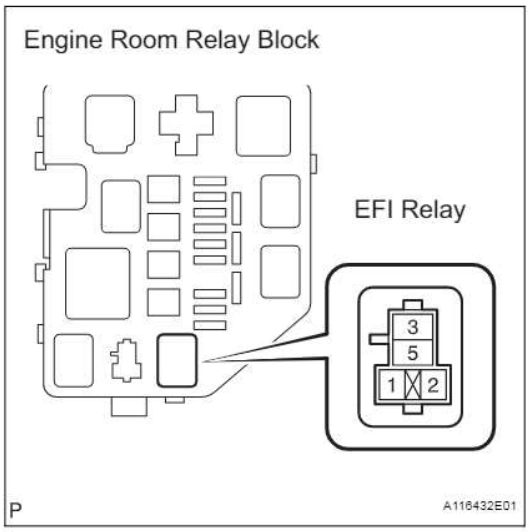
(a) Remove the EFI relay from the engine room relay block.
(b) Measure the resistance of the EFI fuse.
Standard resistance

Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (When battery voltage is applied to terminals 1 and 2)

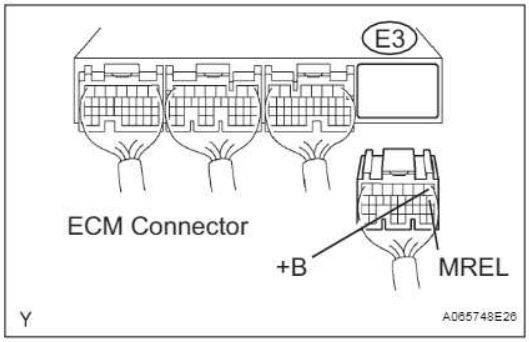
NG → **REPLACE EFI RELAY**

OK

9	CHECK HARNESS AND CONNECTOR (EFI RELAY - ECM, EFI RELAY - BODY GROUND)



(a) Check the harness and connector between the EFI relay and ECM.
(1) Remove the EFI relay from the engine room relay block.



(2) Disconnect the E3 ECM connector.
(3) Measure the resistance of the wire harness side connectors.

Standard resistance (Check for open)

Tester Connections	Specified Conditions
Engine room relay block (EFI relay terminal 2) - MREL (E3-8)	Below 1 Ω
Engine room relay block (EFI relay terminal 3) - +B (E3-1)	Below 1 Ω

Standard resistance (Check for short)

Tester Connections	Specified Conditions
Engine room relay block (EFI relay terminal 2) or MREL (E3-8) - Body ground	10 kΩ or higher
Engine room relay block (EFI relay terminal 3) or +B (E3-1) - Body ground	10 kΩ or higher

(b) Check the harness and connector between the EFI relay and body ground.
(1) Remove the EFI relay from the engine room relay block.
(2) Measure the resistance of the wire harness side connector.

Standard resistance (Check for open)

Tester Connection	Specified condition
Engine room relay block (EFI relay terminal 1) - Body ground	Below 1 Ω

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

CHECK AND REPLACE HARNESS OR CONNECTOR (TERMINAL 5 OF EFI RELAY - BATTERY POSITIVE TERMINAL)

CHECKING MONITOR STATUS

The purpose of the monitor result (mode 06) is to allow access to the results for on-board diagnostic monitoring tests of specific components/systems that are not continuously monitored. Examples are catalyst, evaporative emission (EVAP) and thermostat.

The monitor result allows the intelligent tester to display the monitor status, test value, minimum test value and maximum test limit. These data are displayed after the vehicle has been driven to run the monitor.

When the test value is not between the minimum test limit and maximum test limit, the ECM (PCM) interprets this as a malfunction. When the component is not malfunctioning, if the difference of the test value and test limit is very small, the component will malfunction in the near future. Perform the following instructions to view the monitor status. Although these instructions refer to the Lexus/Toyota diagnostic tester, it can be checked using a generic OBD II scan tool. Refer to your scan tool operator's manual for specific procedures.

1. PERFORM MONITOR DRIVE PATTERN

(a) Connect the intelligent tester to the DLC3.

(b) Turn the ignition switch and intelligent tester ON.

(c) Clear the DTCs (see page ES-37).

(d) Run the vehicle in accordance with the applicable drive pattern described in READINESS MONITOR DRIVE PATTERN (see page ES-23). DO NOT turn the ignition switch OFF.

NOTICE:

The test results will be lost if the ignition switch is turned OFF.

2. ACCESS MONITOR RESULT

(a) Select from the intelligent tester menus: DIAGNOSIS / ENHANCED OBD II / MONITOR INFO and MONITOR RESULT. The monitor status appears after the component name.

- INCMP: The component has not been monitored yet.
- PASS: The component is functioning normally.
- FAIL: The component is malfunctioning.

(b) Confirm that the component is either PASS or FAIL.

(c) Select the component and press ENTER. The accuracy test value appears if the monitor status is either PASS or FAIL.

3. CHECK COMPONENT STATUS

(a) Compare the test value with the minimum test limit (MIN) and maximum test limit (MAX).

(b) If the test value is between the minimum test limit and maximum test limit, the component is functioning normally. If not, the component is malfunctioning. The test value is usually significantly higher or lower than the test limits. If the test value is on the borderline of the test limits, the component will malfunction in the near future.
HINT:
The monitor result might on rare occasions be PASS even if the malfunction indicator lamp (MIL) is illuminated. This indicates the system malfunctioned on a previous driving cycle. This might be caused by an intermittent problem.

ES

4. MONITOR RESULT INFORMATION

If you use a generic scan tool, multiply the test value by the scaling value listed below.

(a) Front Heated Oxygen Sensor

Bank 1 Sensor 1

Monitor ID	Test ID	Scaling	Unit	Description of Test Value
$01	$03	Multiply by 0.001	V	Criteria of Lean sensor. O2S is Lean when voltage is lower than this value
$01	$04	Multiply by 0.001	V	Criteria of Rich sensor. O2S is Rich when voltage is higher than this value
$01	$05	Multiply by 0.001	Seconds	Rich - Lean switch time
$01	$06	Multiply by 0.001	Seconds	Lean - Rich switch time
$01	$07	Multiply by 0.005	V	Minimum sensor voltage
$01	$08	Multiply by 0.005	V	Maximum sensor voltage
$01	$81	Multiply by 0.001	Seconds	Duration while sensor voltage stuck Lean or Rich

(b) Rear Heated Oxygen Sensor

Bank 1 Sensor 2

MID	TID	Scaling	Unit	Description
$02	$05	Multiply by 0.001	Seconds	Rich - Lean switch time
$02	$06	Multiply by 0.001	Seconds	Lean - Rich switch time
$02	$07	Multiply by 0.001	V	Minimum sensor voltage
$02	$08	Multiply by 0.001	V	Maximum sensor voltage
$02	$8A	Multiply by 1	Time	Frequency of sensor switching
$02	$8B	Multiply by 0.001	Seconds	0.35 to 0.2 V sensor switch time
$02	$8D	Multiply by 0.001	Seconds	Duration that sensor voltage drops to 0.2 V during fuel cut

(c) Catalyst

Bank 1

MID	TID	Scaling	Unit	Description
$21	$A1	Multiply by 0.0003	No dimension	Locus length ratio of O2S sensor 1 and sensor 2
$21	$A2	Multiply by 0.0003	No dimension	Voltage area ratio of O2S sensor 1 and sensor 2

MID	TID	Scaling	Unit	Description
$21	$A3	Multiply by 0.0003	No dimension	Locus length ratio of O2S sensor 1 and sensor 2
$21	$A4	Multiply by 0.0003	No dimension	O2S frequency ratio of sensor 2 and sensor 1
$21	$A5	Multiply by 0.0003	No dimension	Locus length ratio of O2S sensor 1 and sensor 2
$21	$A6	Multiply by 0.0003	No dimension	Voltage area ratio of O2S sensor 1 and sensor 2

(d) EVAP (Key-off Type)

MID	TID	Scaling	Unit	Description
$3D	$C9	Multiply by 0.01	kPa	Test value for small leak (P0456)
$3D	$CA	Multiply by 0.01	kPa	Test value for gross leak (P0455)
$3D	$CB	Multiply by 0.01	kPa	Test value for leak detection pump stuck OFF (P2401)
$3D	$CD	Multiply by 0.01	kPa	Test value for leak detection pump stuck ON (P2402)
$3D	$CE	Multiply by 0.01	kPa	Test value for vent valve stuck OFF (P2420)
$3D	$CF	Multiply by 0.01	kPa	Test value for vent valve stuck ON (P2419)
$3D	$D0	Multiply by 0.01	kPa	Test value for reference orifice low flow (P043E)
$3D	$D1	Multiply by 0.01	kPa	Test value for reference orifice high flow (P043F)
$3D	$D4	Multiply by 0.01	kPa	Test value for purge VSV stuck closed (P0441)
$3D	$D5	Multiply by 0.01	kPa	Test value for purge VSV stuck open (P0441)
$3D	$D7	Multiply by 0.01	kPa	Test value for purge flow insufficient (P0441)

(e) Oxygen Sensor Heater

Bank 1 Sensor 1

MID	TID	Scaling	Unit	Description
$41	$90	Multiply by 0.001	A	Maximum sensor heater current

Bank 1 Sensor 2

MID	TID	Scaling	Unit	Description
$42	$90	Multiply by 0.001	A	Maximum sensor heater current

(f) Misfire - All Cylinders

MID	TID	Scaling	Unit	Description
$A1	$0B	Multiply by 1	Time	Exponential Weighted Moving Average (EWMA) misfire counts for last 10 driving cycles - Total
$A1	$0C	Multiply by 1	Time	Misfire counts for last driving cycle and current driving cycle - Total

(g) Misfire - Cylinder 1

MID	TID	Scaling	Unit	Description
$A2	$0B	Multiply by 1	Time	EWMA misfire counts for last 10 driving cycles - Total
$A2	$0C	Multiply by 1	Time	Misfire counts for last driving cycle and current driving cycle - Total

(h) Misfire - Cylinder 2

MID	TID	Scaling	Unit	Description
$A3	$0B	Multiply by 1	Time	EWMA misfire counts for last 10 driving cycles - Total
$A3	$0C	Multiply by 1	Time	Misfire counts for last driving cycle and current driving cycle - Total

(i) Misfire - Cylinder 3

MID	TID	Scaling	Unit	Description
$A4	$0B	Multiply by 1	Time	EWMA misfire counts for last 10 driving cycles - Total
$A4	$0C	Multiply by 1	Time	Misfire counts for last driving cycle and current driving cycle - Total

(j) Misfire - Cylinder 4

MID	TID	Scaling	Unit	Description
$A5	$0B	Multiply by 1	Time	EWMA misfire counts for last 10 driving cycles - Total
$A5	$0C	Multiply by 1	Time	Misfire counts for last driving cycle and current driving cycle - Total

(k) Thermostat

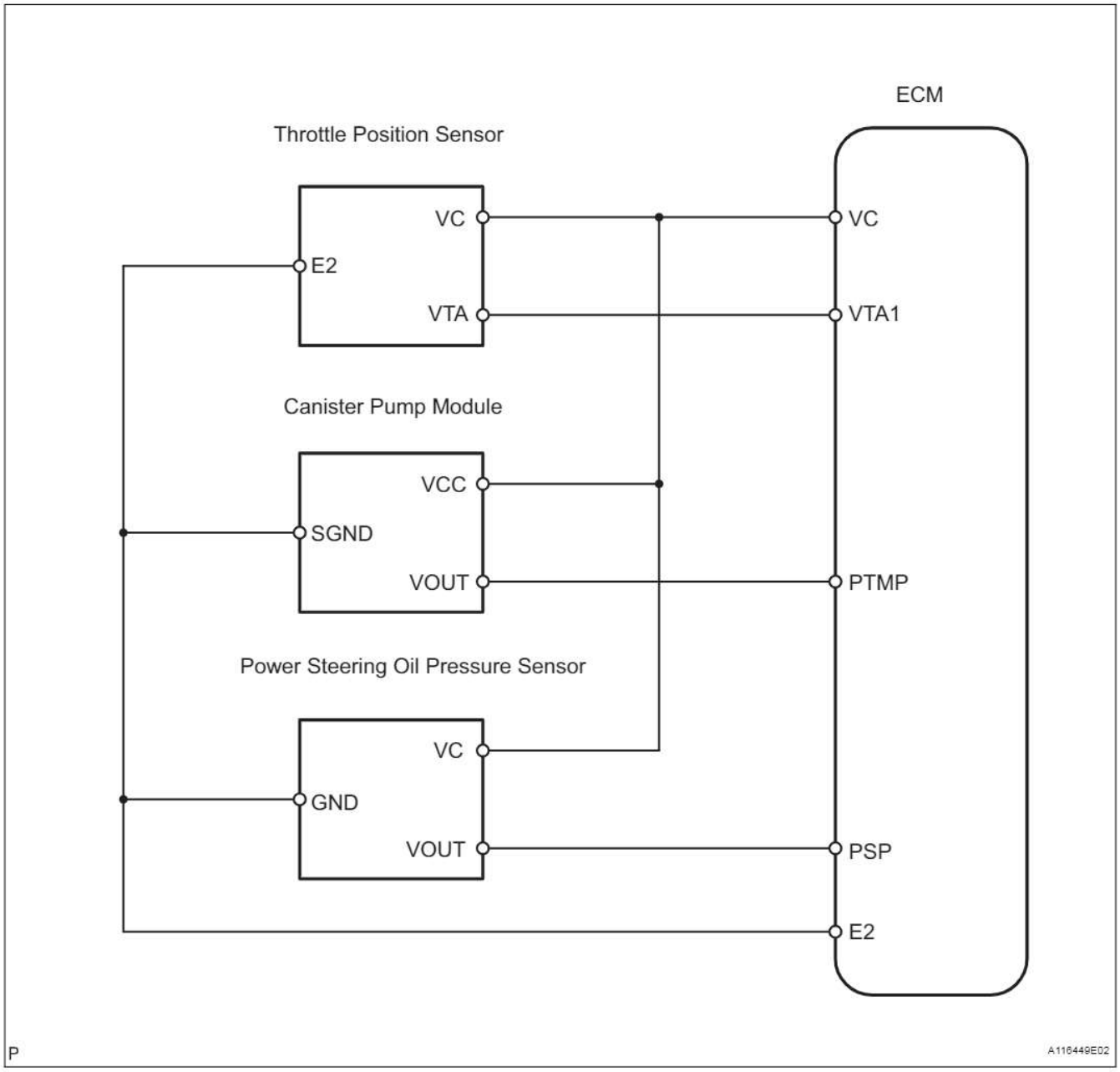
MID	TID	Scaling	Unit	Description
$E1	$E8	Multiply by 0.1	°C	ECT sensor output when estimated ECT reaches malfunction criteria

VC Output Circuit

DESCRIPTION

The VC voltage (5 V) is generated in the ECM. The voltage is used to supply power to the throttle position sensor, canister pump module, etc.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	CHECK MIL

(a) Check that the Malfunction Indicator Lamp (MIL) lights up when turning the ignition switch ON.

OK:
MIL lights up

OK → **SYSTEM OK**

NG

2	CHECK CONNECTION BETWEEN INTELLIGENT TESTER AND ECM

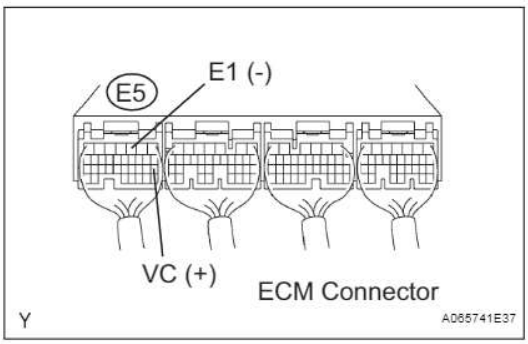
(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and intelligent tester ON.
(c) Check the communication between the intelligent tester and ECM.

Result	Proceed to
Communication is possible	A
Communication is not possible	B

A → **GO TO MIL CIRCUIT**

B

3	INSPECT ECM



(a) Turn the ignition switch ON.
(b) Measure the voltage between E5-18 (VC) and E5-3 (E1) of the ECM connectors.
Result:
Voltage is not 5 V

NEXT

4	CHECK MIL (THROTTLE POSITION SENSOR)

(a) Disconnect the T1 throttle position sensor connector.
(b) Turn the ignition switch ON.
(c) Check the MIL.
Result

Result	Proceed to
MIL illuminates	A
MIL does not illuminate	B

A → **REPLACE THROTTLE POSITION SENSOR**

B

5	CHECK MIL (POWER STEERING OIL PRESSURE SENSOR)

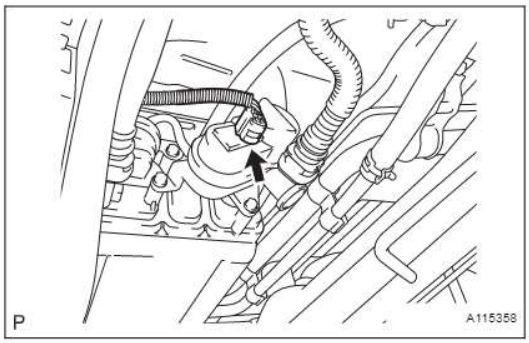
(a) Disconnect the P1 power steering oil pressure sensor connector.
(b) Turn the ignition switch ON.
(c) Check the MIL.
Result

Result	Proceed to
MIL illuminates	A
MIL does not illuminate	B

A → REPLACE POWER STEERING OIL PRESSURE SENSOR

B

6	CHECK MIL (CANISTER PUMP MODULE)



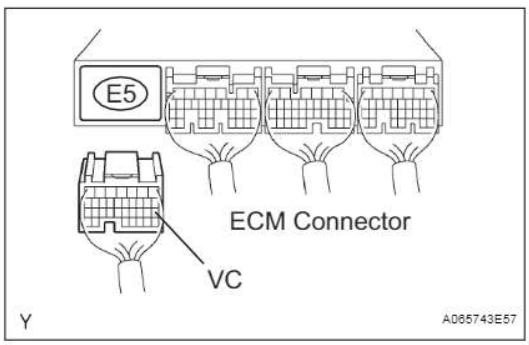
(a) Disconnect the C10 canister pump module connector.
(b) Turn the ignition switch ON.
(c) Check the MIL.
Result

Result	Proceed to
MIL illuminates	A
MIL does not illuminate	B

A → REPLACE CANISTER

B

7	CHECK HARNESS AND CONNECTOR



(a) Disconnect the T1 throttle position sensor connector.
(b) Disconnect the P1 power steering oil pressure sensor connector.
(c) Disconnect the C10 canister pump module connector.
(d) Disconnect the E5 ECM connector.
(e) Measure the resistance of the wire harness side connector.
Standard resistance (check for short)

Tester Connection	Specified Condition
VC (E5-18) - Body ground	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

