DTC	P2120	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D” CIRCUIT

DTC	P2122	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D” CIRCUIT LOW INPUT

DTC	P2123	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D” CIRCUIT HIGH INPUT

DTC	P2125	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”E” CIRCUIT

DTC	P2127	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”E” CIRCUIT LOW INPUT

DTC	P2128	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”E” CIRCUIT HIGH INPUT

DTC	P2138	THROTTLE/PEDAL POSITION SENSOR/SWITCH ”D”/”E” VOLTAGE CORRELATION

HINT:
This is the repair procedure for the ”accelerator pedal position sensor”.

CIRCUIT DESCRIPTION

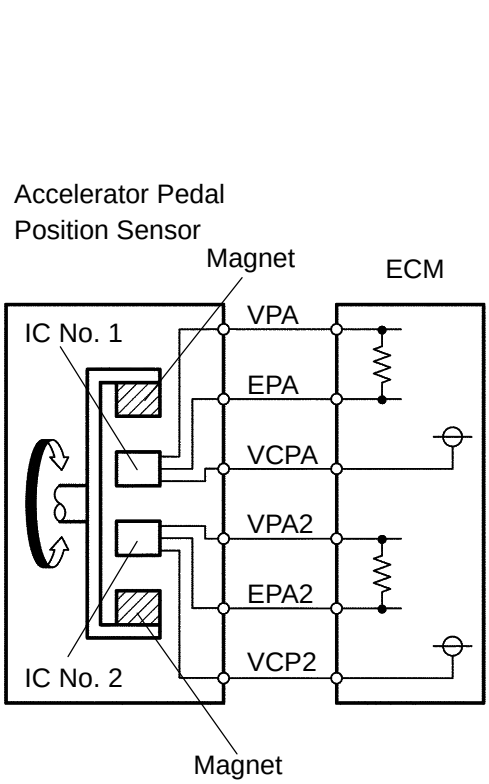
HINT:

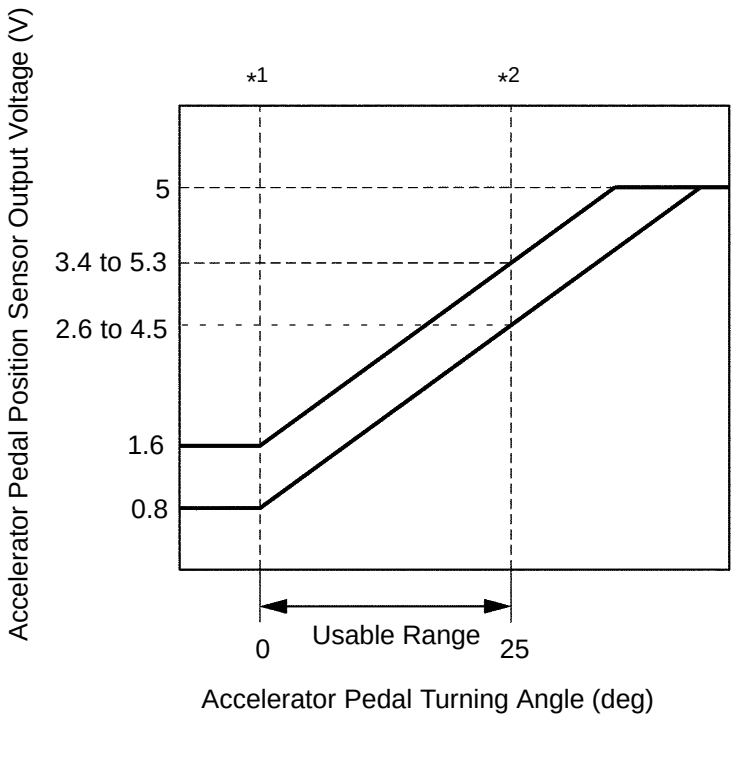
- This Electronic Throttle Control System (ETCS) does not use a throttle cable.
- This description is for the accelerator pedal position sensor.

The Accelerator Pedal Position (APP) sensor is mounted on the accelerator pedal to detect the angle of the accelerator pedal. This sensor is electronically controlled and uses Hall-effect elements.