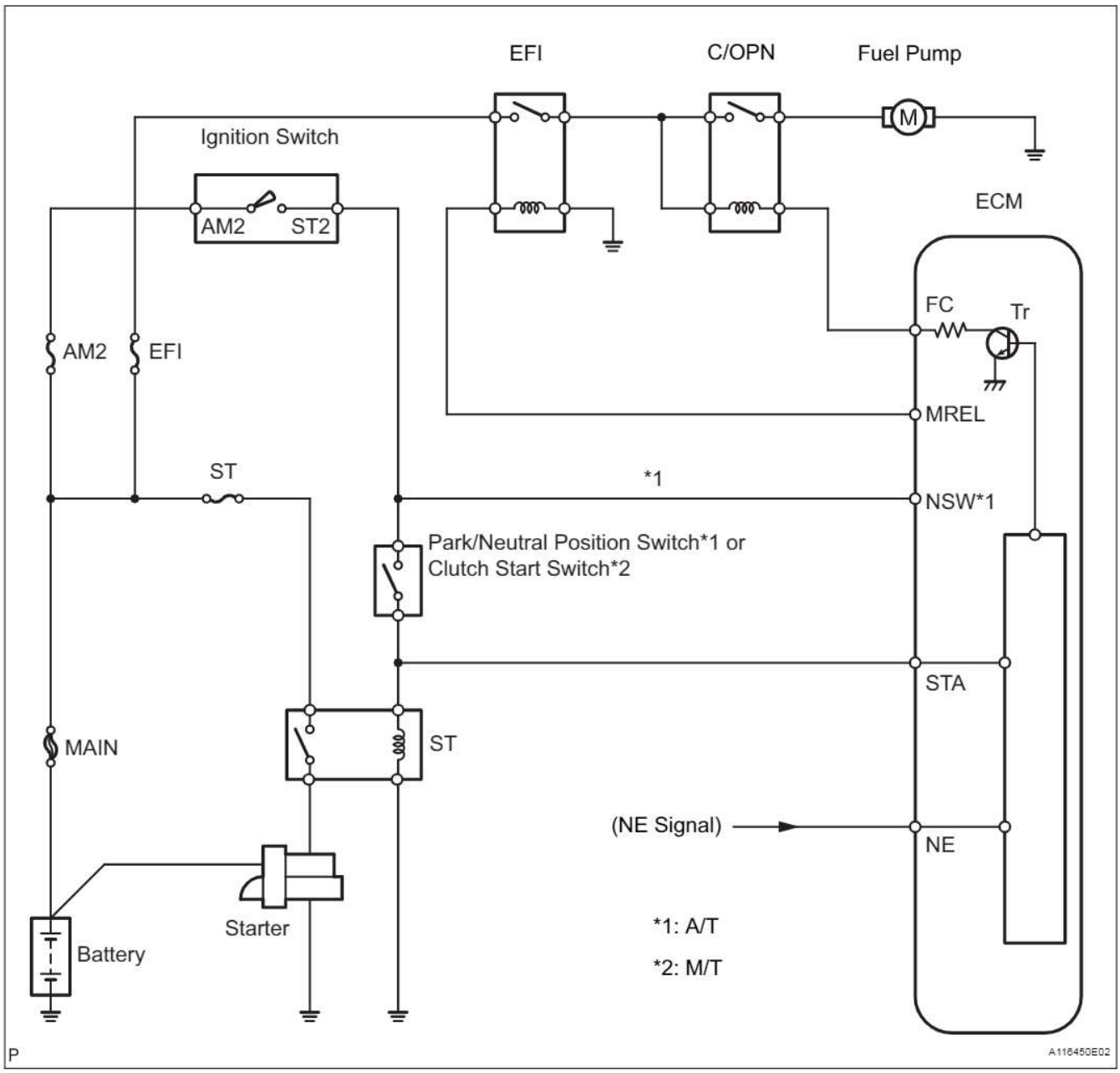
OK

REPLACE ECM

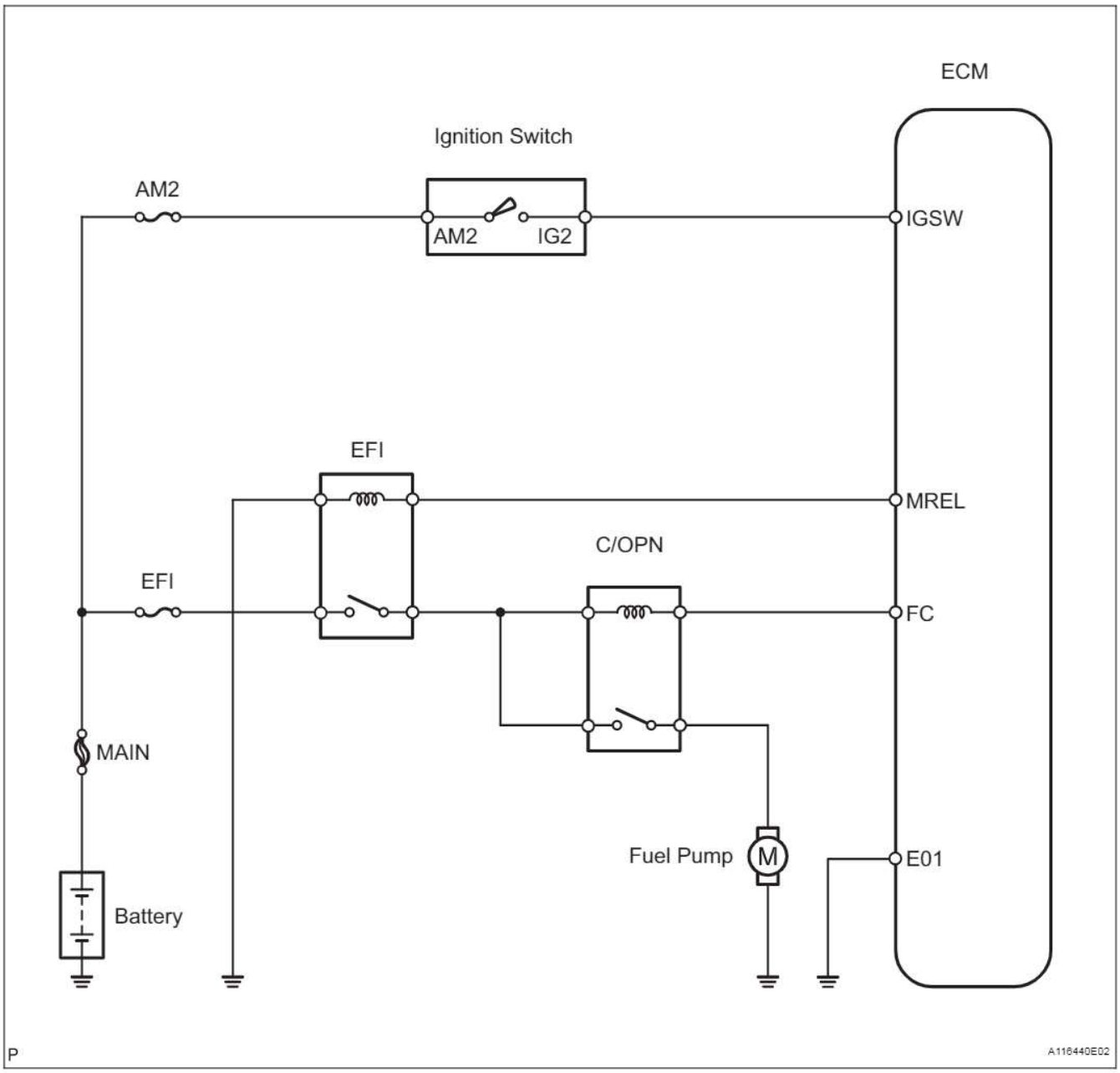
Fuel Pump Control Circuit

DESCRIPTION

When the engine is cranked, a current flows from terminal ST2 of the ignition switch into the starter relay (Marking: ST) coil and a current also flows into terminal STA of the ECM (STA signal).
When the STA and NE signals are received by the ECM, Tr (power transistor) is switched on, allowing a current to flow into the circuit opening relay (Marking: C/OPN) coil. The circuit opening relay switches on, power is supplied to the fuel pump and the fuel pump operates.
While the NE signal is being generated (engine running), the ECM keeps Tr ON, therefore keeping the circuit opening relay ON, so that the fuel pump continues to operate.



WIRING DIAGRAM



INSPECTION PROCEDURE

1	PERFORM ACTIVE TEST BY INTELLIGENT TESTER (OPERATION OF CIRCUIT OPENING RELAY)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / ACTIVE TEST / FUEL PUMP / SPD.
(d) Check whether operating sounds can be heard while operating the relay using the tester.

OK:

Operating sounds can be heard from relay.

OK → Go to step 7

NG

2 INSPECT ECM POWER SOURCE CIRCUIT

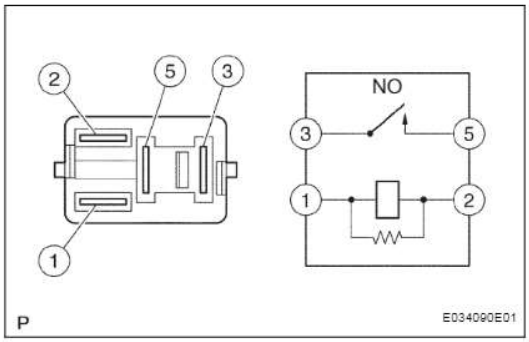
(a) Inspect the ECM power source circuit (see page ES-306).

NG → REPAIR OR REPLACE

OK

ES

3 INSPECT CIRCUIT OPENING RELAY (Marking: C/OPN)



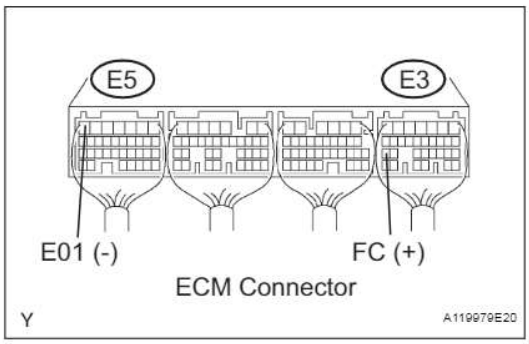
(a) Remove the circuit opening relay from the instrument panel junction block.
(b) Measure the resistance of the circuit opening relay.
Standard resistance

Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

NG → REPLACE CIRCUIT OPENING RELAY

OK

4 INSPECT ECM (FC VOLTAGE)



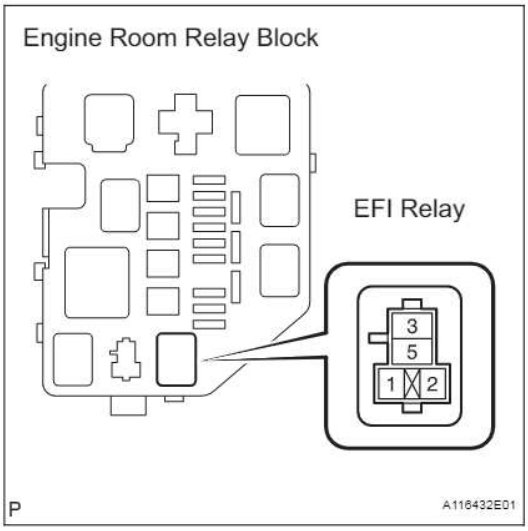
(a) Turn the ignition switch ON.
(b) Measure the voltage of the ECM connectors.
Standard voltage

Tester Connection	Specified Condition
FC (E3-25) - E01 (E5-7)	9 to 14 V

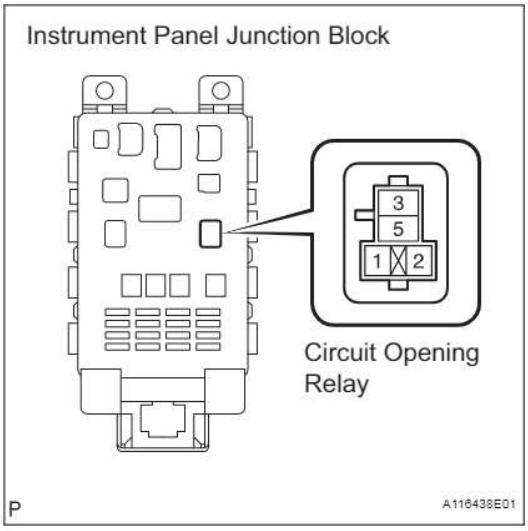
OK → REPLACE ECM

NG

5	CHECK HARNESS AND CONNECTOR (EFI RELAY (Marking: EFI) - CIRCUIT OPENING RELAY (Marking: C/OPN)



(a) Remove the EFI relay from the engine room relay block.



(b) Remove the circuit opening relay from the instrument panel junction block.

(c) Measure the resistance of the wire harness side connectors.

Standard resistance (Check for open)

Tester Connection	Specified Condition
Engine room relay block (EFI relay terminal 3) - Instrument panel junction block (Circuit opening relay terminal 1)	Below 1 Ω
Engine room relay block (EFI relay terminal 3) - Instrument panel junction block (Circuit opening relay terminal 5)	Below 1 Ω

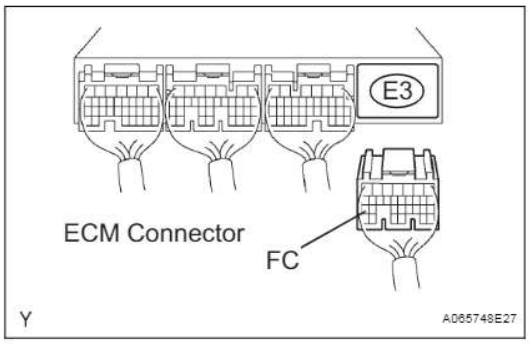
Standard resistance (Check for short)

Tester Connection	Specified Condition
Engine room relay block (EFI relay terminal 3) or Circuit opening relay (1) - Body ground	10 kΩ or higher
Instrument panel junction block (Circuit opening relay terminal 5) - Body ground	10 kΩ or higher

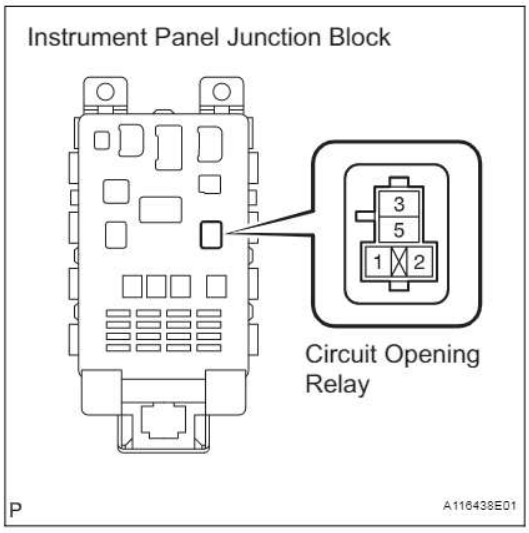
NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

6	CHECK HARNESS AND CONNECTOR (ECM - CIRCUIT OPENING RELAY)



(a) Disconnect the E3 ECM connector.



(b) Remove the circuit opening relay from the instrument panel junction block.

(c) Measure the resistance of the wire harness side connectors.

Standard resistance (Check for open)

Tester Connection	Specified Condition
FC (E3-25) - Instrument panel junction block (Circuit opening relay terminal 2)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
FC (E3-25) or Instrument panel junction block (Circuit opening relay terminal 2) - Body ground	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE ECM

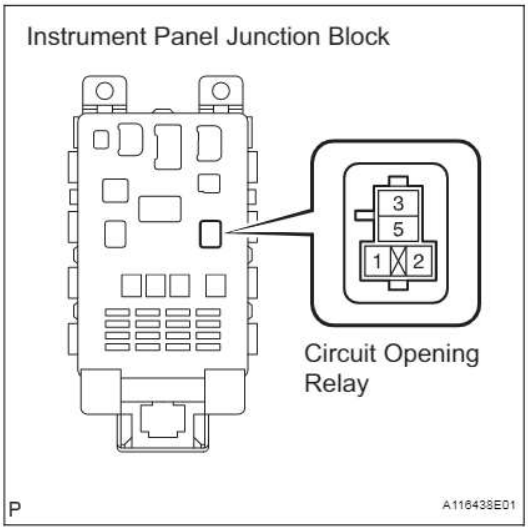
7	INSPECT FUEL PUMP

(a) Inspect the fuel pump (see page FU-21).

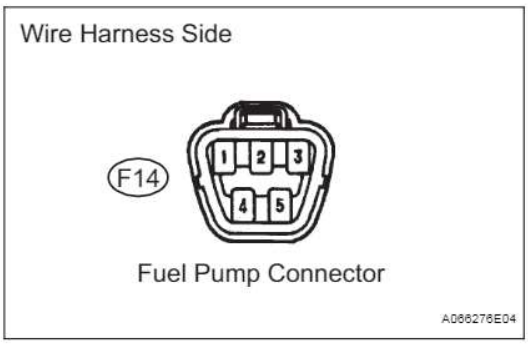
NG → REPLACE FUEL PUMP

OK

8	CHECK HARNESS AND CONNECTOR (CIRCUIT OPENING RELAY (Marking: C/OPN) - FUEL PUMP, FUEL PUMP - BODY GROUND)



(a) Remove the circuit opening relay from the instrument panel junction block.
(b) Disconnect the F14 fuel pump connector.



(c) Measure the resistance of the wire harness side connectors.

Standard resistance (Check for open)

Tester Connection	Specified Condition
Instrument panel junction block (Circuit opening relay terminal 3) - Fuel pump (F14-4)	Below 1 Ω
Fuel pump (F14-5) - Body ground	Below 1 Ω

Standard resistance Check for short)

Tester Connection	Specified Condition
Instrument panel junction block (Circuit opening relay terminal 3) or Fuel pump (F14-4) - Body ground	10 kΩ or higher

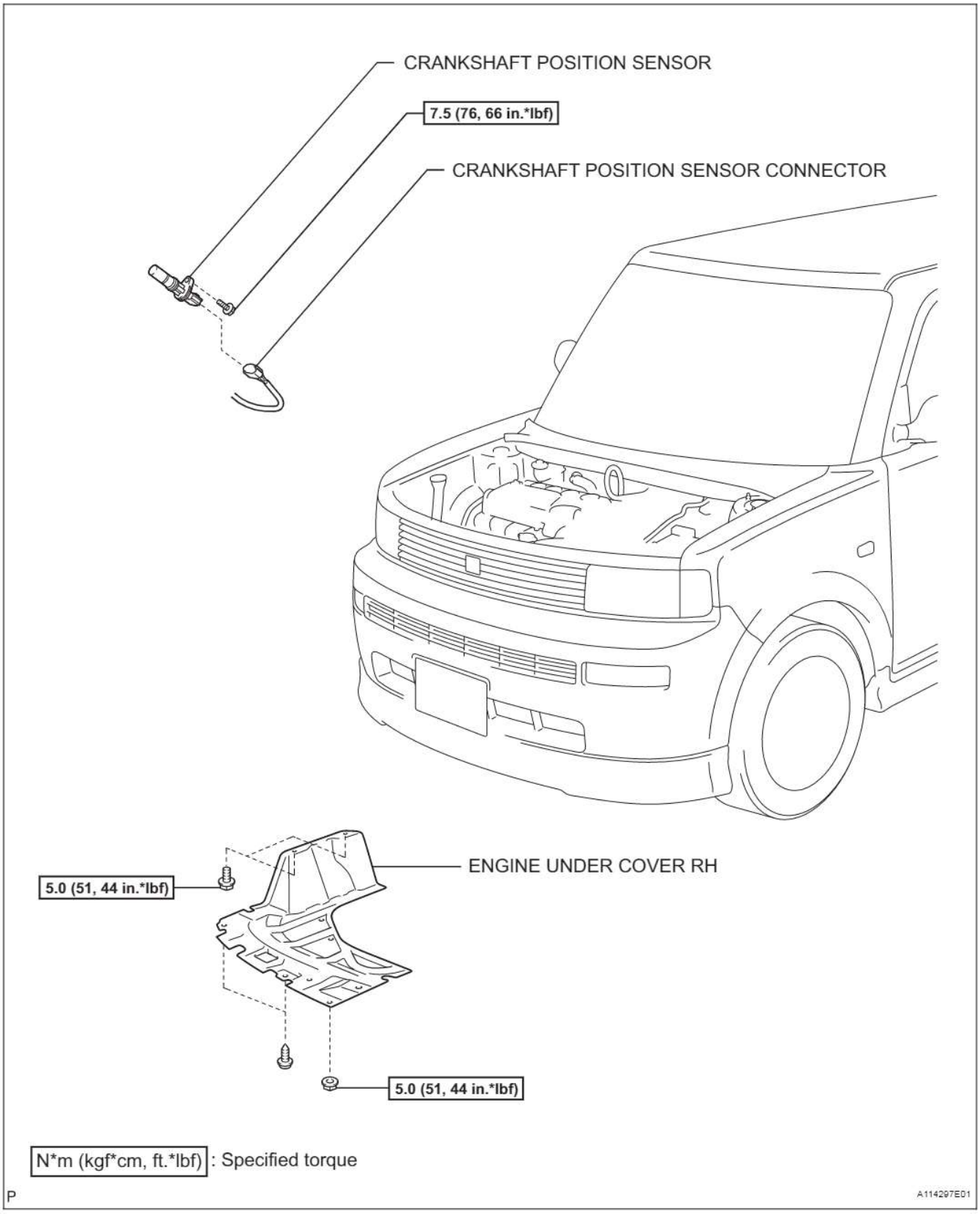
NG → **REPAIR OR REPLACE HARNESS OR CONNECTOR**

OK

REPLACE ECM

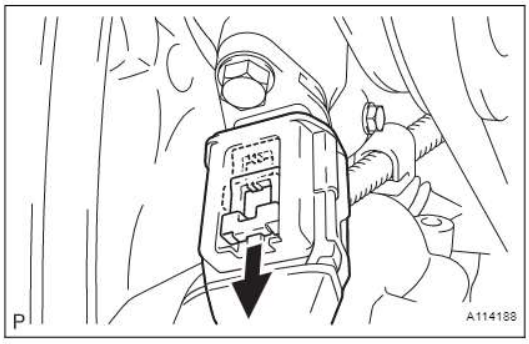
CRANKSHAFT POSITION SENSOR

COMPONENTS

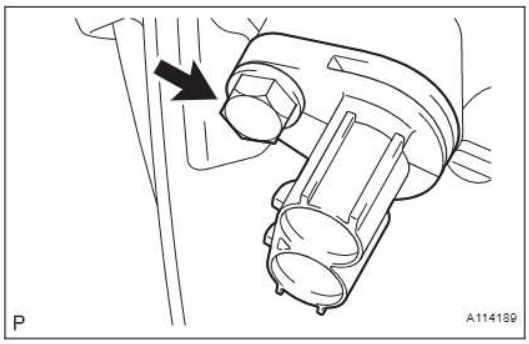


REMOVAL

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
2. **REMOVE ENGINE UNDER COVER RH**
3. **REMOVE CRANKSHAFT POSITION SENSOR**
   (a) Disconnect the sensor connector.

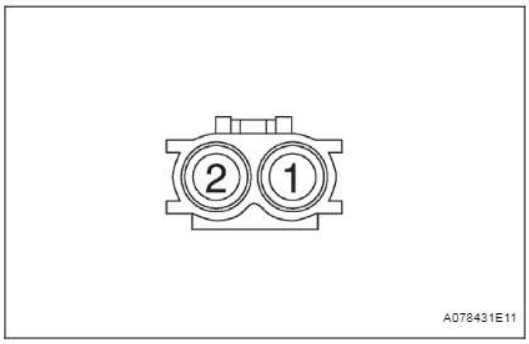


   (b) Remove the bolt and sensor.



INSPECTION

1. **INSPECT CRANKSHAFT POSITION SENSOR**
   (a) Measure the resistance of the sensor.
   Standard resistance



Tester Connection	Condition	Specified Condition
1 - 2	Cold	985 to 1.600 Ω
1 - 2	Hot	1.265 to 1.890 Ω

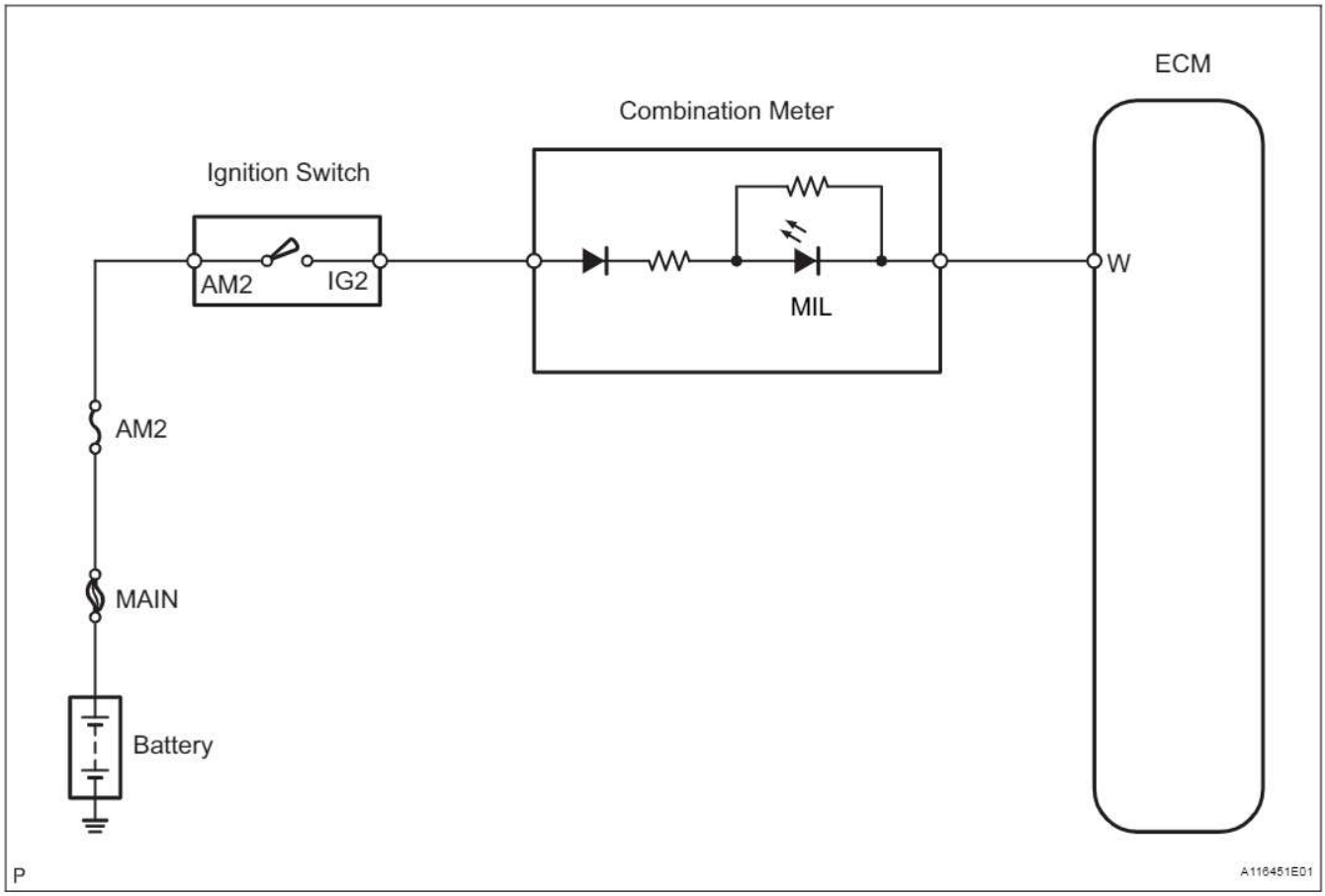
If the result is not as specified, replace the crankshaft position sensor.
NOTICE:
The terms cold and hot refer to the temperature of the sensors. Cold means approximately -10 to 50°C (14 to 122°F). Hot means approximately 50 to 100°C (122 to 212°F).