In the accelerator pedal position sensor, the voltage applied to terminals VPA and VPA2 of the ECM changes between 0 V and 5 V in proportion to the angle of the accelerator pedal. The VPA is a signal to indicate the actual accelerator pedal angle and is used for the engine control. VPA2 is used to detect malfunctions of the sensor itself.

The ECM monitors the accelerator pedal angle from VPA and VPA2 signal outputs, and controls the throttle motor based on these signals.





DTC No.	DTC Detection Condition (All of the following are 1 trip detection logic)	Trouble Area
P2120	Condition (a) continues for 0.5 sec. or more: (a) VPA is 0.2 V or less or VPA is 4.8 V or more	• Accelerator pedal position sensor • ECM
P2122	VPA is 0.2 V or less for 0.5 sec. or more when VPA2 output indicates accelerator pedal is opened	• Accelerator pedal position sensor • Open in VCP1 circuit • VPA circuit open or ground short • ECM
P2123	Condition (a) continues for 2.0 sec. or more: (a) VPA is 4.8 V or more	• Accelerator pedal position sensor • Open in EPA circuit • ECM
P2125	Condition (a) continues for 0.5 sec. or more: (a) (VPA2 is 0.5 V or less) or (VPA2 is 4.8 V or more)	• Accelerator pedal position sensor • ECM
P2127	VPA2 is 0.5 V or less for 0.5 sec. or more when VPA output indicates accelerator pedal is opened	• Accelerator pedal position sensor • Open in VCP2 circuit • VPA2 circuit open or ground short • ECM
P2128	Conditions (a) and (b) continue for 2.0 sec. or more: (a) VPA2 is 4.8 V or more (b) VPA is 0.2 V or more and VPA is 3.45 V or less	• Accelerator pedal position sensor • Open in EPA2 circuit • ECM
P2138	Condition (a) or (b) continues for 2.0 sec. or more: (a) Difference between VPA and VPA2 is 0.02 V or less (b) VPA is 0.2 V or less and VPA2 is 0.5 V or less	• VPA and VPA2 circuit are short circuited • Accelerator pedal position sensor • ECM

HINT:

After confirming DTC P2120, P2122, P2123, P2125, P2127, P2128 and P2138, use the hand-held tester or the OBD II scan tool to confirm the accelerator pedal position sensor output voltage.

Trouble Area	Accelerator pedal position expressed as voltage output			
	Accelerator pedal released		Accelerator pedal depressed	
	ACCEL POS #1	ACCEL POS #2	ACCEL POS #1	ACCEL POS #2
VCP circuit open	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V	0 to 0.2 V
VPA circuit open or ground short	0 to 0.2 V	1.2 to 2.0 V	0 to 0.2 V	3.4 to 5.3 V
VPA2 circuit open or ground short	0.5 to 1.1 V	0 to 0.2 V	2.6 to 4.5 V	0 to 0.2 V
EPA circuit open	4.5 to 5.5 V	4.5 to 5.5 V	4.5 to 5.5 V	4.5 to 5.5 V

MONITOR DESCRIPTION

When VPA or VPA2 deviates from the standard, or the difference between the voltage outputs of the two sensors is less than the threshold, the ECM concludes that there is a defect in the accelerator pedal position sensor. The ECM turns on the MIL and a DTC is set.

Example:

The voltage output of the VPA is below 0.2 V or exceeds 4.8 V.

FAIL-SAFE

The accelerator pedal position sensor has 2 (main and sub) sensor circuits. If a malfunction occurs in either of the sensor circuits, the ECM detects the abnormal signal voltage difference between the 2 sensor circuits and switches to fail-safe mode. In fail-safe mode, the remaining circuit is used to calculate the accelerator pedal opening angle to allow the vehicle to continue driving.

If both circuits malfunction, the ECM regards the opening angle of the accelerator pedal to be fully closed. In this case, the throttle valve will remain closed as if the engine is idling.

If a ”pass” condition is detected and then the ignition switch is turned OFF, the fail-safe operation will stop and the system will return to normal condition.