MIL Circuit

DESCRIPTION

The MIL (Malfunction Indicator Lamp) is used to indicate vehicle malfunction detections by the ECM.
By turning the ignition switch ON, power is supplied to the MIL circuit, and the ECM provides the circuit ground which illuminates the MIL.
The MIL operation can be checked visually: When the ignition switch is first turned ON, the MIL should be illuminated and should then turn OFF. If the MIL remains illuminated or is not illuminated, conduct the following troubleshooting procedure using the intelligent tester.

WIRING DIAGRAM



INSPECTION PROCEDURE

1	CHECK THAT MIL IS ILLUMINATED

(a) Perform troubleshooting in accordance with the chart below.
Result

Condition	Proceed to
MIL remains ON	A
MIL does not illuminate	B

B	Go to step 5

A

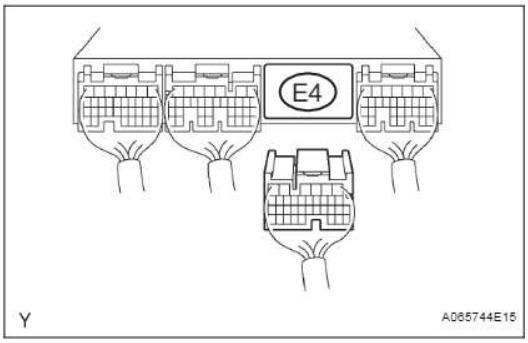
2	CHECK WHETHER MIL TURNS OFF

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Check whether any DTCs have been stored (see page ES-48). Write them down if necessary.
(d) Clear DTCs (see page ES-37).
(e) Check if the MIL turns off.
OK:
MIL should turn off.

OK → **REPAIR CIRCUIT INDICATED BY OUTPUT DTC**

NG

3	CHECK HARNESS AND CONNECTOR (CHECK FOR SHORT IN WIRE HARNESS)



(a) Disconnect the E4 ECM connector.
(b) Turn the ignition switch ON.
(c) Check that the MIL is not illuminated.
OK:
MIL is not illuminated.

OK → **REPLACE ECM**

NG

4	CHECK HARNESS AND CONNECTOR (COMBINATION METER - ECM)

(a) Check the harness and connector (see page IN-29).

OK → **REPAIR OR REPLACE COMBINATION METER**

NG

REPAIR OR REPLACE HARNESS OR CONNECTOR

5	CHECK THAT MIL IS ILLUMINATED

(a) Check if the MIL is illuminated when the ignition switch is turned ON.
Standard:
MIL should be illuminated.

OK → SYSTEM OK

NG

6 CHECK THAT ENGINE STARTS

(a) Turn the ignition switch ON.
(b) Start the engine.

Result

Condition	Proceed to
Engine starts	A
Engine does not start*	B

ES

HINT:
*: The intelligent tester cannot communicate with the ECM.

B → GO TO VC OUTPUT CIRCUIT

A

7 INSPECT COMBINATION METER ASSEMBLY (MIL CIRCUIT)

(a) See the combination meter troubleshooting procedure (see page ME-6).

NG → REPAIR OR REPLACE COMBINATION METER

OK

CHECK AND REPLACE HARNESS OR CONNECTOR (COMBINATION METER - ECM)

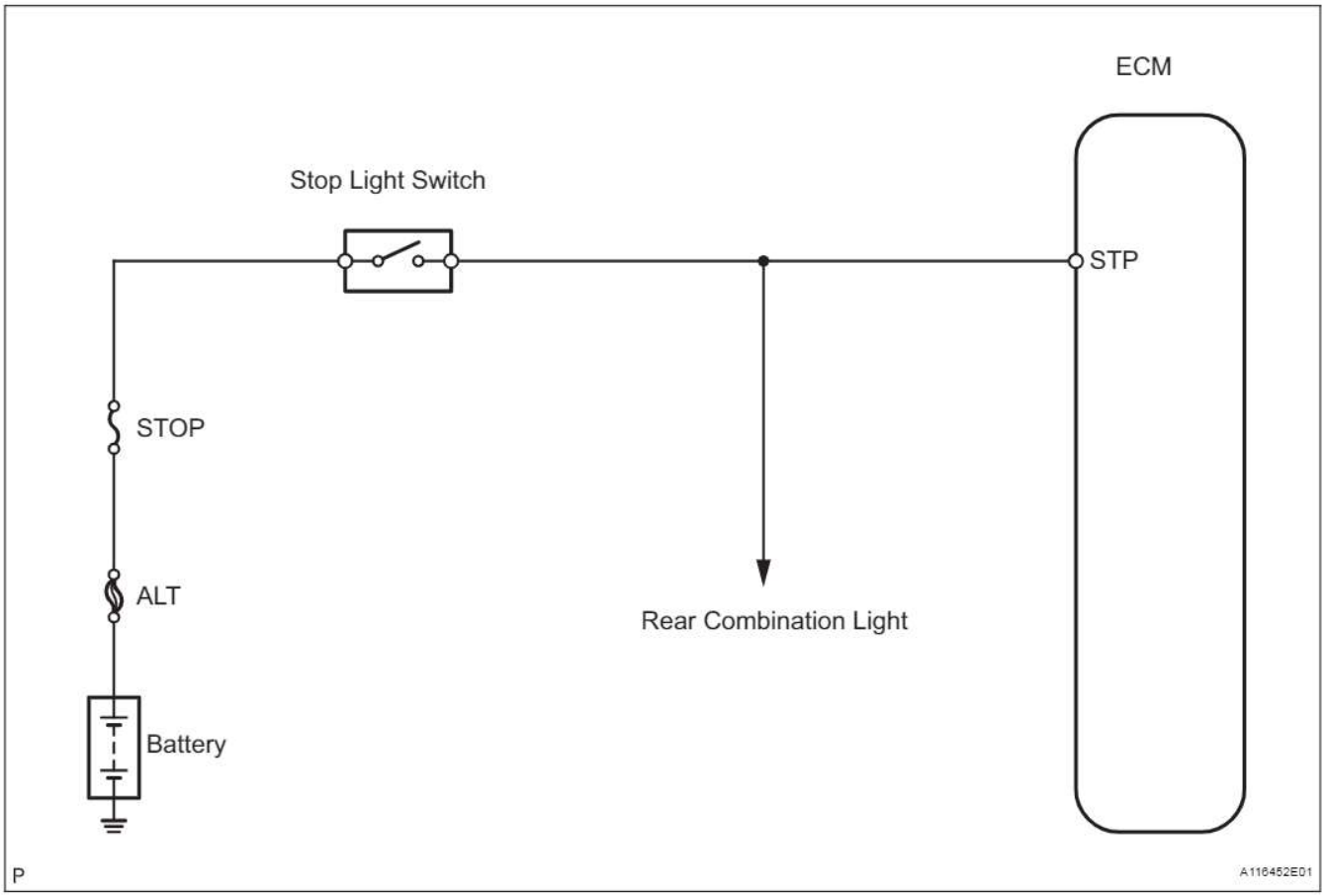
Stop Light Switch Circuit

DESCRIPTION

When the brake pedal is depressed, the stop light switch turns on and transmits an STP signal to the ECM. Upon receipt of the STP signal, the ECM determines that the brakes have been applied. The signal voltage level is the same as that of the voltage which is applied to the stop lights. In addition, the STP signal is used to control the fuel cut-off engine speed. Therefore, the fuel cut-off engine speed is slightly reduced when the vehicle is braking.

WIRING DIAGRAM

ES



INSPECTION PROCEDURE

1	CHECK OPERATION OF STOP LIGHT

(a) Check whether the stop lights turn on and off normally when the brake pedal is depressed and released.
OK:
Stop lights turn ON when brake pedal is depressed.

NG → **REPAIR OR REPLACE STOP LIGHT SWITCH CIRCUIT**

OK

2 READ VALUE OF INTELLIGENT TESTER (STP SIGNAL)

(a) Connect the intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) On the tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / STOP LIGHT SW.
(d) Read the value displayed on the tester.
Standard

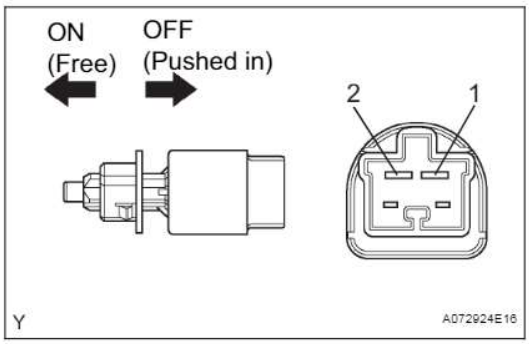
Brake Pedal Operation	Specified Condition
Depressed	STP Signal ON
Released	STP Signal OFF

ES

OK → CHECK FOR INTERMITTENT PROBLEMS

NG

3 INSPECT STOP LIGHT SWITCH ASSEMBLY



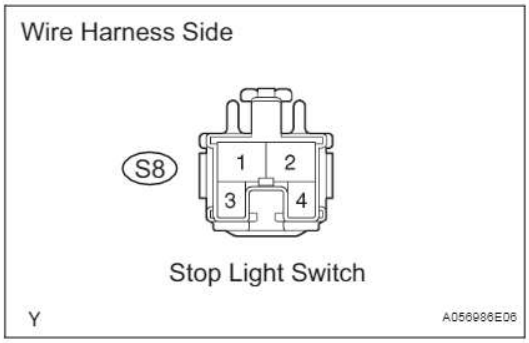
(a) Check the resistance when the stop light switch is ON and OFF.
Standard resistance

Switch Position	Tester Connection	Specified Condition
ON (Free)	1 - 2	Below 1 Ω
OFF (Pushed in)	1 - 2	10 kΩ or higher

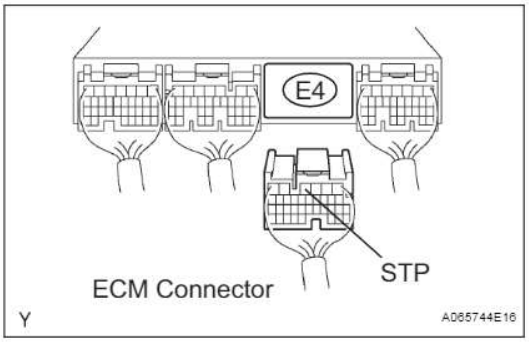
NG → REPLACE STOP LIGHT SWITCH ASSEMBLY

OK

4 CHECK HARNESS AND CONNECTOR (STOP LIGHT SWITCH - ECM)



(a) Disconnect the S8 stop light switch connector.



(b) Disconnect the E4 ECM connector.
(c) Measure the resistance of the wire harness side connector.

Standard resistance (Check for open)

Tester Connection	Specified Condition
S8-1 - STP (E4-4)	Below 1 Ω

Standard resistance (Check for short)

Tester Connection	Specified Condition
S8-1 or STP (E4-4) - Body ground	10 kΩ or higher

NG → REPAIR OR REPLACE HARNESS OR CONNECTOR

ES

OK

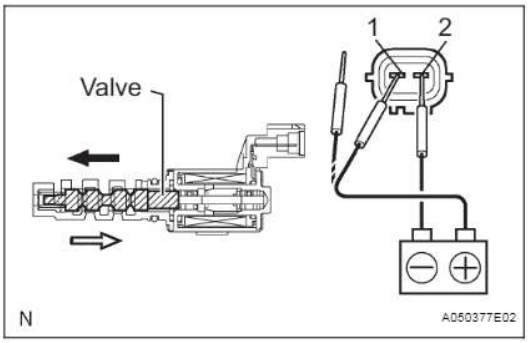
REPLACE ECM

ES

INSPECTION

1. INSPECT CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

(a) Measure the resistance of the oil control valve.
Standard resistance:
6.9 to 7.9 Ω at 20°C (68°F)
If the result is not as specified, replace the camshaft timing oil control valve assembly.



(b) Inspect the operation.
(1) Connect the battery positive (+) lead to terminal 1 and negative (-) lead to terminal 2, and inspect the movement of the valve.
Specified condition

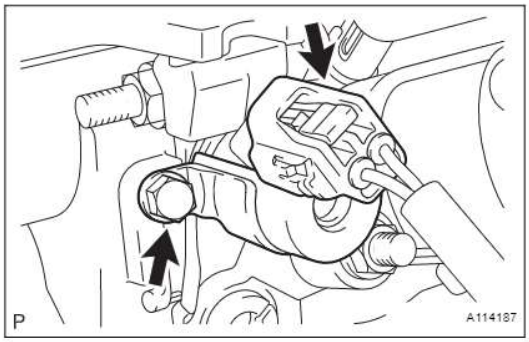
Condition	Specified Condition
Battery positive (+) voltage is applied	Valve moves in left arrow direction shown in illustration
Battery positive (+) voltage is cut off	Valve moves in right arrow direction shown in illustration

If the result is not as specified, replace the camshaft timing oil control valve assembly.
NOTICE:
Confirm that the valve moves freely and is not stuck in any position.
HINT:
Foreign objects in the oil can cause subtle pressure leaks in the valve. The pressure leaks will cause the cam to advance. This condition will usually set a DTC.

INSTALLATION

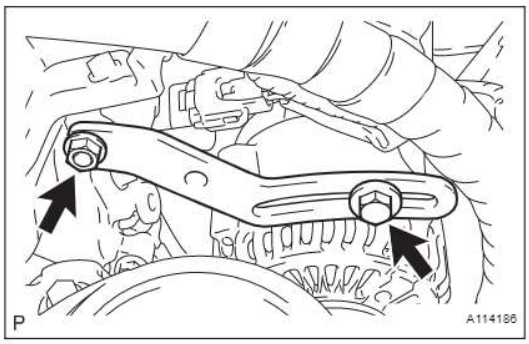
1. INSTALL CAMSHAFT TIMING OIL CONTROL VALVE ASSEMBLY

(a) Apply a light coat of engine oil to a new O-ring.
(b) Install the O-ring to the oil control valve.
(c) Install the oil control valve with the bolt.
Torque: 7.5 N*m (76 kgf*cm, 66 in.*lbf)
(d) Connect the oil control valve connector.



2. INSTALL FAN BELT ADJUSTING BAR

(a) Temporarily install the adjusting bar with the bolt and nut.
(b) Adjust the drive belt tension (see page EM-7).

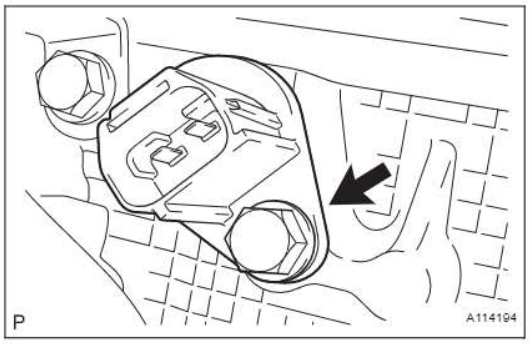


3. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

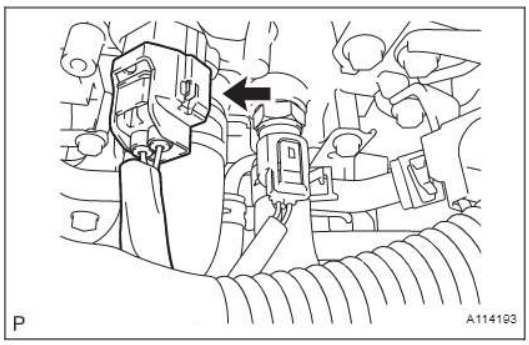
ES

NOTICE:
The terms cold and hot refer to the temperature of the sensors. Cold means approximately -10 to 50°C (14 to 122°F). Hot means approximately 50 to 100°C (122 to 212°F).

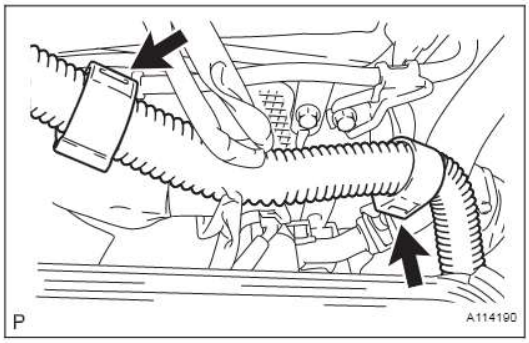
INSTALLATION



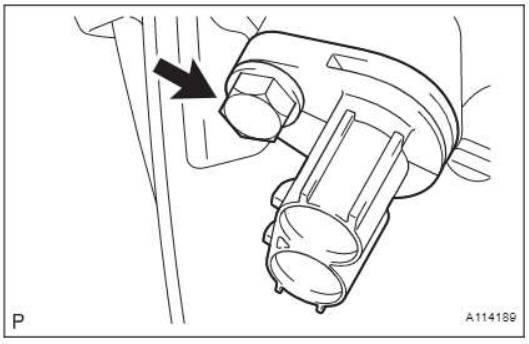
1. **INSTALL CAMSHAFT POSITION SENSOR**
   (a) Install the sensor with the bolt.
   Torque: 8.0 N*m (82 kgf*cm, 71 in.*lbf)



   (b) Connect the sensor connector.



2. **CONNECT ENGINE WIRE**
   (a) Connect the 2 clamps of the engine wire.
3. **INSTALL AIR CLEANER ASSEMBLY (See page ES-349)**
4. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**



INSTALLATION

1. **INSTALL CRANKSHAFT POSITION SENSOR**
   (a) Install the sensor with the bolt.
   Torque: 7.5 N*m (76 kgf*cm, 66 in.*lbf)
   (b) Connect the sensor connector.
2. **INSTALL ENGINE UNDER COVER RH**
3. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

ES

INSPECTION

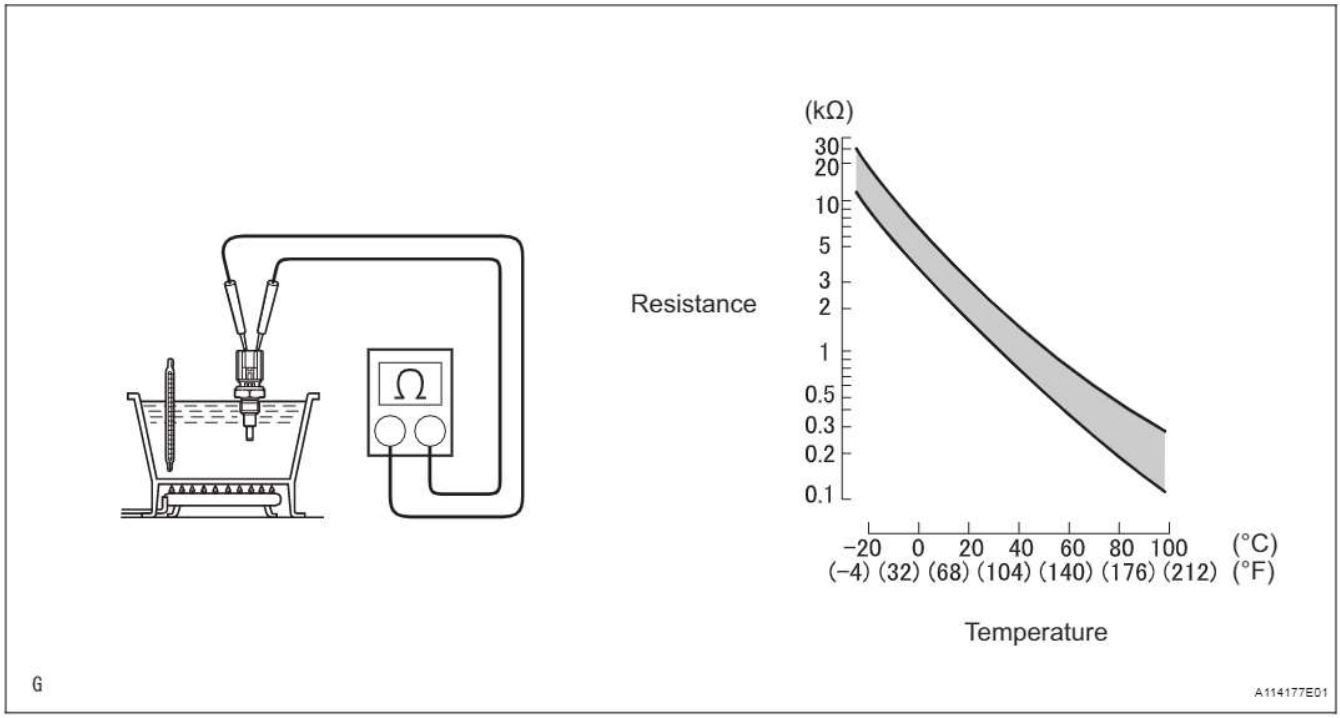
1. INSPECT ENGINE COOLANT TEMPERATURE SENSOR

(a) Measure the resistance of the sensor.

Standard resistance

Tester Connection	Condition	Specified Condition
1 - 2	20°C (68°F)	2.29 to 2.60 kΩ
1 - 2	80°C (176°F)	0.301 to 0.327 kΩ

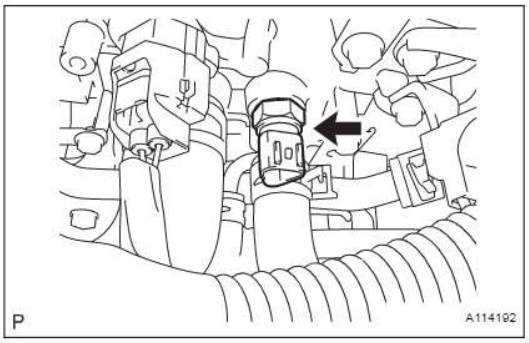
NOTICE:
If checking the engine coolant temperature sensor in water, be careful not to allow water to intrude the terminals. After checking, dry the sensor.

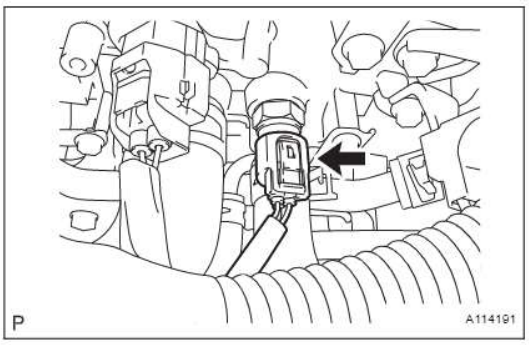


If the result is not as specified, replace the engine coolant temperature sensor.

INSTALLATION

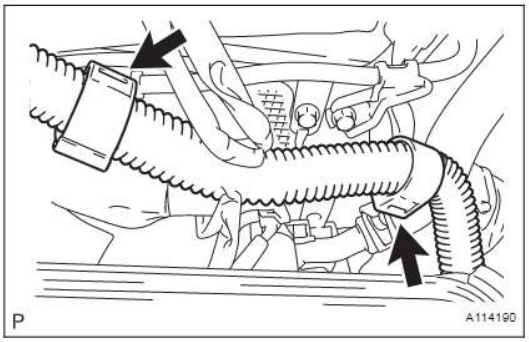
1. **INSTALL ENGINE COOLANT TEMPERATURE SENSOR**
   (a) Install a new gasket to the sensor.
   (b) Install the sensor.
   Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)





   (c) Connect the sensor connector.

2. **CONNECT ENGINE WIRE**
   (a) Connect the 2 clamps of the engine wire.



3. **INSTALL AIR CLEANER ASSEMBLY (See page ES-349)**

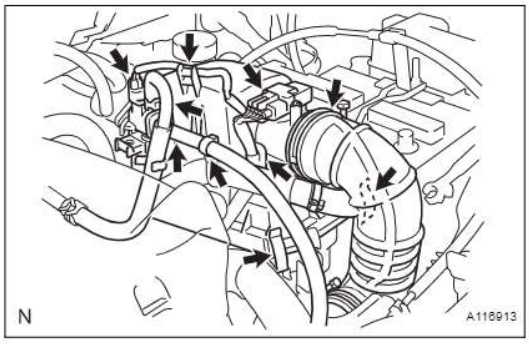
4. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

REMOVAL

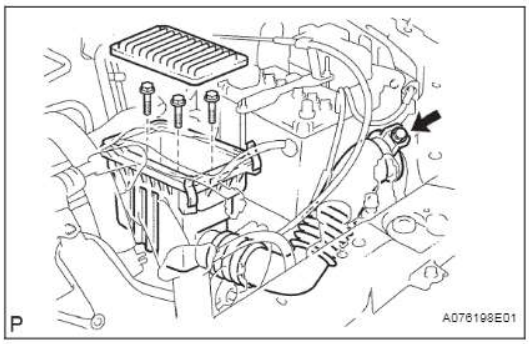
1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.

2. **DRAIN ENGINE COOLANT (See page CO-5)**

3. **REMOVE AIR CLEANER ASSEMBLY**

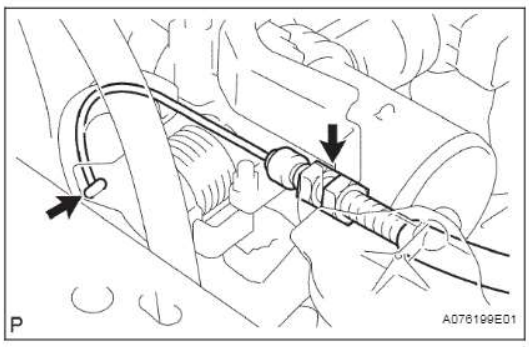


(a) Disconnect the MAF meter connector.
(b) Disconnect the purge VSV connector.
(c) Detach the wire harness clamp.
(d) Disconnect the No. 2 purge line hose.
(e) Disconnect the ventilation hose.
(f) Disconnect the No. 1 purge line hose.
(g) Unlock the 2 clamp hooks.
(h) Loosen the hose clamp and remove the air cleaner case.



(i) Remove the air cleaner filter element.
(j) Remove the 4 bolts and air cleaner case.

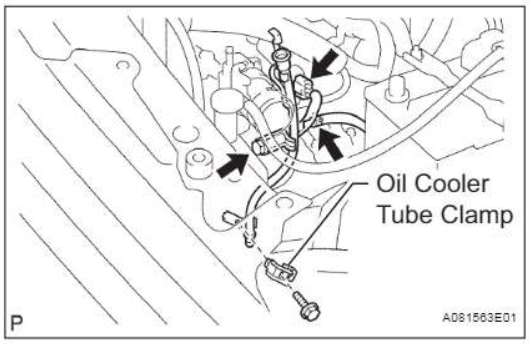
4. **REMOVE ACCELERATOR CONTROL CABLE**



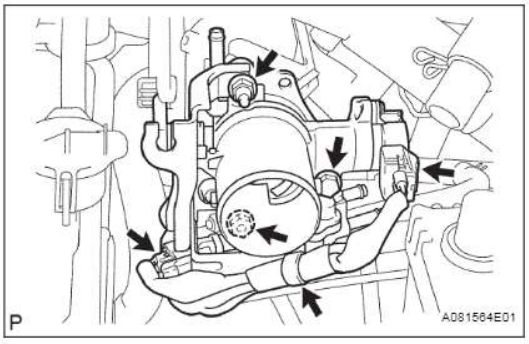
(a) Loosen the nut and disconnect the accelerator control cable.

5. **REMOVE TRANSMISSION OIL FILLER TUBE SUB-ASSEMBLY (for Automatic Transaxle)**

(a) Remove the oil dipstick.

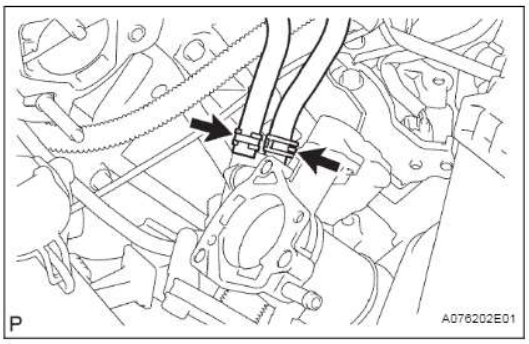


(b) Disconnect the throttle position sensor connector.
(c) Disconnect the hose.
(d) Remove the bolt and oil cooler tube clamp.
(e) Remove the bolt and transmission oil filler tube.
(f) Remove the O-ring from the transmission oil filler tube.

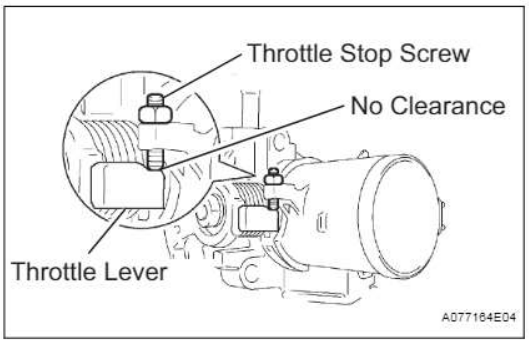


6. REMOVE THROTTLE BODY ASSEMBLY

(a) Disconnect the IAC valve connector.
(b) Disconnect the throttle position sensor connector (for manual transaxle).
(c) Remove the wire harness clamp.
(d) Remove the bolt and 2 nuts, then remove the accelerator control cable bracket and throttle body.
(e) Remove the gasket from the intake manifold.



(f) Disconnect the No. 1 water by-pass hose.
(g) Disconnect the No. 2 water by-pass hose.



INSPECTION

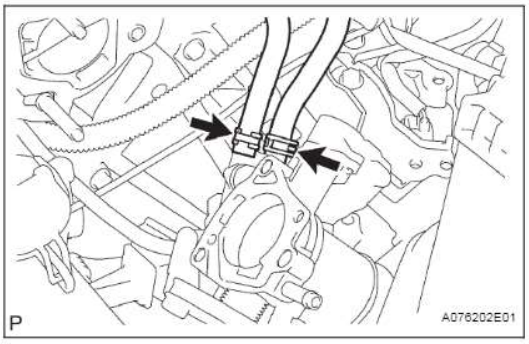
1. INSPECT THROTTLE BODY ASSEMBLY

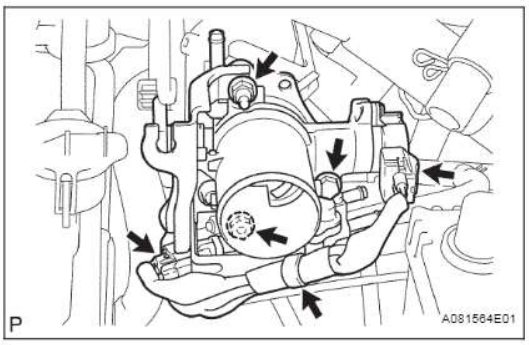
(a) Inspect that the throttle valve shaft is not rickety.
(b) Inspect that all ports are not clogged.
(c) Inspect that the throttle valve opens and closes smoothly.
(d) Inspect that there is no clearance between the throttle stop screw and throttle lever at throttle valve closed position.
NOTICE:
Do not touch the throttle stop screw.

INSTALLATION

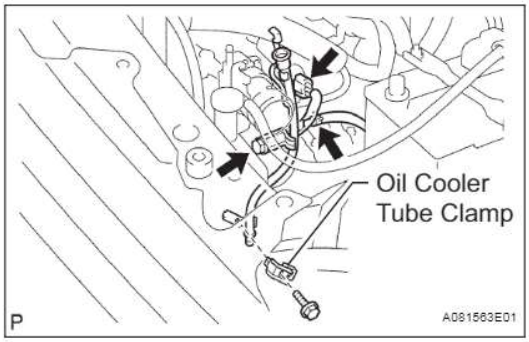
1. INSTALL THROTTLE BODY ASSEMBLY

(a) Connect the No. 1 water by-pass hose.
(b) Connect the No. 2 water by-pass hose.
(c) Install a new gasket into the intake manifold.

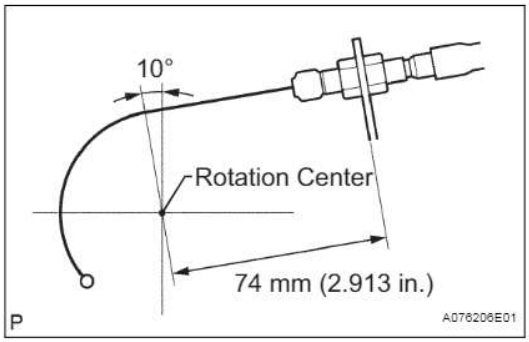




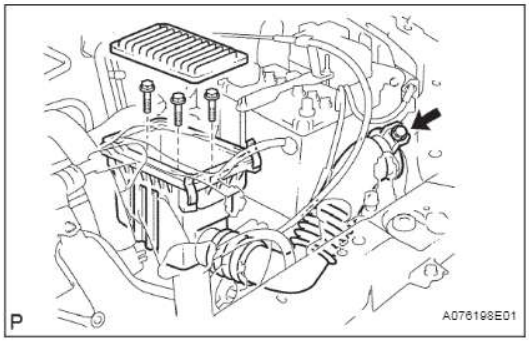
(d) Install the throttle body and accelerator control bracket with the bolt and 2 nuts.
Torque: 30 N*m (306 kgf*cm, 22 ft.*lbf)
(e) Install the wire harness clamp.
(f) Connect the throttle position sensor connector (for manual transaxle).
(g) Connect the IAC valve connector.



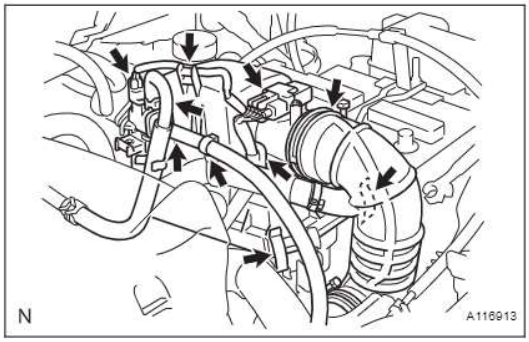
2. **INSTALL TRANSMISSION OIL FILLER TUBE SUB-ASSEMBLY (for Automatic Transaxle)**
   (a) Install a new O-ring onto the transmission oil filler tube.
   (b) Install the transmission oil filler tube with the bolt.
   Torque: 5.5 N*m (56 kgf*cm, 49 in.*lbf)
   (c) Install the oil cooler tube clamp with the bolt.
   Torque: 5.5 N*m (56 kgf*cm, 49 in.*lbf)
   (d) Connect the hose.
   (e) Connect the throttle position sensor connector.
   (f) Install the oil dipstick.



3. **INSTALL ACCELERATOR CONTROL CABLE ASSEMBLY**
   (a) Install the accelerator control cable as shown in the illustration.
   Torque: 13 N*m (133 kgf*cm, 10 ft.*lbf)



4. **INSTALL AIR CLEANER ASSEMBLY**
   (a) Install the air cleaner case to the air cleaner bracket with the 3 bolts.
   Torque: 7.8 N*m (80 kgf*cm, 69 in.*lbf)
   (b) Connect the air cleaner inlet to the engine compartment with the bolt.
   Torque: 7.5 N*m (76 kgf*cm, 66 in.*lbf)



   (c) Tighten the hose clamp.
   (d) Connect the MAF meter connector.
   (e) Connect the purge VSV connector.
   (f) Attach the wire harness clamp.
   (g) Connect the No. 2 purge line hose.
   (h) Connect the ventilation hose.
   (i) Connect the No. 1 purge line hose.
   (j) Lock the 2 clamp hooks.

5. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

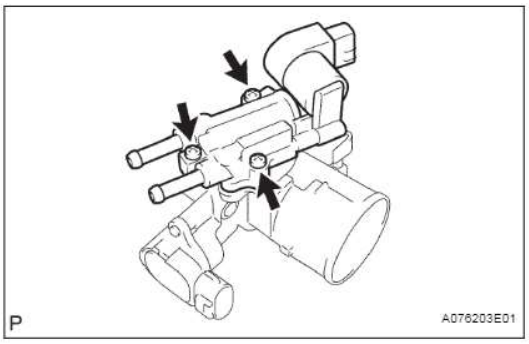
6. **ADD ENGINE COOLANT (See page CO-5)**

7. **CHECK FOR ENGINE COOLANT LEAKS**
   (a) Check for engine coolant leaks (see page CO-1).

ES

REMOVAL

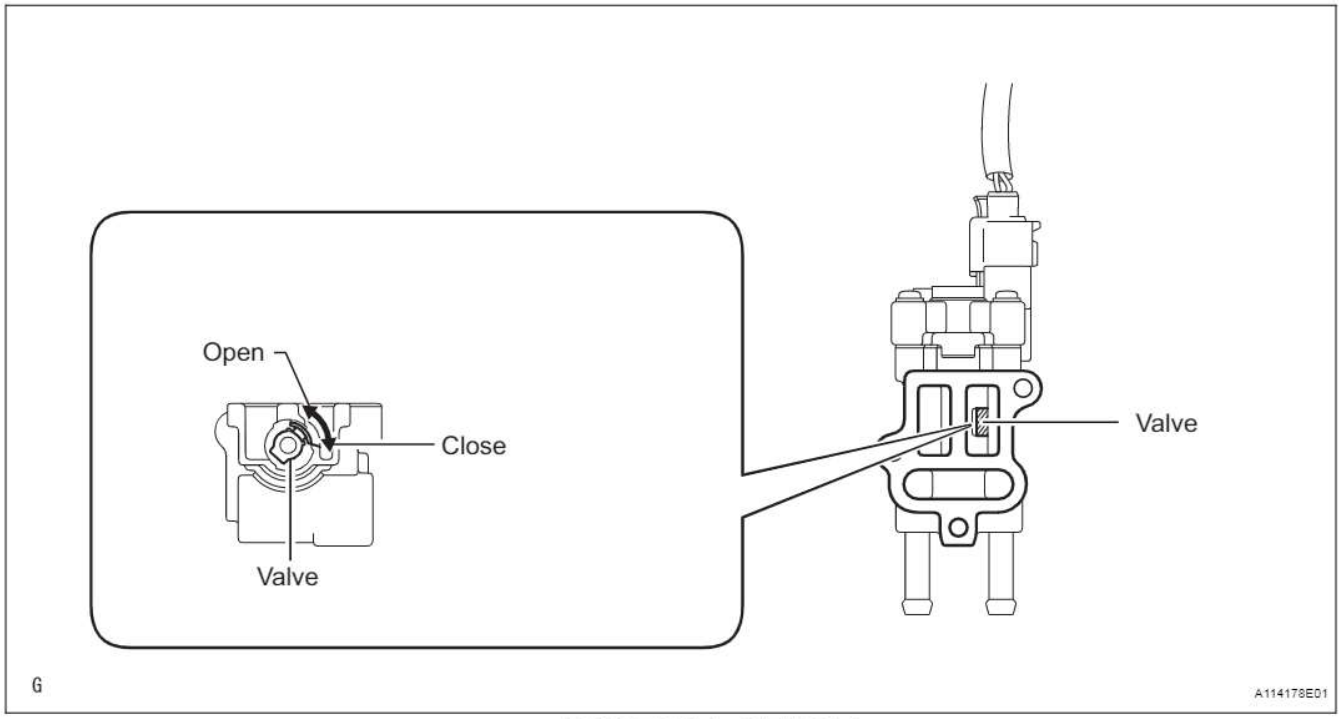
1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
2. **REMOVE THROTTLE BODY ASSEMBLY**
   (a) Remove the throttle body (see page ES-347).
3. **REMOVE IDLE AIR CONTROL VALVE ASSEMBLY**
   (a) Remove the 3 screws, valve and gasket.

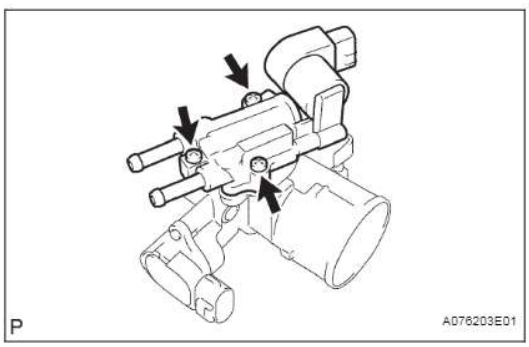


INSPECTION

1. **INSPECT IDLE AIR CONTROL VALVE ASSEMBLY**
   NOTICE:
   - **Since the IAC valve has an internal IC circuit which converts the ECM duty signal into the drive signal, it is impossible to check its resistor value and valve operation with the valve alone.**
   - **Clear the DTC after inspection.**

   HINT:
   DTC P0505 (see page ES-235) will be set when the IAC valve is stuck.
   (a) Connect the IAC valve connector to the IAC valve.
   (b) Inspect the valve movement when the ignition switch is turned ON.
   Standard movement:
   Half open → fully closed → fully open → half open
   HINT:
   The series of the valve movements mentioned above occur within 0.5 seconds.





INSTALLATION

1. **INSTALL IDLE AIR CONTROL VALVE ASSEMBLY**
   (a) Install a new gasket and the valve with the 3 screws.
   Torque: 3.4 N*m (35 kgf*cm, 30 in.*lbf)
2. **INSTALL THROTTLE BODY ASSEMBLY**
   (a) Install the throttle body (see page ES-348).
3. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

READINESS MONITOR DRIVE PATTERN

1. PURPOSE OF READINESS TESTS

- The On-Board Diagnostic (OBD II) system is designed to monitor the performance of emission related components, and indicate any detected abnormalities with DTCs (Diagnostic Trouble Codes). Since various components need to be monitored during different driving conditions, the OBD II system is designed to run separate monitoring programs called Readiness Monitors.
- The intelligent tester's software must be version 9.0 or newer to view the Readiness Monitor status. To view the status, enter the following menus: DIAGNOSIS / ENHANCED OBD II / MONITOR INFO / MONITOR STATUS.
- When the Readiness Monitor status reads COMPL (complete), the necessary conditions have been met for running the performance tests for that Readiness Monitor.
- A generic OBD II scan tool can also be used to view the Readiness Monitor status.

ES

HINT:
Many state Inspection and Maintenance (I/M) programs require a vehicle's Readiness Monitor status to show COMPL before beginning emission tests.
The Readiness Monitor will be reset to INCMPL (incomplete) if:

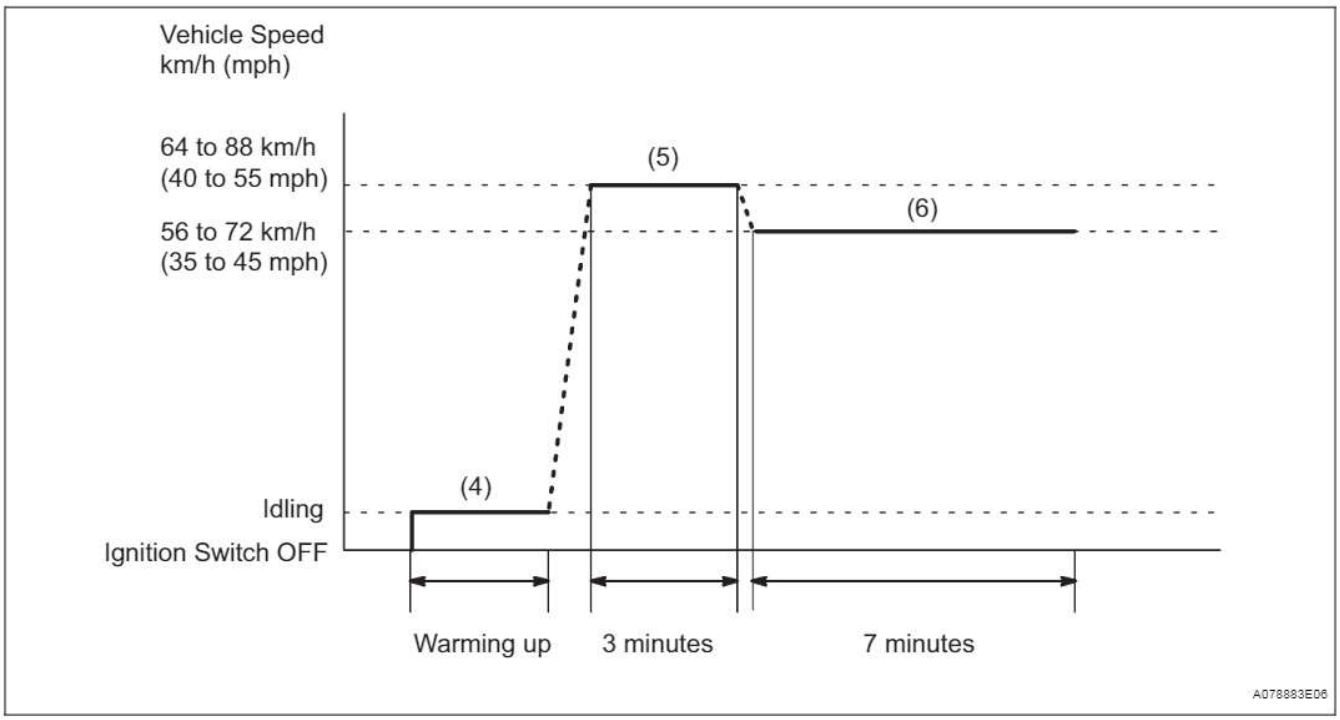
- The ECM has lost battery power or blown a fuse.
- DTCs have been cleared.
- The conditions for running the Readiness Monitor have not been met.

If the Readiness Monitor status shows INCMPL, follow the appropriate Readiness Monitor Drive Pattern to change the status to COMPL.

CAUTION:
Strictly observe posted speed limits, traffic laws, and road conditions when performing these drive patterns.

NOTICE:
These drive patterns represent the fastest method of satisfying all conditions necessary to achieve complete status for each specific Readiness Monitor.
In the event of a drive pattern being interrupted (possibly due to factors such as traffic conditions), the drive pattern can be resumed. In most cases, the Readiness Monitor will still achieve complete status upon completion of the drive pattern.
To ensure completion of the Readiness Monitors, avoid sudden changes in vehicle load and speed (driving up and down hills and/or sudden acceleration).

2. CATALYST MONITOR (Front Heated Oxygen Sensor Type)



(a) Preconditions

The monitor will not run unless:

- MIL is OFF.
- Engine Coolant Temperature (ECT) is 75°C (167°F) or higher.
- Intake Air Temperature (IAT) is -10°C (14°F) or higher.

NOTICE:

The readiness test can be completed in cold ambient conditions (less than -10°C [14°F]), if the drive pattern is repeated a second time after turning the ignition switch OFF.

(b) Drive Pattern

(1) Connect the intelligent tester to the DLC3.

(2) Turn the ignition switch ON and turn the tester ON.

(3) Clear DTCs (if set) (see page ES-37).

(4) Start the engine, and warm it up until the ECT reaches 75°C (167°F) or higher.