MONITOR STRATEGY

Related DTCs	P2120: APP (Accelerator pedal position) Sensor 1 range check (chattering) P2122: APP sensor 1 range check (low voltage) P2123: APP sensor 1 range check (high voltage) P2125: APP sensor 2 range check (chattering) P2127: APP sensor 2 range check (low voltage) P2128: APP sensor 2 range check (high voltage) P2138: APP sensor range check (correlation)
Required sensors / components (Main)	APP sensor
Required sensors / components (Related)	-
Frequency of operation	Continuous
Duration	0.5 sec.: P2120, P2122, P2125 and P2127 2 sec.: P2123, P2128 and P2138
MIL operation	Immediate
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

The monitor will run whenever these DTCs are not present	See page 05-16

TYPICAL MALFUNCTION THRESHOLDS

P2120:

Either of the following conditions is met:	Condition 1 or 2
1. VPA1 voltage when VPA2 is 0.97° or more	0.2 V or less
2. VPA1 voltage	4.8 V or more

P2122:

VPA1 voltage when VPA2 is 0.97° or more	0.2 V or less

P2123:

VPA1 voltage	4.8 V or more

P2125:

Either of the following conditions is met:	Condition 1 or 2
1. VPA2 voltage when VPA1 is 0.97° or more	0.5 V or less
2. VPA2 voltage when VPA1 is 0.2 to 3.45 V	4.8 V or more

P2127:

VPA2 voltage when VPA1 is 0.97° or more	0.5 V or less

P2128:

VPA2 voltage when VPA1 is 0.2 to 3.45 V	4.8 V or more

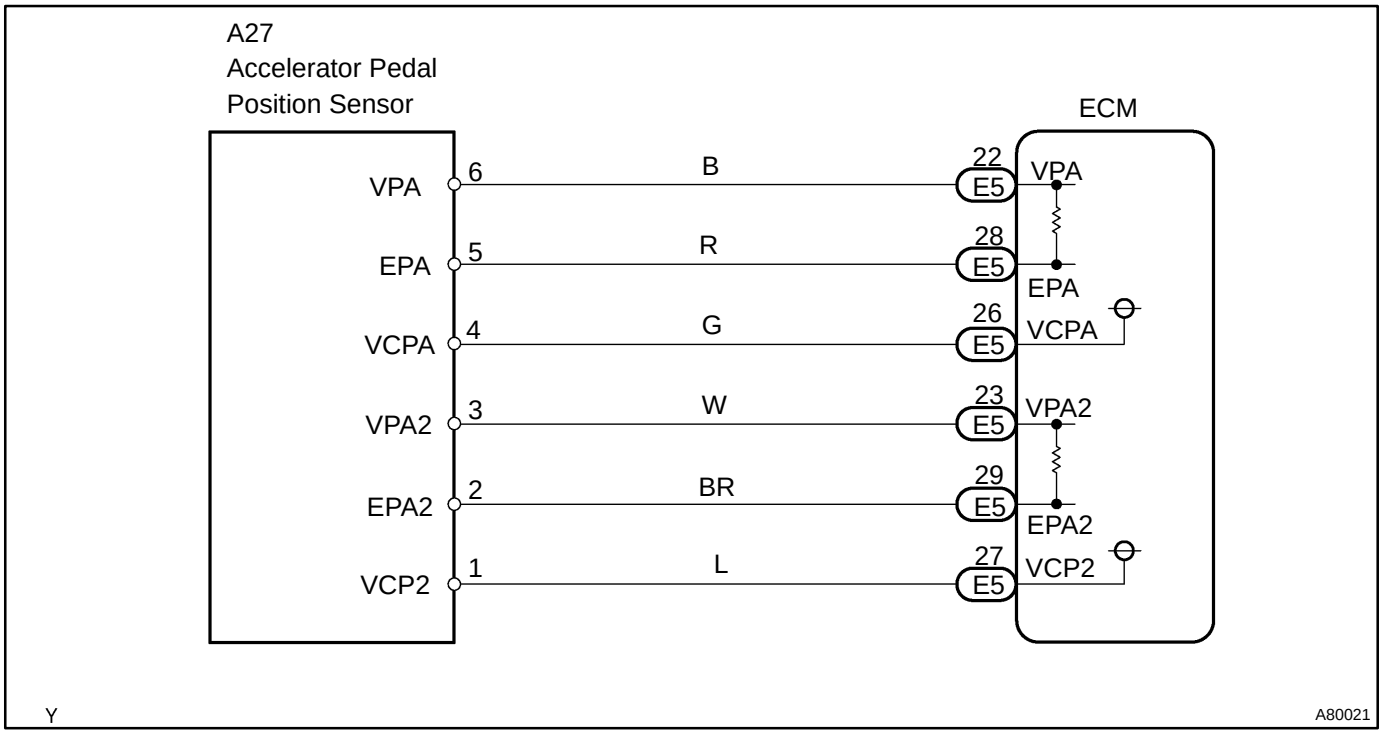
P2138:

Either of the following conditions is met:	Condition 1 or 2
1. Difference betrween VPA 1 and VPA2 voltage	0.02 V or less
Condition 2	-
VPA1 voltage	0.2 V or less
VPA2 voltage	0.5 V or less

COMPONENT OPERATING RANGE

VPA voltage	0.5 to 4.5 V
VPA2 voltage	1.2 to 4.8 V

WIRING DIAGRAM



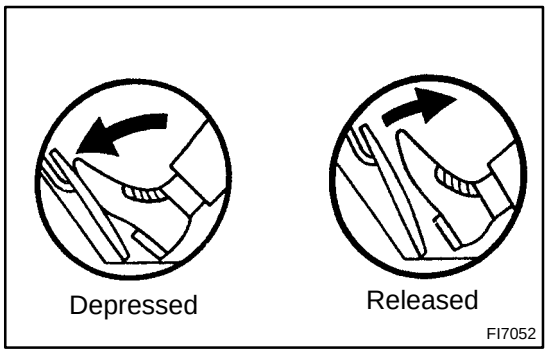
INSPECTION PROCEDURE

HINT:

Read freeze frame data using the hand−held tester or the OBD II scan tool. 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.

Hand-held tester:

1	READ VALUE OF HAND-HELD TESTER (ACCEL POS #1 AND ACCEL POS #2)



(a) Connect the hand-held tester to the DLC3.
(b) Turn the ignition switch ON.
(c) On the hand-held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ETCS / ACCEL POS #1 and ACCEL POS #2" and read its value displayed on the hand-held tester.

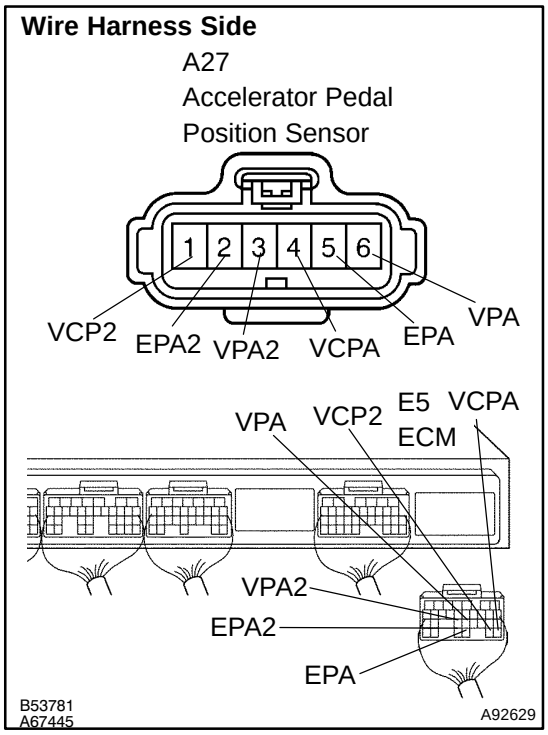
Standard:

Accelerator Pedal	ACCEL POS #1	ACCEL POS #2
Released	0.5 to 1.1 V	1.2 to 2.0 V
Depressed	2.6 to 4.5 V	3.4 to 5.3 V

OK → **Go to step 5**

NG

2 CHECK WIRE HARNESS (ACCELERATOR PEDAL POSITION SENSOR - ECM)



(a) Disconnect the A27 sensor connector.
(b) Disconnect the E5 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