(5) Drive the vehicle at between 64 km/h and 88 km/h (40 mph and 55 mph) for approximately 3 minutes.

NOTICE:

Drive with smooth throttle operation and avoid sudden acceleration.

If the IAT was less than 10°C (50°F) when starting the engine, drive the vehicle at between 64 km/h and 88 km/h (40 mph and 55 mph) for approximately 3 additional minutes.

(6) Drive the vehicle at between 56 km/h and 72 km/h (35 mph and 45 mph) for approximately 7 minutes.

NOTICE:

Drive with smooth throttle operation and avoid sudden deceleration that causes the throttle to close fully.

(c) Monitor Status

(1) Check the Readiness Monitor status displayed on the tester.

(2) If the status does not switch to COMPL (complete), make sure that the preconditions have been met, and turn the ignition switch OFF. Then, repeat steps (5) and (6) in Drive Pattern above.

3. EVAP SYSTEM MONITOR (KEY OFF TYPE)

(a) Preconditions

The monitor will not run unless:

- The fuel tank is less than 90% full.
- The altitude is less than 8,000 ft (2,450 m).
- The vehicle is stationary.
- The engine coolant temperature is 4.4 to 35°C (40 to 95°F).
- The intake air temperature is 4.4 to 35°C (40 to 95°F).
- Vehicle was driven in an urban area (or on a freeway) for 10 minutes or more.

(b) Monitor Conditions

(1) Turn the ignition switch OFF and wait for 6 hours.

HINT:

Do not start the engine until checking Readiness Monitor status. If the engine is started, the step described above must be repeated.

(c) Monitor Status

(1) Connect the intelligent tester to the DLC3.

(2) Turn the ignition switch ON and turn the tester ON.

(3) Check the Readiness Monitor status displayed on the tester.

If the status does not switch to COMPL (complete), restart the engine, make sure that the preconditions have been met, and then perform the Monitor Conditions again.

4. Heated Oxygen (HO2) Sensor Monitors (Front and Rear HO2 Sensor Type)

(a) Preconditions

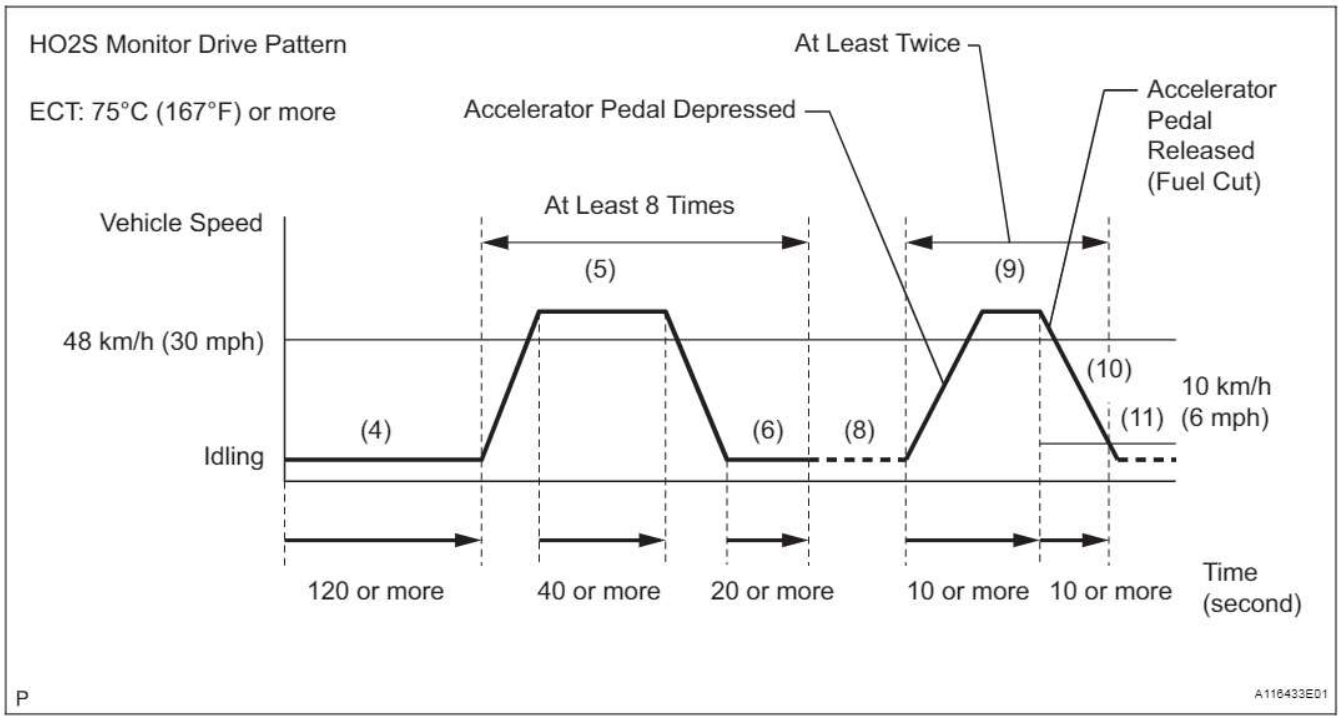
The monitor will not run unless:

- 2 minutes or more have elapsed since the engine was started.
- The Engine Coolant Temperature (ECT) is 75°C (167°F) or more.
- Cumulative driving time at a vehicle speed of 48 km/h (30 mph) or more exceeds 6 minutes.
- Air-fuel ratio feedback control is performed.

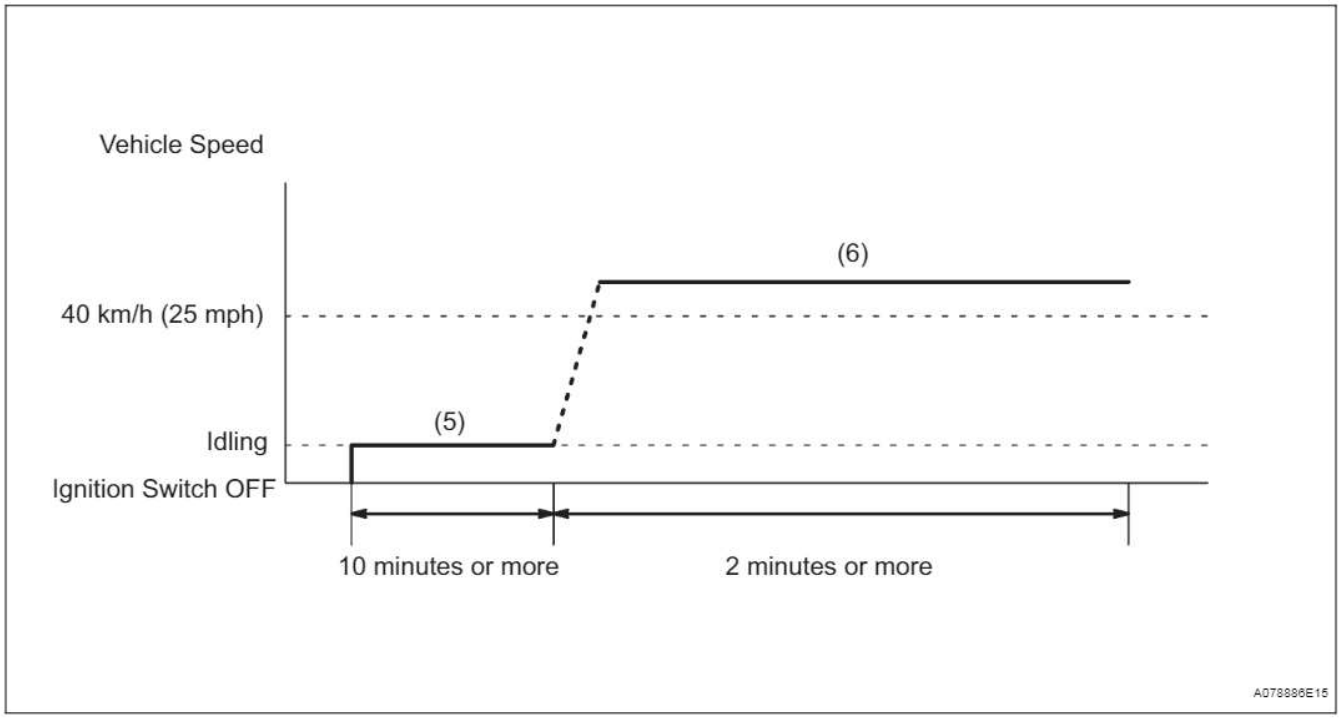
- Fuel cut control is performed for 8 seconds or more (for the Rear HO2 Sensor Monitor).

(b) Drive Pattern for Front and Rear HO2 Sensors
(1) Connect the intelligent tester to the DLC3.
(2) Turn the ignition switch ON and turn the tester ON.
(3) Clear the DTCs (see page ES-37).
(4) Start the engine and warm it up until the ECT reaches 75°C (167°F) or higher.
(5) Drive the vehicle at 48 km/h (30 mph) or more for at least 40 seconds.
(6) Allow the engine to idle for 20 seconds or more.
(7) Repeat steps (5) and (6) at least 8 times in 1 driving cycle.
(8) Change the transmission to 2nd gear.
(9) Accelerate the vehicle to 48 km/h (30 mph) or more by depressing the accelerator pedal for at least 10 seconds.
(10) Soon after performing step (9) above, release the accelerator pedal for at least 10 seconds without depressing the brake pedal, in order to execute fuel-cut control.
(11) Allow the vehicle to decelerate until the vehicle speed declines to less than 10 km/h (6 mph).
(12) Repeat steps from (9) through (11) above at least twice in 1 driving cycle.

(c) Monitor Status
(1) Check the Readiness Monitor status displayed on the tester.
(2) If the status does not switch to COMPL (complete), make sure that the preconditions have been met, and then perform steps from (4) through (12) in the Drive Pattern above.



5. Heated Oxygen (HO2) Sensor Heater Monitors (Front and Rear HO2 Sensor Type)



(a) Preconditions
The monitor will not run unless:
- The MIL is OFF

(b) Drive Pattern
(1) Connect the intelligent tester to the DLC3.
(2) Turn the ignition switch ON and turn the tester ON.
(3) Clear the DTCs (if set) (see page ES-37).

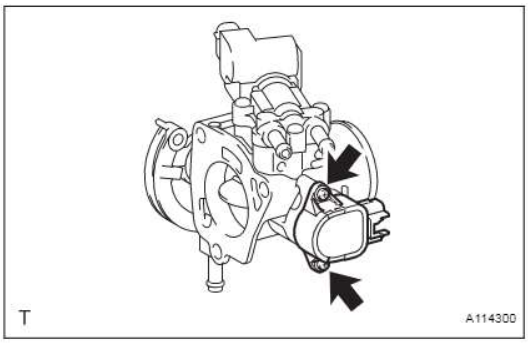
(4) Start the engine.
(5) Allow the engine to idle for 10 minutes or more.
(6) Drive the vehicle at 40 km/h (25 mph) or more for at least 2 minutes.

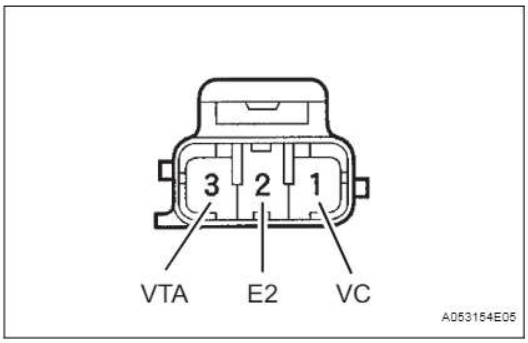
(c) Monitor Status
(1) Check the Readiness Monitor status displayed on the tester.
If the status does not switch to COMPL (complete), restart the engine, make sure the preconditions have been met, and repeat steps (5) and (6) described in the Drive Pattern above.

ES

REMOVAL

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
2. **REMOVE THROTTLE BODY ASSEMBLY**
   (a) Remove the throttle body (see page ES-347).
3. **REMOVE THROTTLE POSITION SENSOR**
   (a) Remove the 2 screws and sensor.



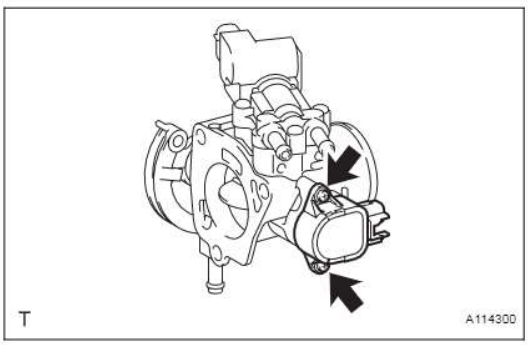


INSPECTION

1. **INSPECT THROTTLE POSITION SENSOR**
   (a) Measure the resistance of the sensor.
   Standard resistance

Tester Connection	Throttle Valve Position	Specified Condition
1 (VC) - 2 (E2)	-	2.5 to 6.0 kΩ
3 (VTA) - 2 (E2)	Fully closed	0.2 to 11.0 kΩ
3 (VTA) - 2 (E2)	Fully open	2.0 to 16.0 kΩ

If the resistance is not as specified, replace the throttle position sensor.

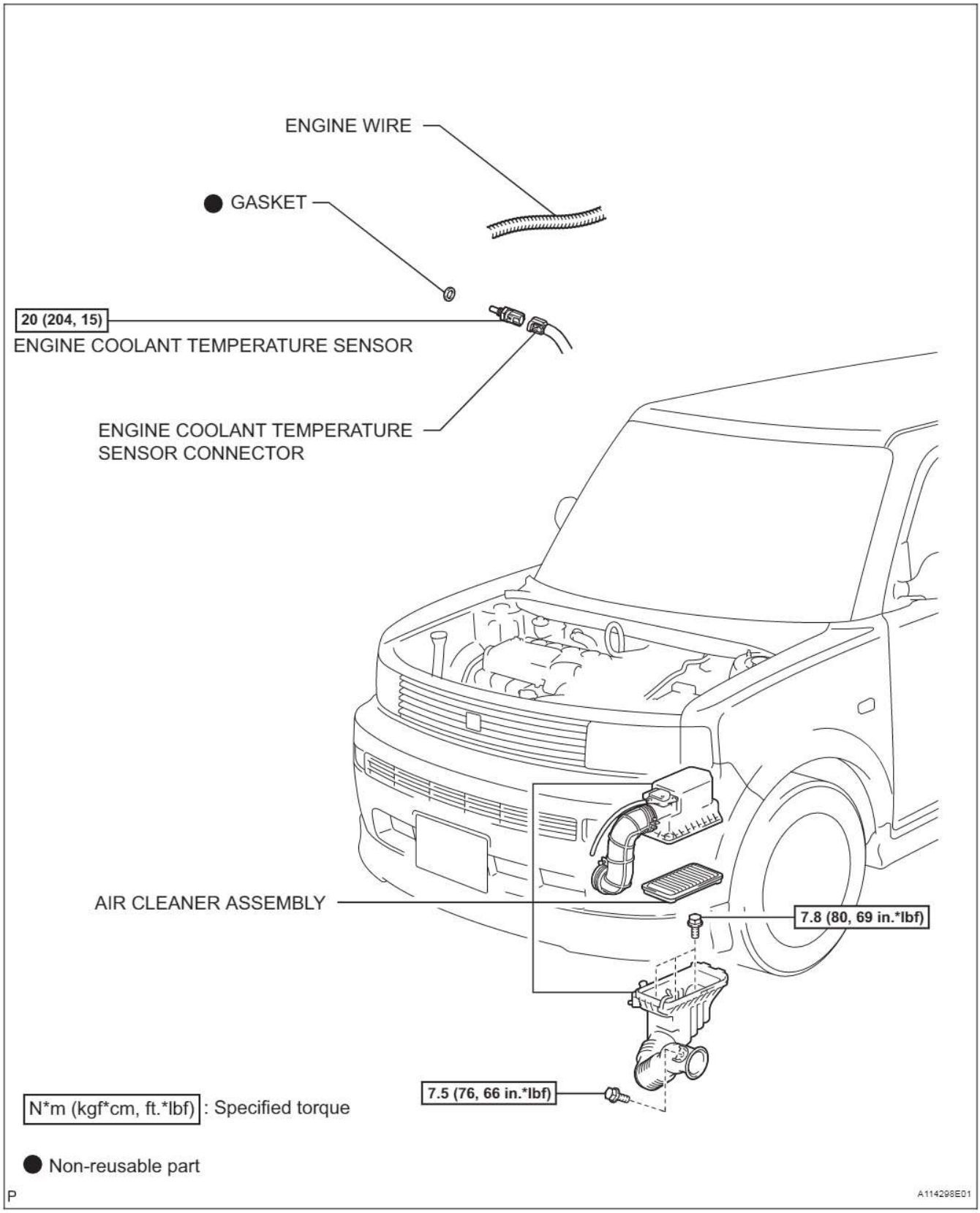


INSTALLATION

1. **INSTALL THROTTLE POSITION SENSOR**
   (a) Install the sensor with the 2 screws.
   Torque: 2.0 N*m (20 kgf*cm, 18 in.*lbf)
2. **INSTALL THROTTLE BODY ASSEMBLY**
   (a) Install the throttle body (see page ES-348).
3. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

ENGINE COOLANT TEMPERATURE SENSOR

COMPONENTS

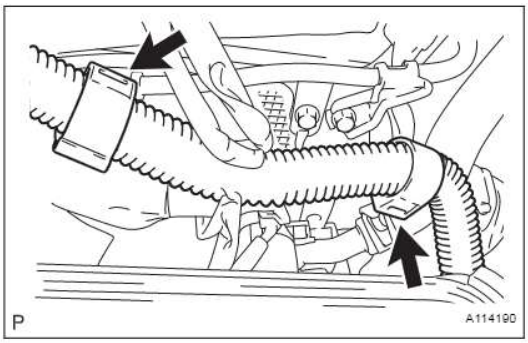


REMOVAL

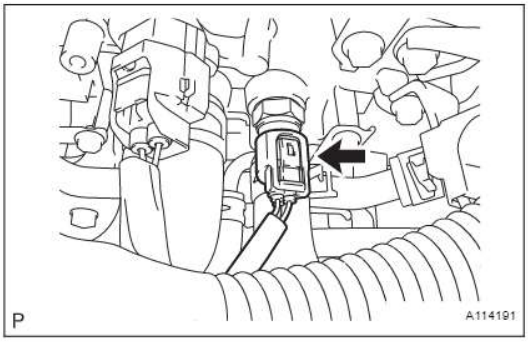
1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.

2. **REMOVE AIR CLEANER ASSEMBLY (See page ES-347)**

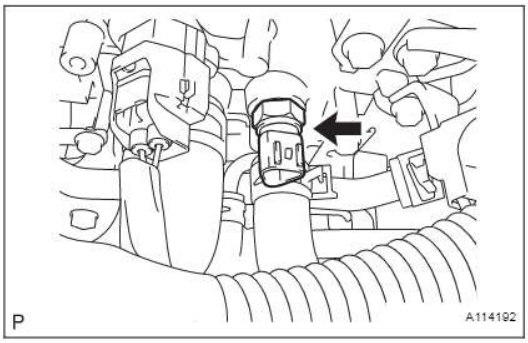
3. **DISCONNECT ENGINE WIRE**
   (a) Disconnect the 2 clamps of the engine wire.



4. **REMOVE ENGINE COOLANT TEMPERATURE SENSOR**
   (a) Disconnect the sensor connector.



   (b) Remove the sensor and gasket.



PROBLEM SYMPTOMS TABLE

HINT:
When a malfunction is not confirmed by a DTC (Diagnostic Trouble Code) check and the cause of problem cannot be identified through a basic inspection, troubleshoot according to the priority order indicated in the table below.

Symptom	Suspected area	See page
Engine does not crank (does not start)	1. Starter	ST-3
	2. Starter relay	ST-15
	3. Park/Neutral position switch circuit*1	AX-88
	4. Clutch start switch*2	CL-21
No initial combustion (does not start)	1. ECM power source circuit	ES-306
	2. VC output circuit	ES-312
	3. Ignition coil circuit	ES-185
	4. Fuel pump control circuit	ES-316
	5. Injector	FU-13
Incomplete combustion (does not start)	1. Fuel pump control circuit	ES-316
	2. Ignition coil circuit	ES-185
	3. Injector	FU-13
Engine cranks normally but difficult to start	1. Starter signal circuit	ES-250
	2. IAC valve circuit	ES-235
	3. Fuel pump control circuit	ES-316
	4. Ignition coil	ES-185
	5. Spark plug	IG-3
	6. Compression	EM-1
	7. Injector	FU-13
Difficult to start with cold engine	1. Starter signal circuit	ES-250
	2. IAC valve circuit	ES-235
	3. Fuel pump control circuit	ES-316
	4. Injector	FU-13
	5. Ignition coil	ES-185
	6. Spark plug	IG-3
Difficult to start with warm engine	1. Starter signal circuit	ES-250
	2. IAC valve circuit	ES-235
	3. Fuel pump control circuit	ES-316
	4. Injector	FU-13
	5. Ignition coil	ES-185
	6. Spark plug	IG-3
Incorrect fast idle (poor idling)	1. IAC valve circuit	ES-235
High engine idling speed (poor idling)	1. IAC valve circuit	ES-235
	2. ECM power source circuit	ES-306
	3. Park/Neutral position switch circuit*1	AX-88
Low engine idling speed (poor idling)	1. IAC valve circuit	ES-235
	2. Park/Neutral position switch circuit*1	AX-88
	3. Fuel pump control circuit	ES-316
	4. Injector	FU-13

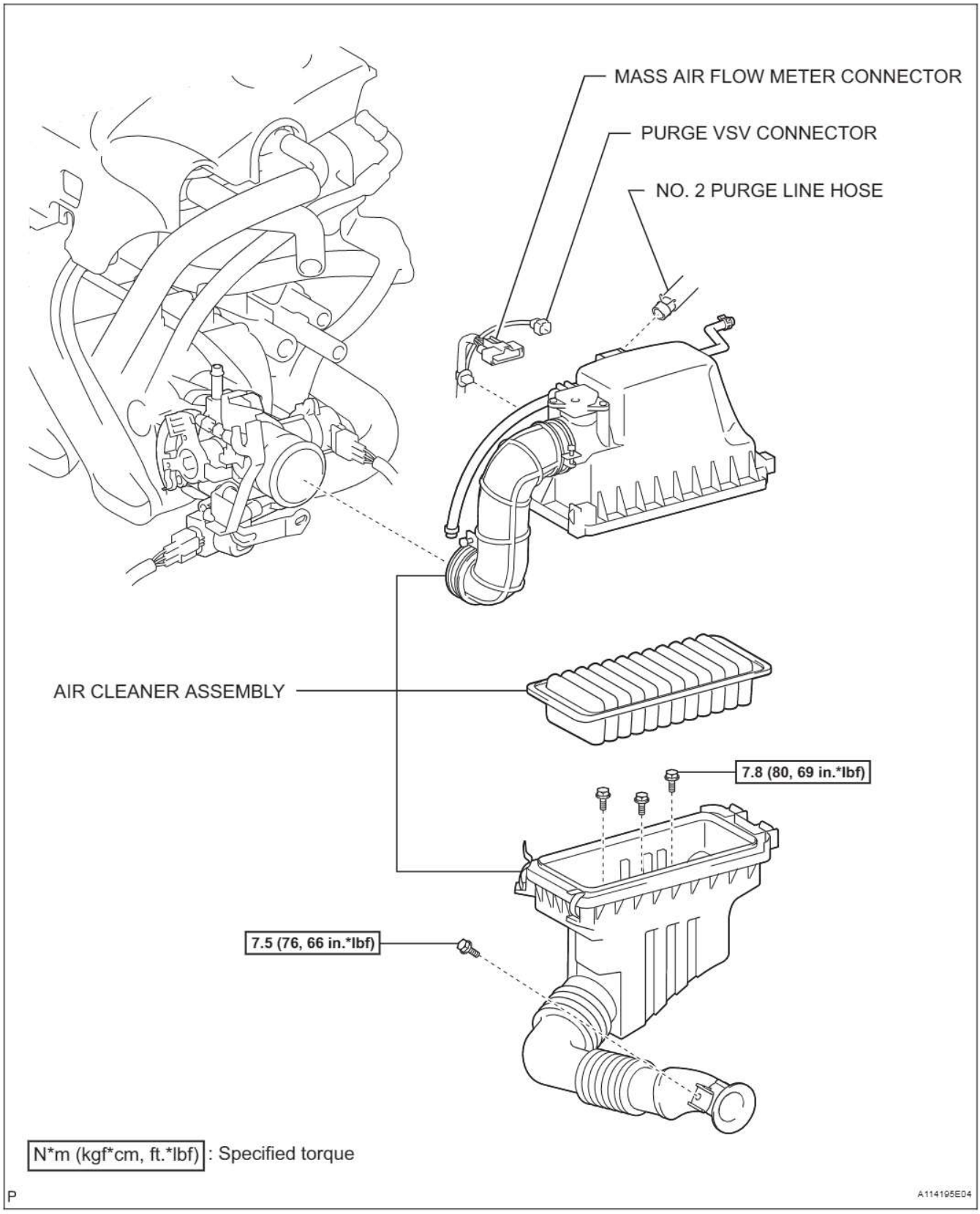
Symptom	Suspected area	See page
Rough idling	1. IAC valve circuit	ES-235
	2. Injector	FU-13
	3. Ignition coil	ES-185
	4. Compression	EM-1
	5. Fuel pump control circuit	ES-316
Hunting (poor idling)	1. IAC valve circuit	ES-235
	2. ECM power source circuit	ES-306
	3. Fuel pump control circuit	ES-316
Hesitation/Poor acceleration (poor driveability)	1. Injector	FU-13
	2. Fuel pump control circuit	ES-316
	3. Ignition coil circuit	ES-185
Muffler explosion, after fire (poor driveability)	1. Ignition coil	ES-185
	2. Spark plug	IG-3
	3. Injector	FU-13
Surging (poor driveability)	1. Fuel pump control circuit	ES-316
	2. Spark plug	IG-3
	3. Injector	FU-13
Engine stalls soon after starting	1. Fuel pump control circuit	ES-316
	2. IAC valve circuit	ES-235
Engine stalls when accelerator pedal released	1. Injector	FU-13
	2. IAC valve circuit	ES-235
	3. ECM	ES-30
Engine stalls when shifting from N to D	1. Park/Neutral position switch circuit*1	AX-88
	2. IAC valve circuit	ES-235
Unable/difficult to refuel	1. Refueling valve (canister)	-

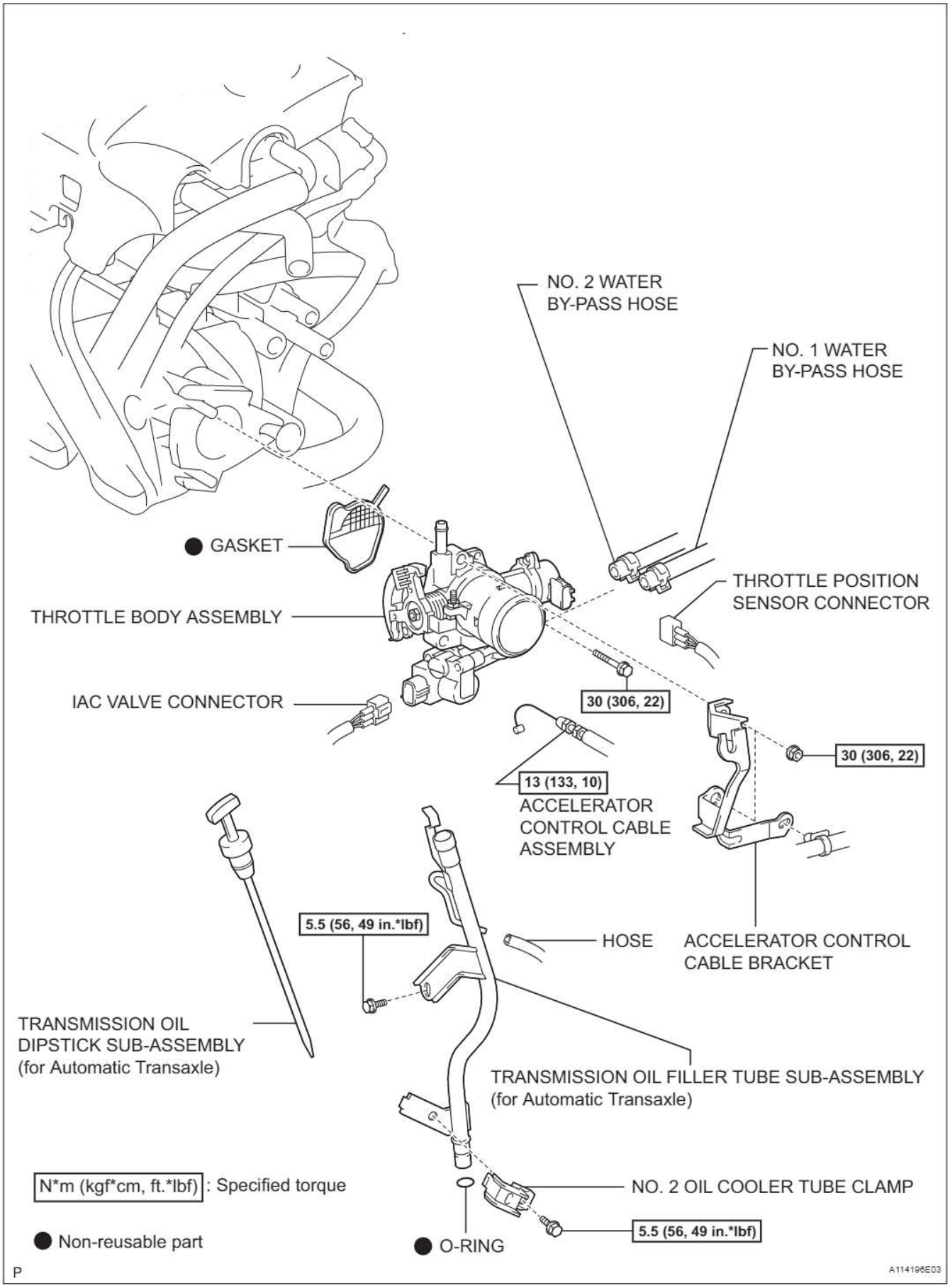
HINT:

- *1: A/T (Automatic Transaxle) only
- *2: M/T (Manual Transaxle) only

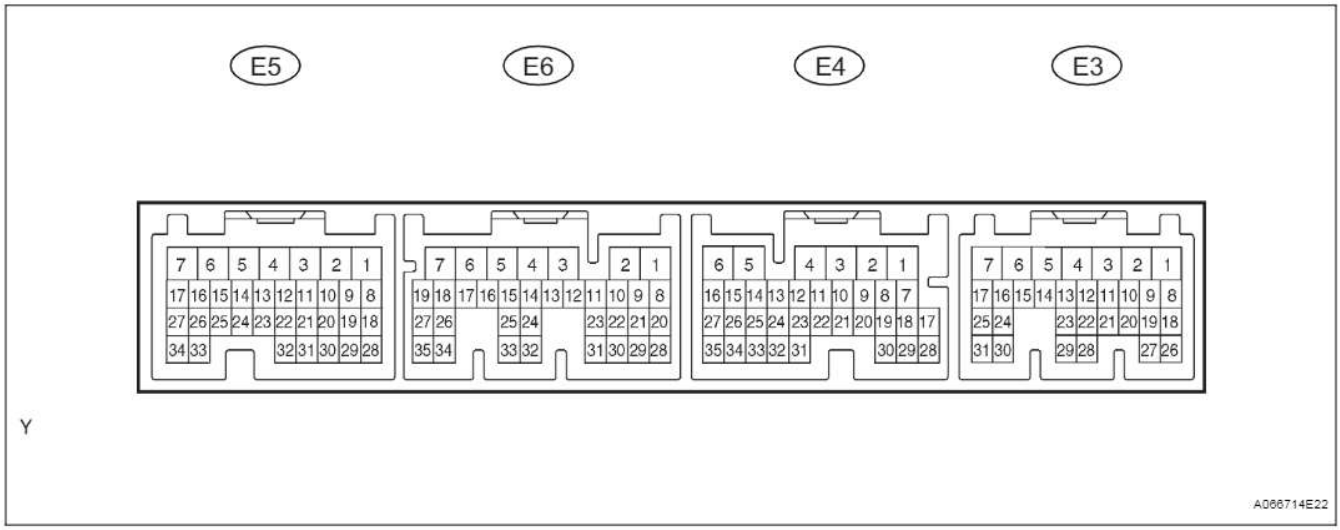
THROTTLE BODY

COMPONENTS




NO. 2 WATER BY-PASS HOSE
NO. 1 WATER BY-PASS HOSE
GASKET
THROTTLE BODY ASSEMBLY
THROTTLE POSITION SENSOR CONNECTOR
IAC VALVE CONNECTOR
30 (306, 22)
30 (306, 22)
13 (133, 10)
ACCELERATOR CONTROL CABLE ASSEMBLY
5.5 (56, 49 in.*lbf)
HOSE
ACCELERATOR CONTROL CABLE BRACKET
TRANSMISSION OIL DIPSTICK SUB-ASSEMBLY (for Automatic Transaxle)
TRANSMISSION OIL FILLER TUBE SUB-ASSEMBLY (for Automatic Transaxle)
N*m (kgf*cm, ft.*lbf) : Specified torque
NO. 2 OIL COOLER TUBE CLAMP
5.5 (56, 49 in.*lbf)
Non-reusable part
O-RING
P
A114196E03

TERMINALS OF ECM



HINT:
The standard normal voltage between each pair of ECM terminals is shown in the table below. The appropriate conditions for checking each pair of terminals is also indicated.
The result of checks should be compared with the standard normal voltage for that pair of terminals, displayed in the Specified Condition column.
The illustration above can be used as a reference to identify the ECM terminal locations.

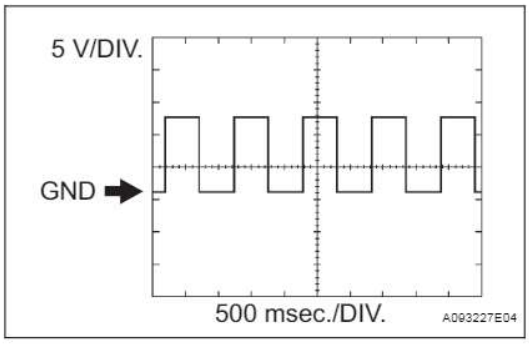
Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
BATT (E3-3) - E1 (E5-3)	B-Y - BR	Battery (for measuring battery voltage and for ECM memory)	Always	9 to 14 V
IGSW (E3-9) - E1 (E5-3)	B-R - BR	Ignition switch	Ignition switch ON	9 to 14 V
FC (E3-25) - E1 (E5-3)	G - BR	Fuel pump control	Ignition switch ON	9 to 14 V
FC (E3-25) - E1 (E5-3)	G - BR	Fuel pump control	Idling	Below 1.5 V
W (E4-30) - E1 (E5-3)	Y-R - BR	MIL	Idling	9 to 14 V
W (E4-30) - E1 (E5-3)	Y-R - BR	MIL	Ignition switch ON	Below 3.5 V
+B (E3-1) - E1 (E5-3)	B-R - BR	Power source of ECM	Ignition switch ON	9 to 14 V
+B2 (E3-2) - E1 (E5-3)	B-R - BR	Power source of ECM	Ignition switch ON	9 to 14 V
MREL (E3-8) - E1 (E5-3)	GR - BR	EFI relay	Ignition switch ON	9 to 14 V
STP (E4-4) - E1 (E5-3)	G-W - BR	Stop light switch	Ignition switch ON, Brake pedal depressed	9 to 14 V
STP (E4-4) - E1 (E5-3)	G-W - BR	Stop light switch	Ignition switch ON, Brake pedal released	Below 1.5 V
F/PS (E4-32) - E1 (E5-3)	Y - BR	Airbag sensor	Ignition switch ON	Pulse generation (see waveform 1)
STA (E3-12) - E1 (E5-3)	B-Y - BR	Starter signal	Cranking	5.5 V or more
PSP (E6-32) - E1 (E5-3)	Y - BR	Power steering oil pressure sensor	Ignition switch ON	9 to 14 V
SPD (E4-8) - E1 (E5-3)	V-W - BR	Speed signal from combination meter	Driving at 20 km/h (12 mph)	Pulse generation (see waveform 2)
TACH (E4-1) - E1 (E5-3)	B - BR	Engine speed	Idling	Pulse generation (see waveform 3)
VC (E5-18) - E2 (E5-28)	R-W - BR	Power source of sensor (specific voltage)	Ignition switch ON	4.5 to 5.5 V

Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
PRG (E6-23) - E01 (E5-7)	W-G - BR	Purge VSV	Ignition switch ON and engine stopping	9 to 14 V
PRG (E6-23) - E01 (E5-7)	W-G - BR	Purge VSV	Idling with warm engine	Pulse generation (see waveform 4)
VG (E6-28) - E2G (E6-30)	P - V	Mass air flow meter	Idling, A/C switch OFF	1.1 to 1.5 V
OX1A (E5-21) - E2 (E5-28)	W - BR	Heated oxygen sensor (Sensor 1)	Engine speed maintained at 2,500 rpm for 2 minutes after warming up sensor	Pulse generation (see waveform 5)
HT1A (E5-1) - E03 (E6-4)	B-R - BR	Heated oxygen sensor heater (Sensor 1)	Idling	Below 3.0 V
HT1A (E5-1) - E03 (E6-4)	B-R - BR	Heated oxygen sensor heater (Sensor 1)	Ignition switch ON	9 to 14 V
OX1B (E5-25) - E2 (E5-28)	L - BR	Heated oxygen sensor (Sensor 2)	Engine speed maintained at 2,500 rpm for 2 minutes after warming up sensor	Pulse generation (see waveform 6)
HT1B (E5-2) - E03 (E6-4)	W - BR	Heated oxygen sensor heater (Sensor 2)	Idling	Below 3.0 V
HT1B (E5-2) - E03 (E6-4)	W - BR	Heated oxygen sensor heater (Sensor 2)	Ignition switch ON	9 to 14 V
THW (E5-32) - E2 (E5-28)	R-L - BR	Engine coolant temperature sensor	Idling, Engine coolant temperature 80°C (176°F)	0.2 to 1.0 V
G2+ (E5-26) - NE- (E5-34)	B - W	Camshaft position sensor	Idling	Pulse generation (see waveform 7)
NE+ (E5-27) - NE- (E5-34)	O - W	Crankshaft position sensor	Idling	Pulse generation (see waveform 7)
THA (E6-29) - E2 (E5-28)	Y-B - BR	Intake air temperature sensor	Idling, Intake air temperature 20°C (68°F)	0.5 to 3.4 V
VTA1 (E5-20) - E2 (E5-28)	Y-R - BR	Throttle position sensor	Ignition switch ON, Throttle valve fully closed	0.3 to 1.0 V
VTA1 (E5-20) - E2 (E5-28)	Y-R - BR	Throttle position sensor	Ignition switch ON, Throttle valve fully open	3.2 to 4.9 V
#10 (E6-6) - E01 (E5-7) #20 (E6-5) - E01 (E5-7) #30 (E6-2) - E01 (E5-7) #40 (E6-1) - E01 (E5-7)	B-O - BR B-Y - BR B-W - BR B-L - BR	Injector	Ignition switch ON	9 to 14 V
#10 (E6-6) - E01 (E5-7) #20 (E6-5) - E01 (E5-7) #30 (E6-2) - E01 (E5-7) #40 (E6-1) - E01 (E5-7)	B-O - BR B-Y - BR B-W - BR B-L - BR	Injector	Idling	Pulse generation (see waveform 8)
IGT1 (E5-17) - E1 (E5-3) IGT2 (E5-16) - E1 (E5-3) IGT3 (E5-15) - E1 (E5-3) IGT4 (E5-14) - E1 (E5-3)	G-R - BR G-B - BR G-O - BR G-Y - BR	Ignition coil (ignition signal)	Idling	Pulse generation (see waveform 9)
IGF (E5-23) - E1 (E5-3)	Y - BR	Ignition coil (ignition confirmation signal)	Ignition switch ON	4.5 to 5.5 V
IGF (E5-23) - E1 (E5-3)	Y - BR	Ignition coil (ignition confirmation signal)	Idling	Pulse generation (see waveform 9)
RSD (E5-5) - E01 (E5-7)	B-R - BR	Idle air control valve	Ignition switch ON	9 to 14 V
OC1+ (E5-13) - OC1- (E5-12)	R-Y - R-B	Camshaft timing oil control valve	Ignition switch ON	Pulse generation (see waveform 10)
KNK1 (E5-29) - EKNK (E5-30)	W - B	Knock sensor	Idling	Pulse generation (see waveform 11)
TC (E4-17) - E1 (E5-3)	P-B - BR	Terminal TC of DLC3	Ignition switch ON	9 to 14 V
NSW (E3-30)* - E1 (E5-3)	B - BR	Park/Neutral position switch signal	Ignition switch ON and shift lever P or N position	Below 1 V
NSW (E3-30)* - E1 (E5-3)	B - BR	Park/Neutral position switch signal	Ignition switch ON and shift lever except P or N position	9 to 14 V

Symbols (Terminal No.)	Wiring Color	Terminal Description	Condition	Specified Condition
VPMP (E3-5) - E1 (E5-3)	P - BR	Vent valve (built into canister pump module)	Ignition switch ON	9 to 14 V
MPMP (E3-6) - E1 (E5-3)	V - BR	Leak detection pump (built into canister pump module)	Leak detection pump OFF	0 to 3 V
MPMP (E3-6) - E1 (E5-3)	V - BR	Leak detection pump (built into canister pump module)	Leak detection pump ON	9 to 14 V
PTMK (E3-31) - E1 (E5-3)	R - BR	Canister pressure sensor (built into canister pump module)	Ignition switch ON	3 to 3.6 V
CANH (E4-33) - E1 (E5-3)	B - BR	CAN communication line	Ignition switch ON	Pulse generation (see waveform 12)
CANL (E4-34) - E1 (E5-3)	W - BR	CAN communication line	Ignition switch ON	Pulse generation (see waveform 13)

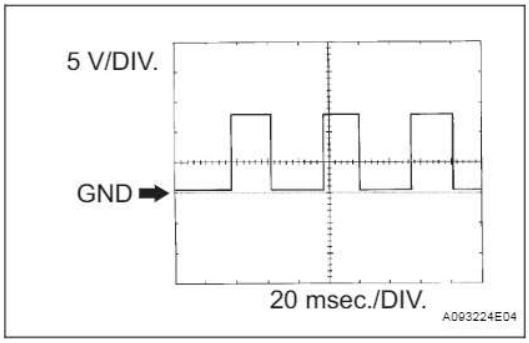
ES

*: A/T only



1. WAVEFORM 1
Airbag sensor assembly

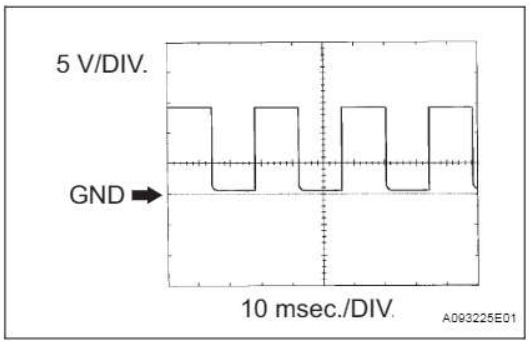
ECM Terminal Names	Between F/PS and E1
Tester Ranges	5 V/DIV., 500 msec./DIV.
Conditions	Idling with warm engine



2. WAVEFORM 2
Vehicle speed signal

ECM Terminal Names	Between SPD and E1
Tester Ranges	5 V/DIV., 20 msec./DIV.
Conditions	Driving at 25 mph (40 km/h)

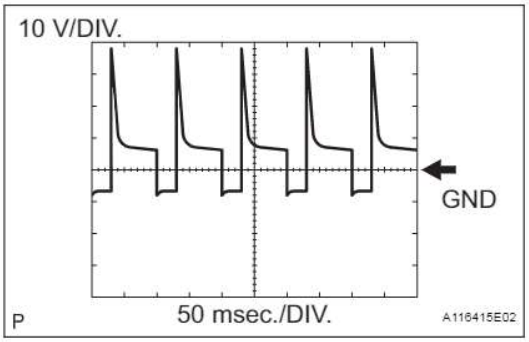
HINT:
The wavelength becomes shorter as the vehicle speed increases.



3. WAVEFORM 3
Engine speed signal

ECM Terminal Names	Between TACH and E1
Tester Ranges	5 V/DIV., 10 msec./DIV.
Conditions	Idling

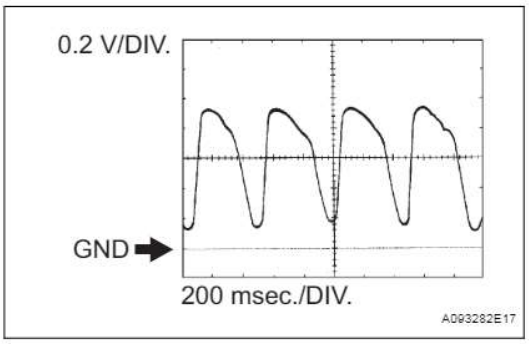
HINT:
The wavelength becomes shorter as the engine rpm increases.



4. WAVEFORM 4
Purge VSV

ECM Terminal Names	Between PRG and E01
Tester Ranges	10 V/DIV., 50 msec./DIV.
Conditions	Idling

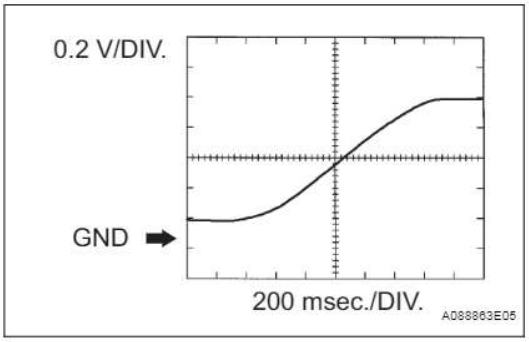
HINT:
If the waveform is not similar to the illustration, check the waveform again after idling for 10 minutes or more.