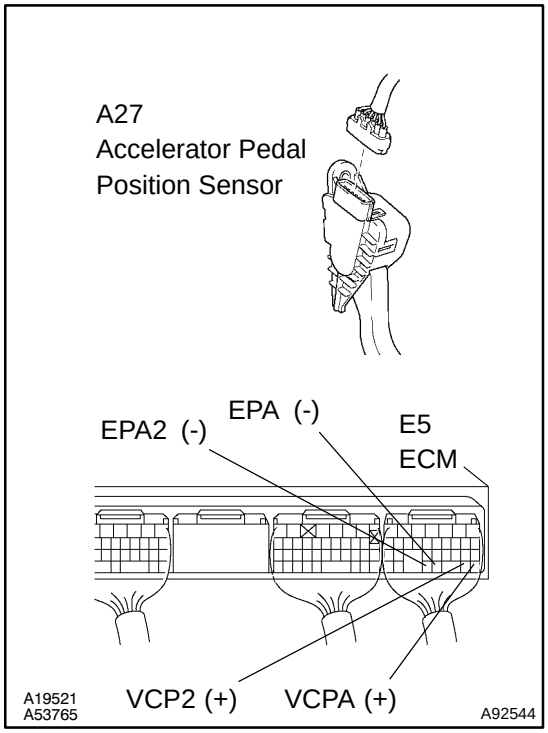
Standard:

Tester Connection	Specified Condition
VPA (A27-6) - VPA (E5-22) EPA (A27-5) - EPA (E5-28) VCPA (A27-4) - VCPA (E5-26) VPA2 (A27-3) - VPA2 (E5-23) EPA2 (A27-2) - EPA2 (E5-29) VCP2 (A27-1) - VCP2 (E5-27)	Below 1 Ω
VPA (A27-6) or VPA (E5-22) - Body ground EPA (A27-5) or EPA (E5-28) - Body ground VCPA (A27-4) or VCPA (E5-26) - Body ground VPA2 (A27-3) or VPA2 (E5-23) - Body ground EPA2 (A27-2) or EPA2 (E5-29) - Body ground VCP2 (A27-1) or VCP2 (E5-27) - Body ground	10 kΩ or higher

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

OK

3 INSPECT ECM (VCPA AND VCP2 VOLTAGE)



(a) Disconnect the A27 sensor connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage of the ECM connector.

Standard:

Tester Connection	Specified Condition
VCPA (E5-26) - EPA (E5-28) VCP2 (E5-27) - EPA2 (E5-29)	4.5 to 5.5 V

NG → **REPLACE ECM (See page 10-9)**

OK

4	REPLACE ACCELERATOR PEDAL ROD ASSY (See page 10-1 1)

GO

5	READ OUTPUT DTC (ACCELERATOR PEDAL POSITION SENSOR DTCS ARE OUTPUT AGAIN)

(a) Clear the DTC (see page 05-38).
(b) Start the engine.
(c) Run the engine at idle for 15 seconds or more.
(d) Read the DTC.

Result:

Display (DTC Output)	Proceed to
P2120, P2122, P2123, P2125, P2127, P2128 and/or P2138 are output again	A
No DTC output	B

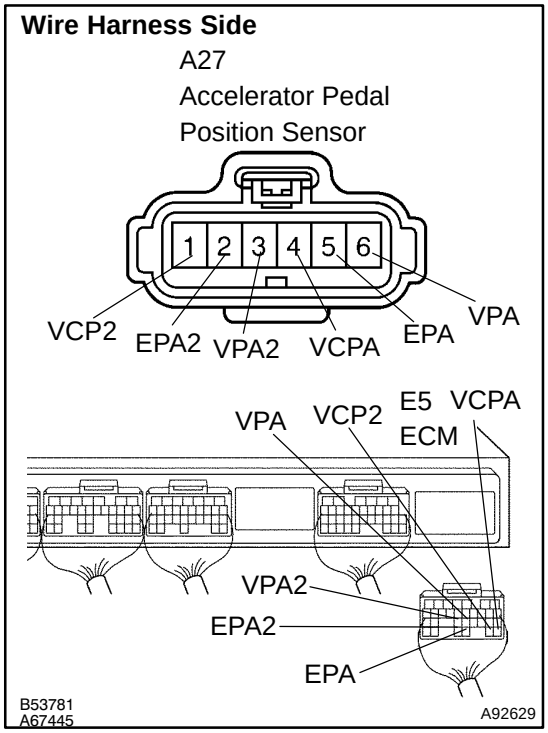
B → **SYSTEM OK**

A

REPLACE ECM (See page 10-9)