5. WAVEFORM 5
Heated Oxygen (HO2) sensor (sensor 1)

ECM Terminal Names	Between OX1A and E2
Tester Ranges	0.2 V/DIV., 200 msec./DIV.
Conditions	Engine maintained at 2,500 rpm when warmed up

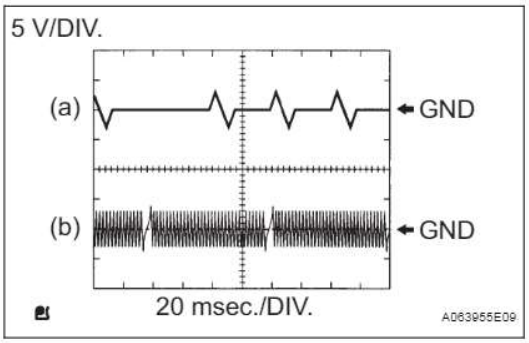
HINT:
In the DATA LIST, item O2S B1S1 shows the ECM input values from the front HO2 sensor (sensor 1).



6. WAVEFORM 6
Heated Oxygen (HO2) sensor (sensor 2)

ECM Terminal Names	Between OX1B and E2
Tester Ranges	0.2 V/DIV., 200 msec./DIV.
Conditions	Engine maintained at 2,500 rpm when warmed up

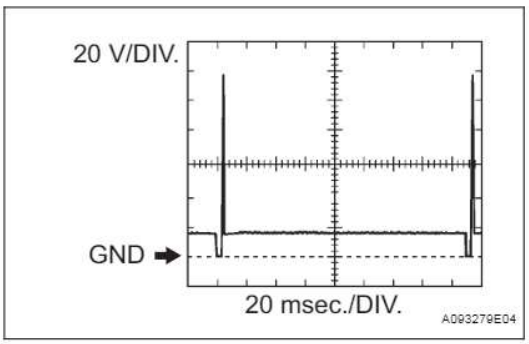
HINT:
In the DATA LIST, item O2S B1S2 shows the ECM input values from the rear HO2 sensor (sensor 2).



7. WAVEFORM 7
Camshaft position sensor and crankshaft position sensor

ECM Terminal Names	(a) Between G2+ and NE- (b) Between NE+ and NE-
Tester Ranges	5 V/DIV., 20 msec./DIV.
Conditions	Idling

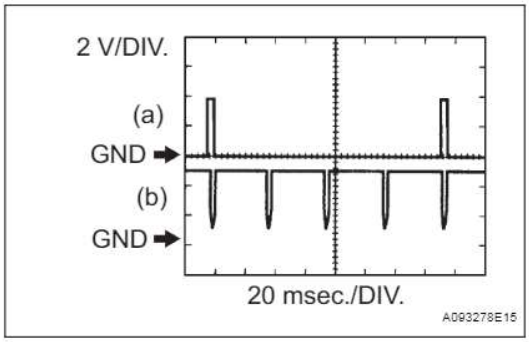
HINT:
The wavelength becomes shorter as the engine rpm increases.



8. WAVEFORM 8
Fuel injector

ECM Terminal Names	Between #10 (to 40) and E01
Tester Ranges	20 V/DIV., 20 msec./DIV.
Conditions	Idling

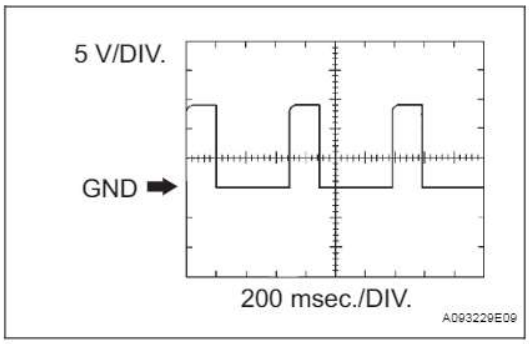
HINT:
The wavelength becomes shorter as the engine rpm increases.



9. WAVEFORM 9
Igniter IGT signal (from ECM to igniter) and igniter IGF signal (from igniter to ECM)

ECM Terminal Name	(a) Between IGT (1 to 4) and E1 (b) Between IGF and E1
Tester Ranges	2 V/DIV., 20 msec./DIV.
Conditions	Idling

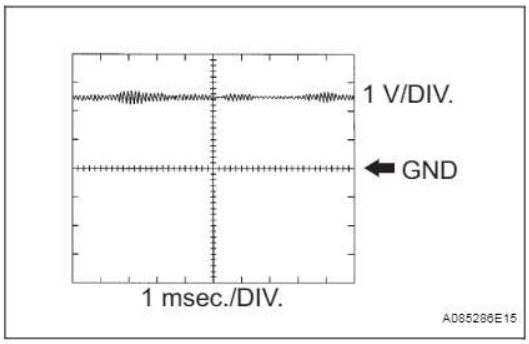
HINT:
The wavelength becomes shorter as the engine rpm increases.



10. WAVEFORM 10
Camshaft timing oil control valve (OCV)

ECM Terminal Names	Between OC1+ and OC1-
Tester Ranges	5 V/DIV., 200 msec./DIV.
Conditions	Idling

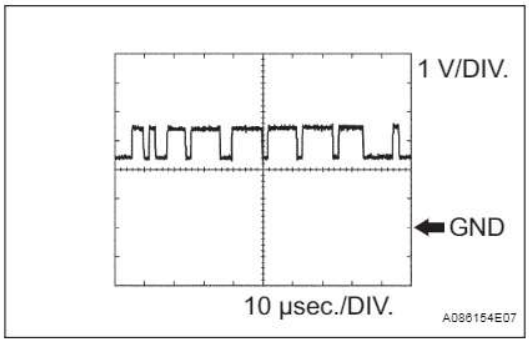
HINT:
The wavelength becomes shorter as the engine rpm increases.



11. WAVEFORM 11
Knock sensor

ECM Terminal Names	Between KNK1 and EKNK
Tester Ranges	0.01 to 10 V/DIV., 0.01 to 10 msec./DIV.
Conditions	Engine maintained at 4,000 rpm when warmed up

HINT:
- The wavelength becomes shorter as the engine rpm increases.
- The waveforms and amplitudes displayed differ slightly depending on the vehicle.

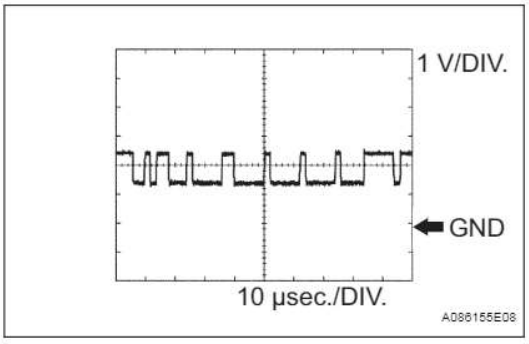


12. WAVEFORM 12
CAN communication signal

ECM Terminal Names	Between CANH and E1
Tester Ranges	1 V/DIV., 10 µsec./DIV.
Conditions	Engine stopped and ignition switch ON

HINT:
The waveform varies depending on the CAN communication signal.

ES



13. WAVEFORM 13
CAN communication signal

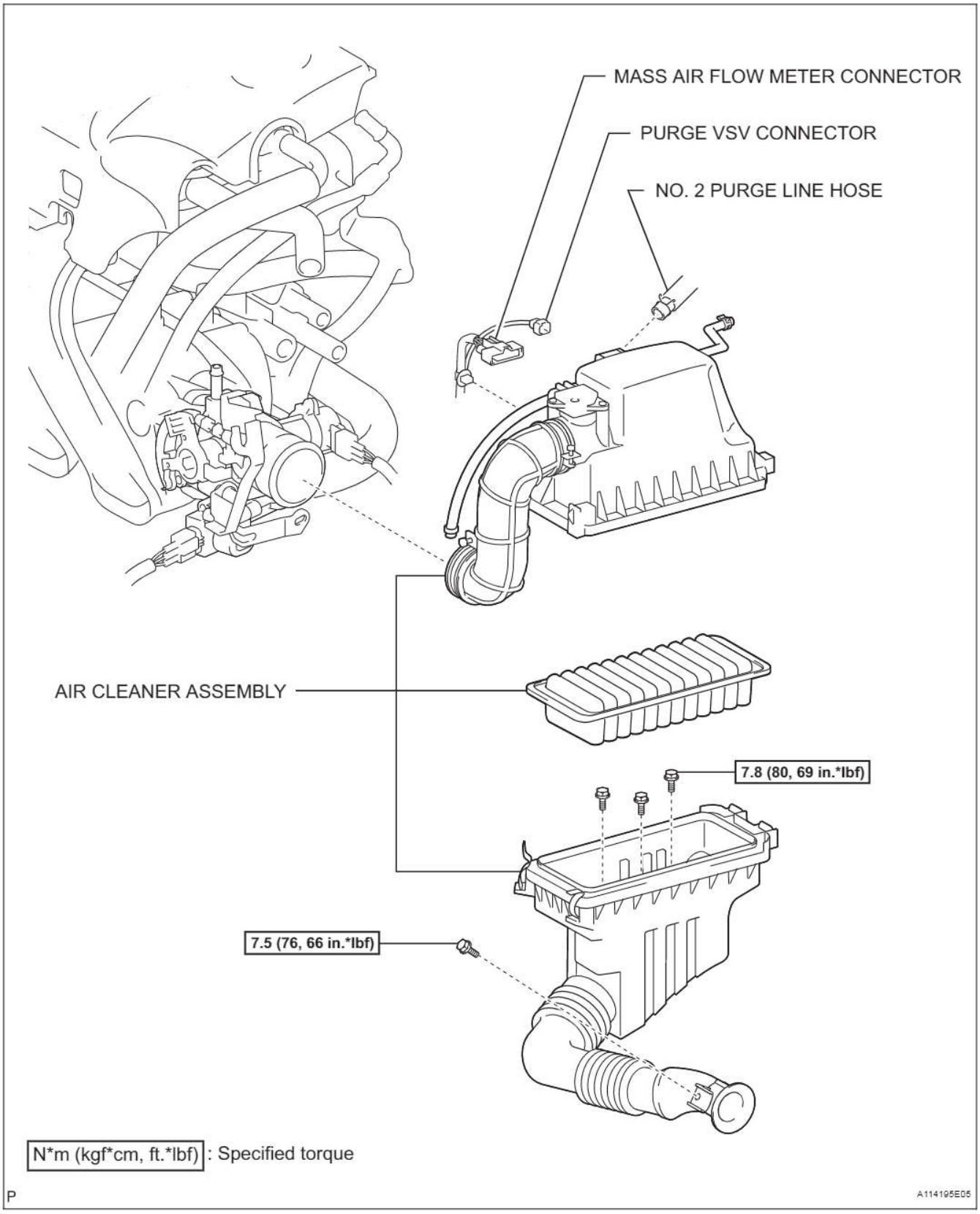
ECM Terminal Names	Between CANL and E1
Tester Ranges	1 V/DIV., 10 µsec./DIV.
Conditions	Engine stopped and ignition switch ON

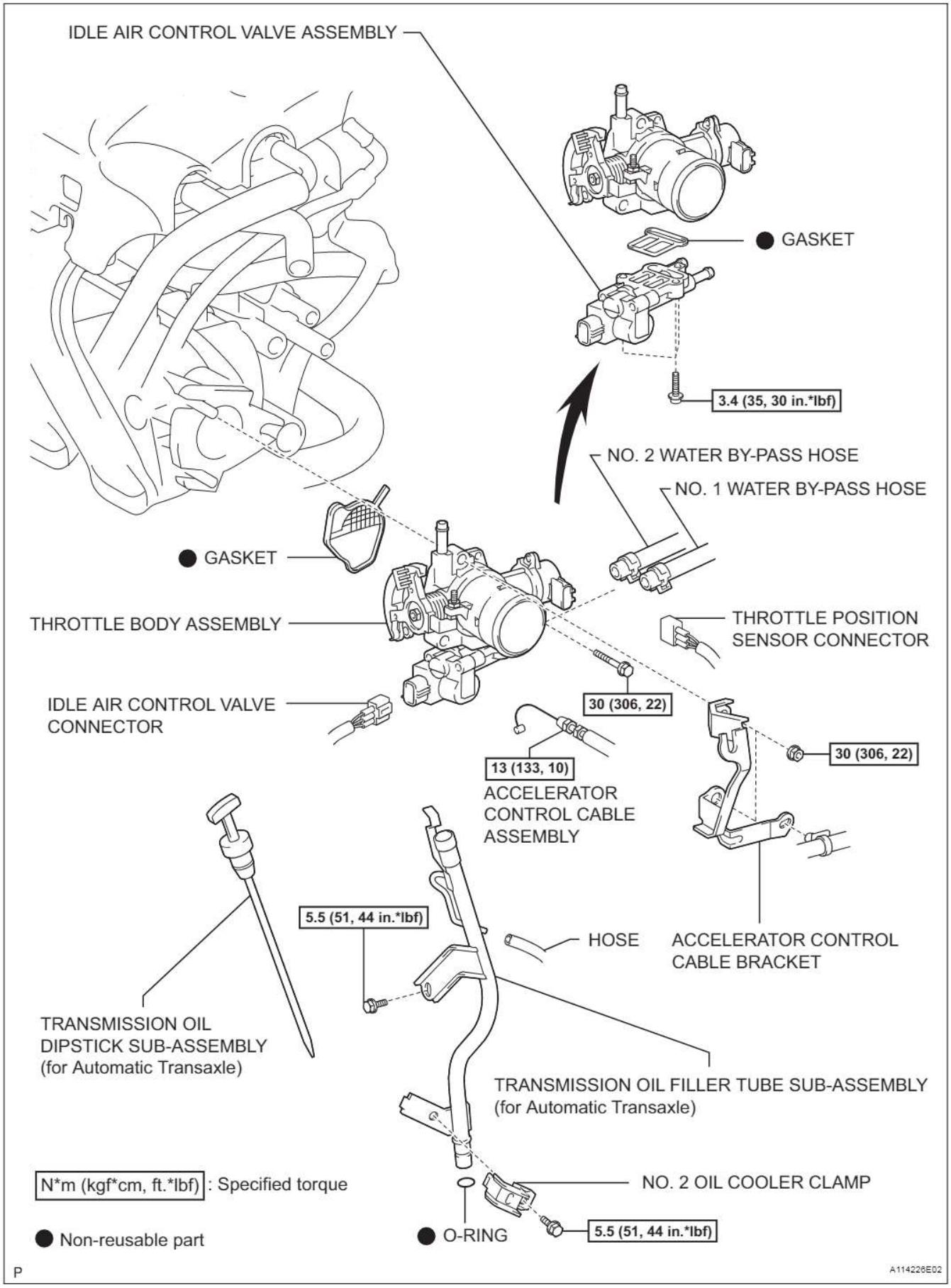
HINT:
The waveform varies depending on the CAN communication signal.

ES

IDLE AIR CONTROL VALVE

COMPONENTS




IDLE AIR CONTROL VALVE ASSEMBLY
GASKET
3.4 (35, 30 in.*lbf)
NO. 2 WATER BY-PASS HOSE
NO. 1 WATER BY-PASS HOSE
GASKET
THROTTLE BODY ASSEMBLY
THROTTLE POSITION SENSOR CONNECTOR
IDLE AIR CONTROL VALVE CONNECTOR
30 (306, 22)
13 (133, 10)
ACCELERATOR CONTROL CABLE ASSEMBLY
30 (306, 22)
5.5 (51, 44 in.*lbf)
HOSE
ACCELERATOR CONTROL CABLE BRACKET
TRANSMISSION OIL DIPSTICK SUB-ASSEMBLY (for Automatic Transaxle)
TRANSMISSION OIL FILLER TUBE SUB-ASSEMBLY (for Automatic Transaxle)
N*m (kgf*cm, ft.*lbf) : Specified torque
NO. 2 OIL COOLER CLAMP
Non-reusable part
O-RING
5.5 (51, 44 in.*lbf)
P
A114226E02

DIAGNOSIS SYSTEM

1. DESCRIPTION



When troubleshooting On-Board Diagnostics (OBD II) vehicles, the intelligent tester (complying with SAE J1987) must be connected to the Data Link Connector 3 (DLC3) of the vehicle. Various data in the vehicle's Engine Control Module (ECM) can then be read.

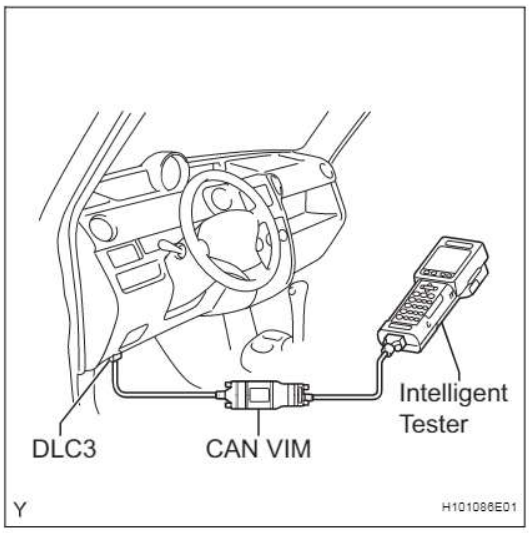
OBD II regulations require that the vehicle's on-board computer illuminates the Malfunction Indicator Lamp (MIL) on the instrument panel when the computer detects a malfunction in:

(a) The emission control systems components

(b) The power train control components (which affect vehicle emissions)

(c) The computer itself

In addition, the applicable Diagnostic Trouble Codes (DTCs) prescribed by SAE J2012 are recorded in the ECM memory. If the malfunction does not reoccur in 3 consecutive trips, the MIL turns off automatically but the DTCs remain recorded in the ECM memory.



To check the DTCs, connect the intelligent tester to the DLC3. The tester displays DTCs, freeze frame data, and a variety of engine data. The DTCs and freeze frame data can be erased with the tester. In order to enhance OBD function on vehicles and develop the Off-Board diagnosis system, the Controller Area Network (CAN) communication is used in this system. It minimizes the gap between technician skills and vehicle technology. CAN is a network which uses a pair of data transmission lines that span multiple ECUs and sensors. It allows high speed communication between the systems and simplifies the wire harness connections. The CAN Vehicle Interface Module (CAN VIM) must be connected with the intelligent tester to display any information from the ECM. The intelligent tester and ECM uses CAN communication signals to communicate. Connect the CAN VIM between the intelligent tester and DLC3.

2. NORMAL MODE AND CHECK MODE

The diagnosis system operates in normal mode during normal vehicle use. In normal mode, 2 trip detection logic is used to ensure accurate detection of malfunctions. Check mode is also available as an option for technicians. In check mode, 1 trip detection logic is used for simulating malfunction symptoms and increasing the system's ability to detect malfunctions, including intermittent problems (intelligent tester only).

3. 2 TRIP DETECTION LOGIC

When a malfunction is first detected, the malfunction is temporarily stored in the ECM memory (1st trip). If the same malfunction is detected during the next subsequent drive cycle, the MIL is illuminated (2nd trip).

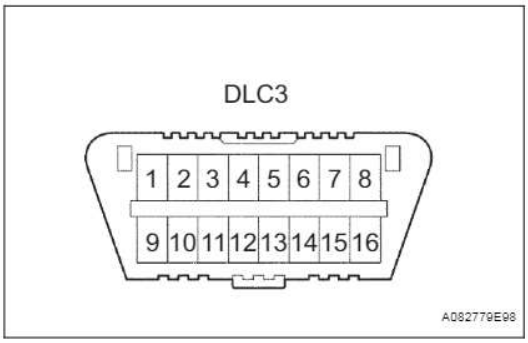
ES

4. FREEZE FRAME DATA

Freeze frame data records the engine conditions (fuel system, calculated engine load, engine coolant temperature, fuel trim, engine speed, vehicle speed, etc.) when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, if the engine was warmed up or not, if the air-fuel ratio was lean or rich, and other data from the time the malfunction occurred.

5. DATA LINK CONNECTOR 3 (DLC3)

The vehicle's ECM uses the ISO 15765-4 for communication protocol. The terminal arrangement of the DLC3 complies with SAE J1962 and matches the ISO 15765-4 format.



Symbols	Terminal No.	Names	Reference terminal	Results	Condition
SIL	7	Bus "+" line	5 - Signal ground	Pulse generation	During transmission
CG	4	Chassis ground	Body ground	1 Ω or less	Always
SG	5	Signal ground	Body ground	1 Ω or less	Always
BAT	16	Battery positive	Body ground	9 to 14 V	Always
CANH	6	CAN "High" line	CANL	54 to 69 Ω	Ignition switch OFF
CANH	6	CAN "High" line	Battery positive	1 MΩ or higher	Ignition switch OFF
CANH	6	CAN "High" line	CG	1 kΩ or higher	Ignition switch OFF
CANL	14	CAN "Low" line	Battery positive	1 MΩ or higher	Ignition switch OFF
CANL	14	CAN "Low" line	CG	1 kΩ or higher	Ignition switch OFF

If the result is not as specified, the DLC3 may have a malfunction. Repair or replace the harness and connector.

HINT:

Connect the cable of the intelligent tester to the DLC3, turn the ignition switch ON and attempt to use the tester. If the display indicates that a communication error has occurred, there is a problem either with the vehicle or with the tester.

If communication is normal when the tester is connected to another vehicle, inspect the DLC3 of the original vehicle.

If communication is still not possible when the tester is connected to another vehicle, the problem may be in the tester itself. Consult the Service Department listed in the tester's instruction manual.

6. BATTERY VOLTAGE

Battery Voltage:

11 to 14 V

If the voltage is below 11 V, recharge or replace the battery before proceeding.

7. MIL (Malfunction Indicator Lamp)

(a) The MIL is illuminated when the ignition switch is first turned ON (the engine is not running).

(b) The MIL should turn OFF when the engine is started. If the MIL remains illuminated, the diagnosis system has detected a malfunction or abnormality in the system.

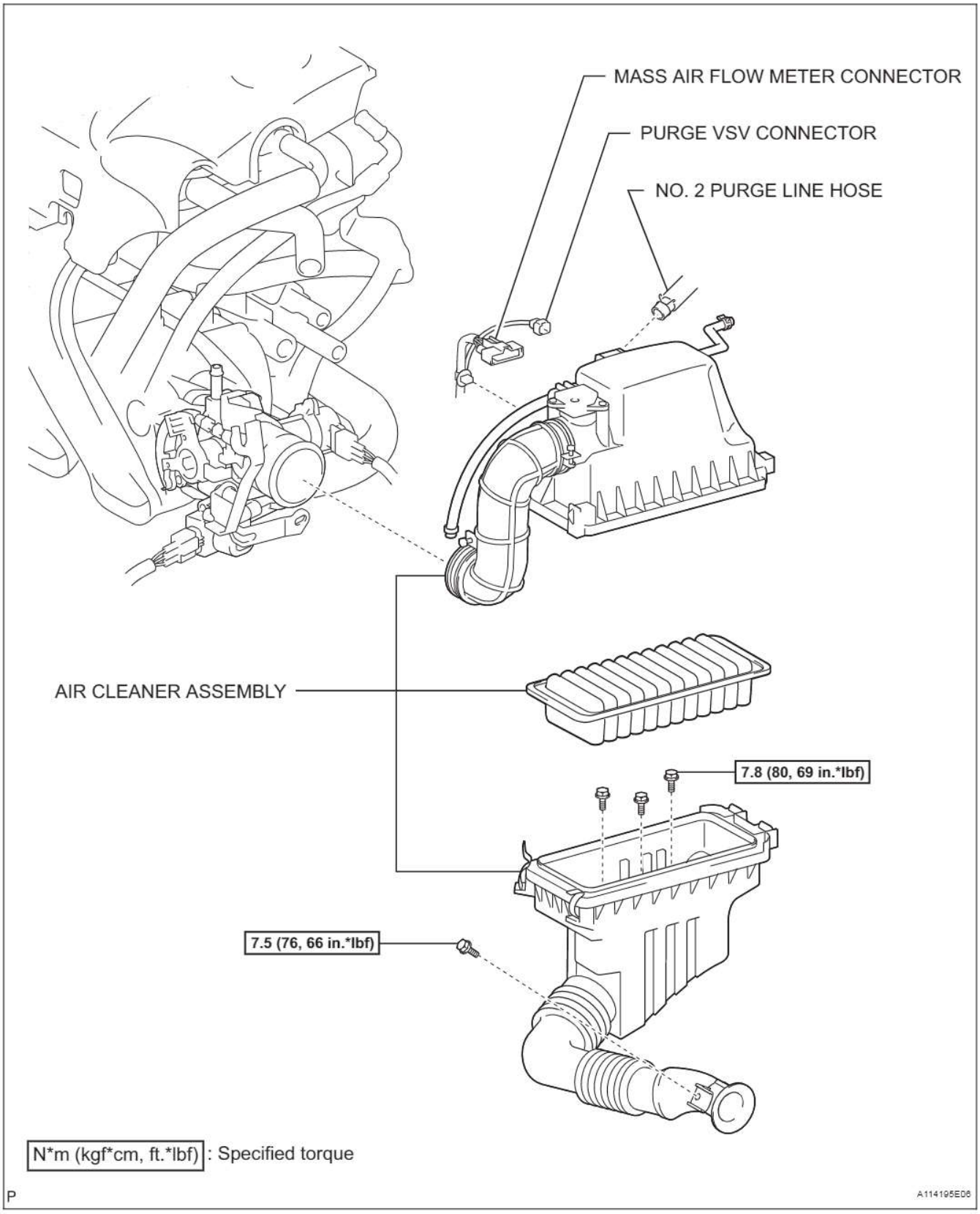
HINT:
If the MIL is not illuminated when the ignition switch is first turned ON, check the MIL circuit (see page ES-322).

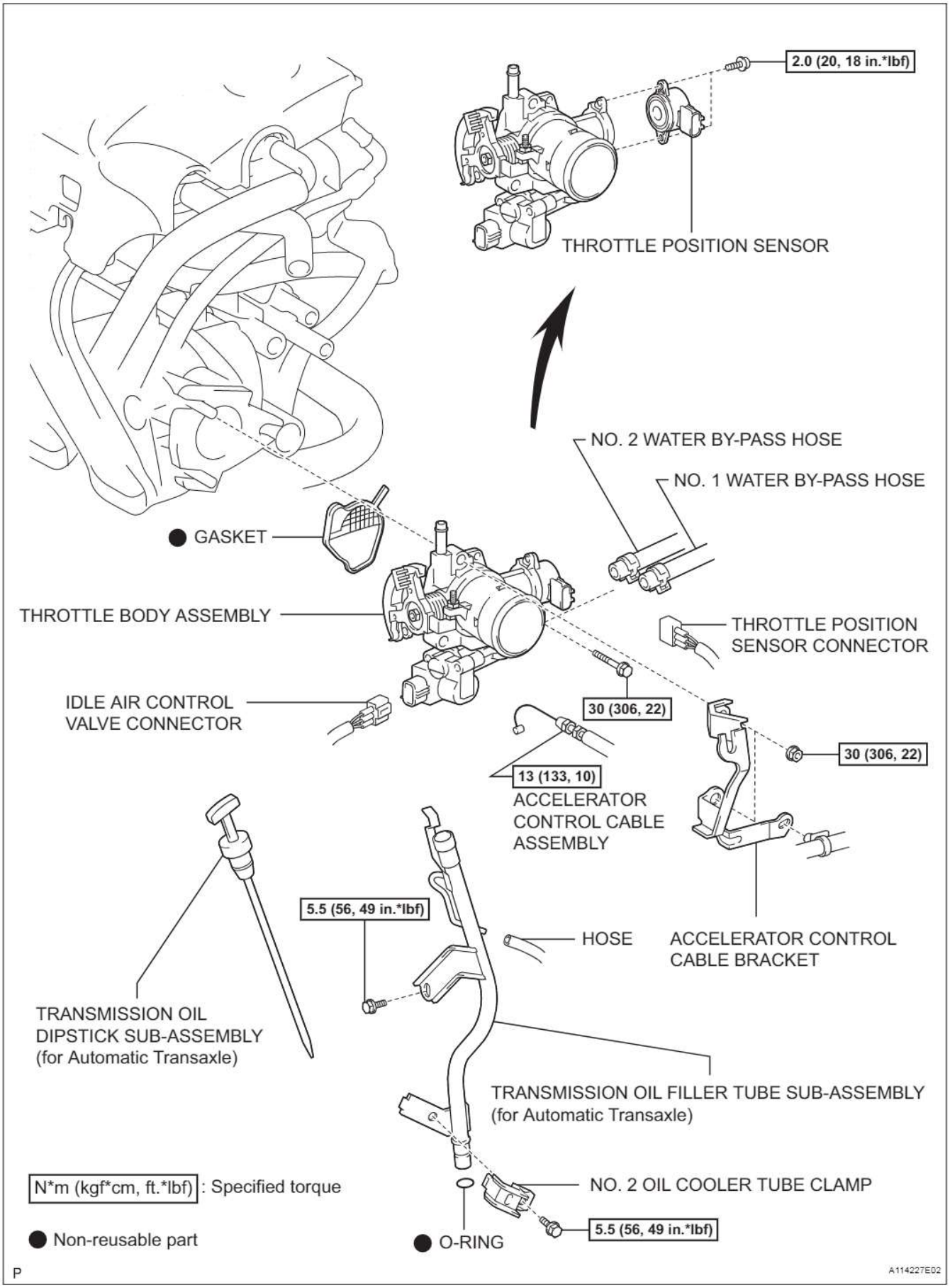
8. ALL READINESS

For the vehicle, using the intelligent tester allows readiness codes corresponding to all DTCs to be read. When diagnosis (normal or malfunctioning) has been completed, readiness codes are set. Enter the following menus on the intelligent tester: ENHANCED OBD II / MONITOR STATUS.

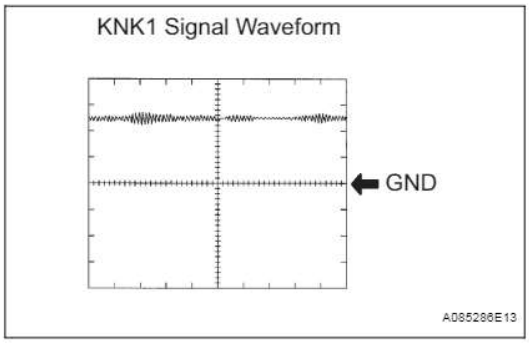
THROTTLE POSITION SENSOR

COMPONENTS



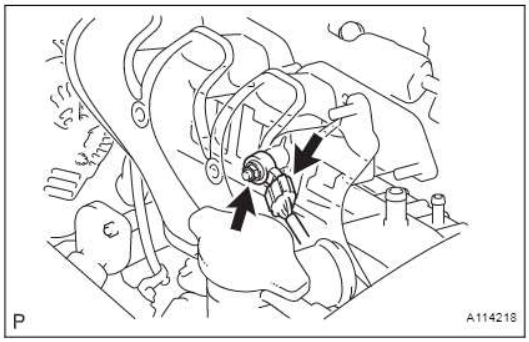

2.0 (20, 18 in.*lbf)
THROTTLE POSITION SENSOR
NO. 2 WATER BY-PASS HOSE
NO. 1 WATER BY-PASS HOSE
GASKET
THROTTLE BODY ASSEMBLY
THROTTLE POSITION SENSOR CONNECTOR
IDLE AIR CONTROL VALVE CONNECTOR
30 (306, 22)
30 (306, 22)
13 (133, 10)
ACCELERATOR CONTROL CABLE ASSEMBLY
5.5 (56, 49 in.*lbf)
HOSE
ACCELERATOR CONTROL CABLE BRACKET
TRANSMISSION OIL DIPSTICK SUB-ASSEMBLY (for Automatic Transaxle)
TRANSMISSION OIL FILLER TUBE SUB-ASSEMBLY (for Automatic Transaxle)
N*m (kgf*cm, ft.*lbf) : Specified torque
NO. 2 OIL COOLER TUBE CLAMP
Non-reusable part
O-RING
5.5 (56, 49 in.*lbf)
P
A114227E02

HINT:
When any of DTCs P0327 and P0328 are set, the ECM enters fail-safe mode. During fail-safe mode, the ignition timing is delayed to its maximum retardation. Fail-safe mode continues until the ignition switch is turned OFF.
Reference: Inspection using an oscilloscope.
The correct waveform is shown.



Items	Contents
Terminals	KNK1 - EKNK
Equipment Settings	0.01 to 10 V/Division, 0.01 to 10 msec./ Division
Conditions	Keep engine speed at 4,000 rpm with warm engine

ES



INSTALLATION

1. **INSTALL KNOCK SENSOR**
   (a) Install the knock sensor with the nut.
   Torque: 20 N*m (204 kgf*cm, 15 ft.*lbf)
   (b) Connect the sensor connector.
2. **INSTALL STARTER ASSEMBLY (See page ST-14)**
3. **INSTALL ENGINE UNDER COVER RH (See page ST-14)**
4. **INSTALL ENGINE UNDER COVER LH (See page ST-14)**
5. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

REMOVAL

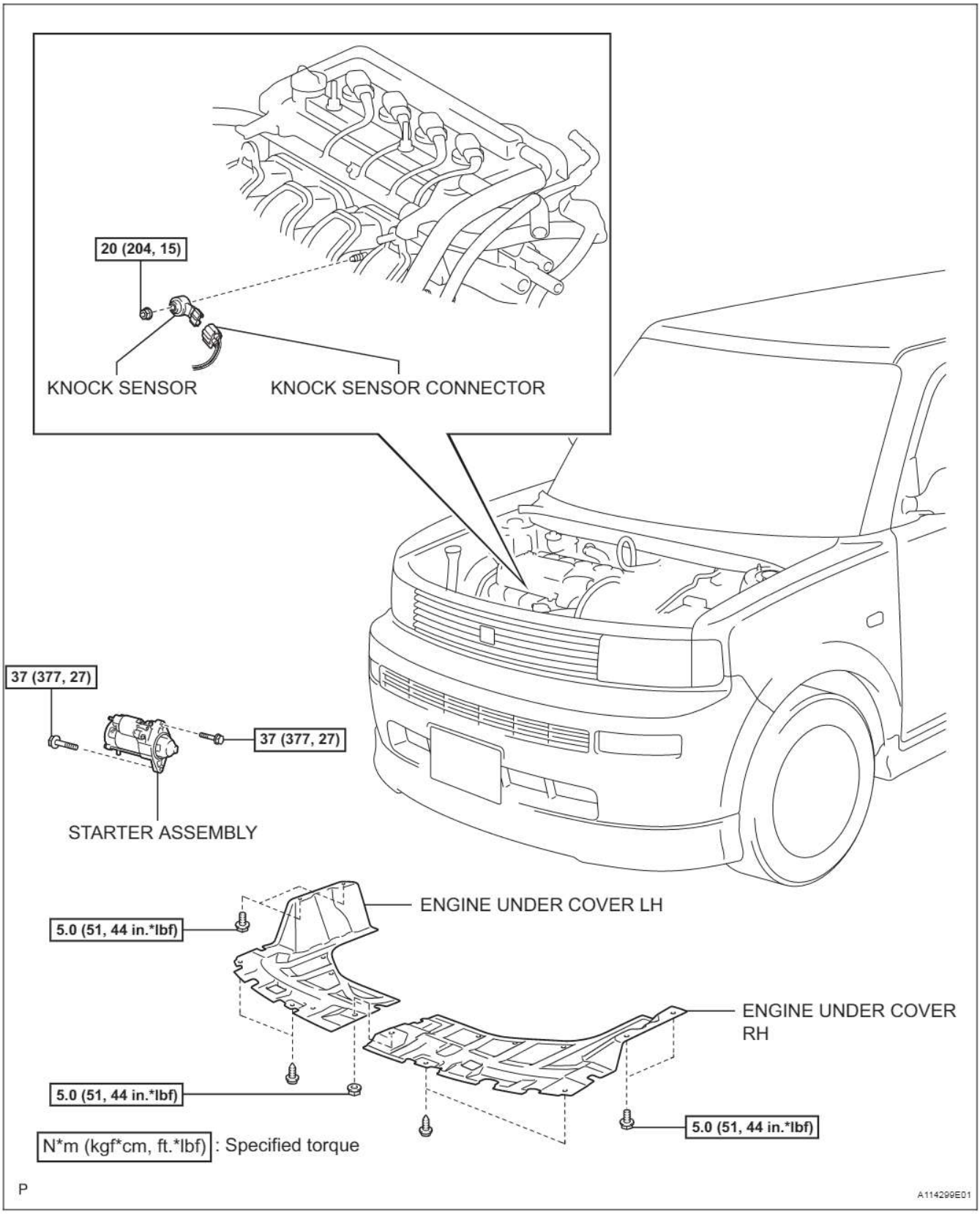
1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
2. **REMOVE GLOVE COMPARTMENT DOOR ASSEMBLY (See page IP-22)**
3. **REMOVE ECM**
   (a) Disconnect the 4 ECM connectors.
   (b) Remove the 2 bolts and ECM.
   (c) Remove the 2 screws and ECM bracket.
   (d) Remove the 2 screws and No. 2 ECM bracket.
   (e) Remove the 2 screws and No. 3 ECM bracket.

INSTALLATION

1. **INSTALL ECM**
   (a) Install the No. 3 ECM bracket with the 2 screws.
   (b) Install the No. 2 ECM bracket with the 2 screws.
   (c) Install the ECM bracket with the 2 screws.
   (d) Install the ECM with the 2 bolts.
   Torque: 3.0 N*m (31 kgf*cm, 27 in.*lbf)
   (e) Connect the 4 ECM connectors.
2. **INSTALL GLOVE COMPARTMENT DOOR ASSEMBLY (See page IP-34)**
3. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

KNOCK SENSOR

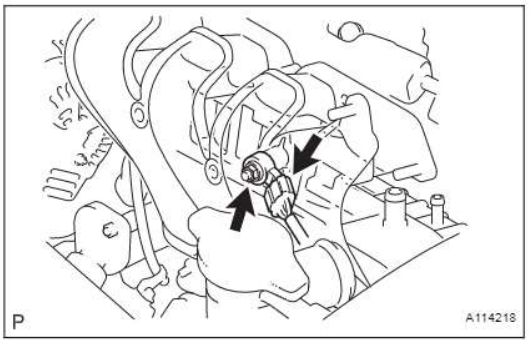
COMPONENTS

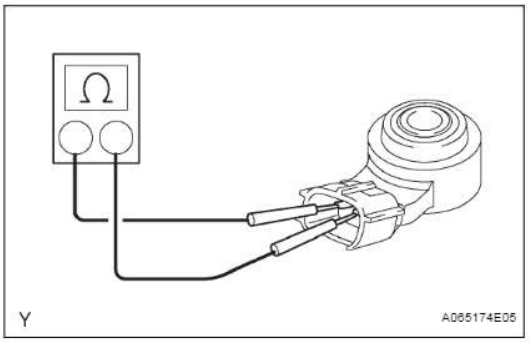


ES

REMOVAL

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
2. **REMOVE ENGINE UNDER COVER LH (See page ST-8)**
3. **REMOVE ENGINE UNDER COVER RH (See page ST-8)**
4. **REMOVE STARTER ASSEMBLY (See page ST-8)**
5. **REMOVE KNOCK SENSOR**
   (a) Disconnect the sensor connector.
   (b) Remove the nut and sensor.





INSPECTION

1. **INSPECT KNOCK SENSOR**
   (a) Measure the resistance of the sensor.
   Standard resistance:
   120 to 280 kΩ at 20°C (68°F)
   If the result is not as specified, replace the knock sensor.
   DESCRIPTION
   A flat type knock sensor (non-resonant type) has a structure that can detect vibrations over a wide band of frequencies: between approximately 6 kHz and 15 kHz.
   Knock sensors are fitted onto the engine block to detect engine knocking.
   The knock sensor contains a piezoelectric element which generates a voltage when it becomes deformed. The voltage is generated when the engine block vibrates due to knocking. Any occurrence of engine knocking can be suppressed by delaying the ignition timing.

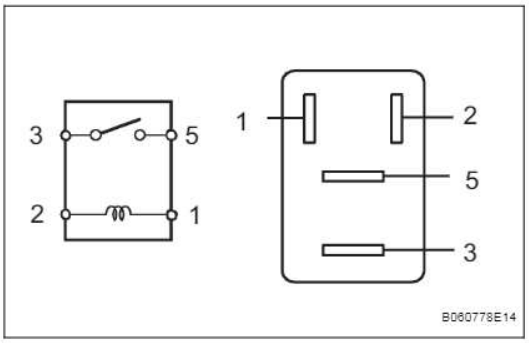
DTC No.	DTC Detection Condition	Trouble Area
P0327	Output voltage of knock sensor 0.5 V or less (1 trip detection logic)	• Short in knock sensor circuit • Knock sensor • ECM
P0328	Output voltage of knock sensor 4.5 V or more (1 trip detection logic)	• Open in knock sensor circuit • Knock sensor • ECM

EFI RELAY

ON-VEHICLE INSPECTION

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.

2. **REMOVE EFI RELAY (Marking: EFI)**
   (a) Remove the engine room relay block cover.
   (b) Remove the EFI relay from the engine room relay block.



3. **INSPECT EFI RELAY**
   (a) Measure the resistance of the EFI relay.
   Standard resistance

Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

If the result is not as specified, replace the EFI relay.

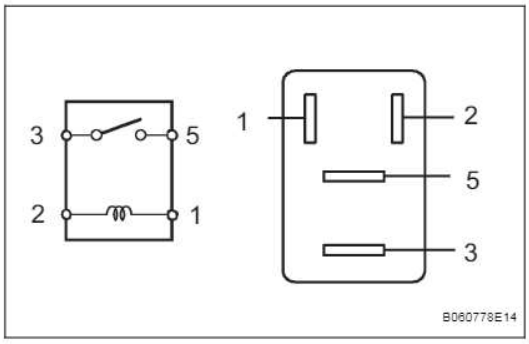
4. **INSTALL EFI RELAY**

5. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

CIRCUIT OPENING RELAY

ON-VEHICLE INSPECTION

1. **DISCONNECT CABLE FROM NEGATIVE BATTERY TERMINAL**
   CAUTION:
   Wait at least 90 seconds after disconnecting the cable from the negative (-) battery terminal to prevent airbag and seat belt pretensioner activation.
2. **REMOVE CIRCUIT OPENING RELAY (Marking: C/OPN)**
   (a) Remove the circuit opening relay from the instrument panel junction block.
3. **INSPECT CIRCUIT OPENING RELAY**
   (a) Measure the resistance of the circuit opening relay.
   Standard resistance



Tester Connection	Specified Condition
3 - 5	10 kΩ or higher
3 - 5	Below 1 Ω (when battery voltage is applied to terminals 1 and 2)

If the result is not as specified, replace the circuit opening relay.

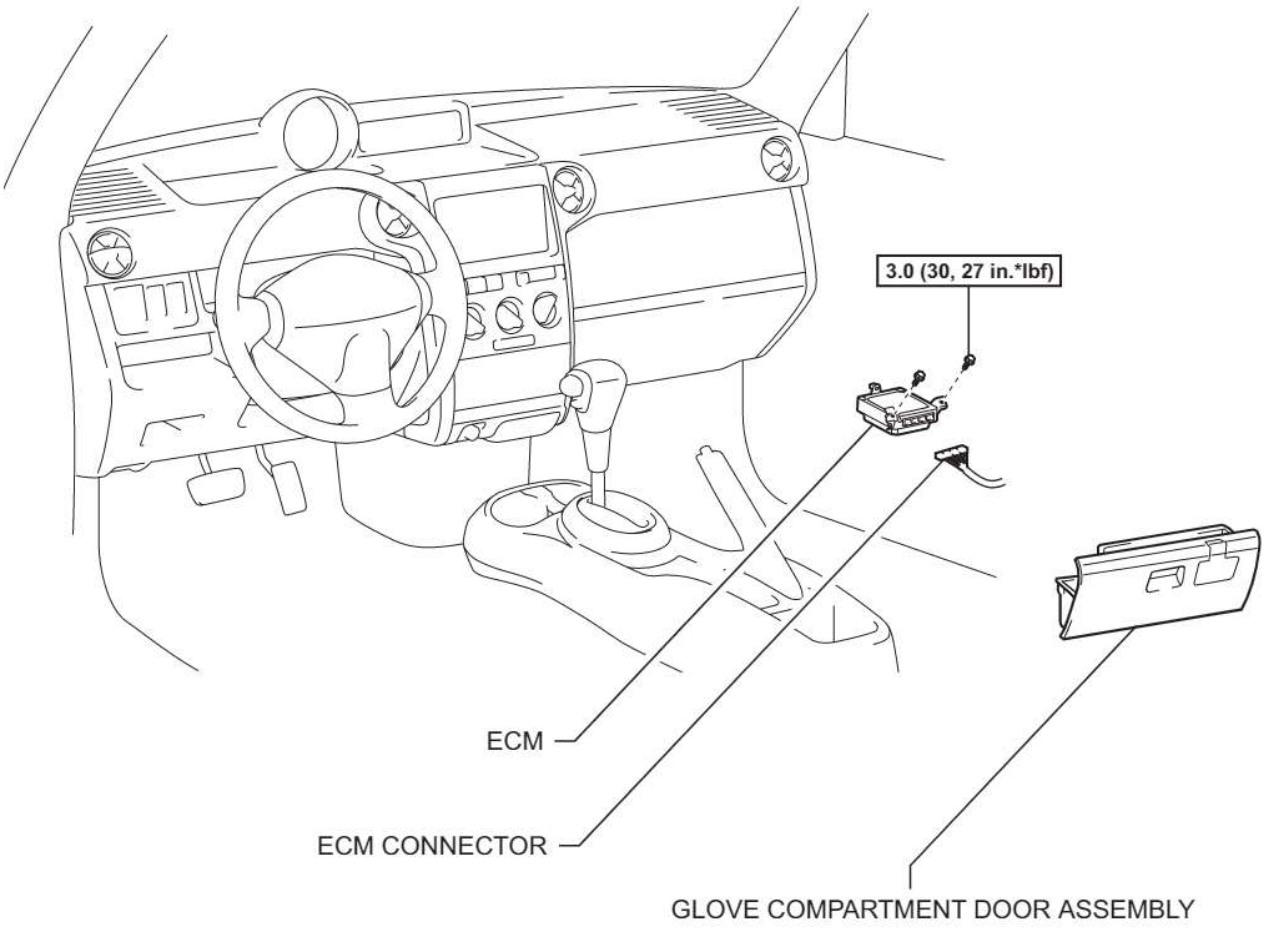
4. **INSTALL CIRCUIT OPENING RELAY**
5. **CONNECT CABLE TO NEGATIVE BATTERY TERMINAL**

ES

ECM

COMPONENTS

ES



N*m (kgf*cm, ft.*lbf) : Specified torque

P A114311E01

ON-VEHICLE INSPECTION

1. **CHECK ECM**
   (a) Check the ECM (see page ES-30).