OBD II scan tool (excluding hand-held tester):

1	CHECK WIRE HARNESS (ACCELERATOR PEDAL POSITION SENSOR - ECM)



(a) Disconnect the A27 sensor connector.
(b) Disconnect the E5 ECM connector.
(c) Measure the resistance of the wire harness side connectors.

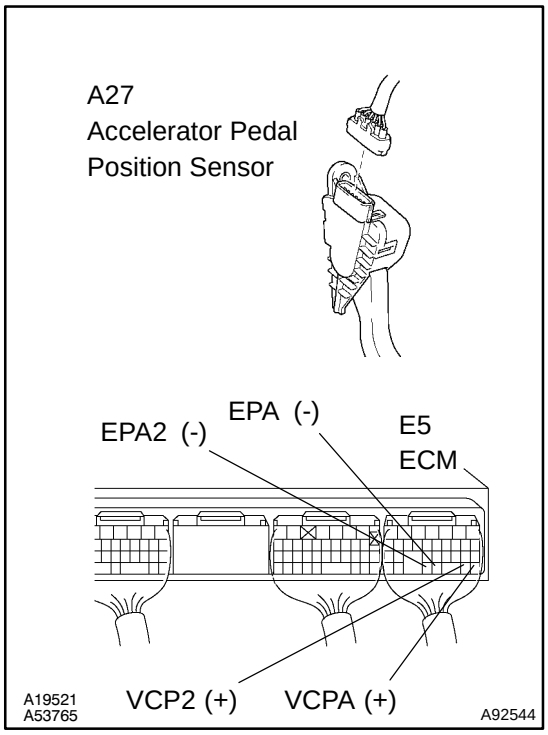
Standard:

Tester Connection	Specified Condition
VPA (A27-6) - VPA (E5-22) EPA (A27-5) - EPA (E5-28) VCPA (A27-4) - VCPA (E5-26) VPA2 (A27-3) - VPA2 (E5-23) EPA2 (A27-2) - EPA2 (E5-29) VCP2 (A27-1) - VCP2 (E5-27)	Below 1 Ω
VPA (A27-6) or VPA (E5-22) - Body ground EPA (A27-5) or EPA (E5-28) - Body ground VCPA (A27-4) or VCPA (E5-26) - Body ground VPA2 (A27-3) or VPA2 (E5-23) - Body ground EPA2 (A27-2) or EPA2 (E5-29) - Body ground VCP2 (A27-1) or VCP2 (E5-27) - Body ground	10 kΩ or higher

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

OK

2	INSPECT ECM (VCPA AND VCP2 VOLTAGE)



(a) Disconnect the A27 sensor connector.
(b) Turn the ignition switch ON.
(c) Measure the voltage of the ECM connector.

Standard:

Tester Connection	Specified Condition
VCPA (E5-26) - EPA (E5-28) VCP2 (E5-27) - EPA2 (E5-29)	4.5 to 5.5 V

NG → **REPLACE ECM (See page 10-9)**

OK

3	REPLACE ACCELERATOR PEDAL ROD ASSY (See page 10-11)

GO

4	READ OUTPUT DTC (ACCELERATOR PEDAL POSITION SENSOR DTCS ARE OUTPUT AGAIN)

(a) Clear the DTC (see page 05-38).
(b) Start the engine.
(c) Run the engine at idle for 15 seconds or more.
(d) Read the DTC.

Result:

Display (DTC Output)	Proceed to
P2120, P2122, P2123, P2125, P2127, P2128 and/or P2138 are output again	A
No DTC output	B

B → **SYSTEM OK**

A

REPLACE ECM (See page 10-9)