

BLACK SMOKE

HINT:

Specified values in the following troubleshooting flowchart are for reference only. Variations in the Data List result values may occur depending on the measuring conditions or the vehicle's age. Do not judge the vehicle to be normal even when the Data List values indicate a standard level. There are possibly some concealed factors of the malfunction.

INSPECTION PROCEDURE

1 READ OUTPUT DTCs (RELATED TO ENGINE)

- Connect the intelligent tester II to the DLC3.
- Turn the ignition switch to ON and turn the intelligent tester II ON.
- Select the following menu items: Powertrain / Engine and ECT / DTC.
- Read DTCs.

Result:

Display (DTC Output)	Proceed To
Other than engine-related DTCs (See page 05-458)	A
DTCs related to the engine (See page 05-458)	B

B

REPAIR OR REPLACE ENGINE CONTROL SYSTEM ACCORDING TO DTC OUTPUT (See page 05-458)

A

2 READ VALUE OF INTELLIGENT TESTER II

- Connect the intelligent tester II to the DLC3.
- Start the engine and turn the intelligent tester II ON.
- Select the following menu items: Powertrain / Engine and ECT / Data List / Injection Volume and Revised Injection Volume #1, #2, #3 and #4.
- Read the value.

Standard:

Item	Engine Speed *	Reference Value
Injection Volume	Idling (No engine load)	3 to 10 mm ³
Revised Injection Volume #1	Idling (No engine load)	-4.9 to 4.9 mm ³
Revised Injection Volume #2	Idling (No engine load)	-4.9 to 4.9 mm ³
Revised Injection Volume #3	Idling (No engine load)	-4.9 to 4.9 mm ³
Revised Injection Volume #4	Idling (No engine load)	-4.9 to 4.9 mm ³

*: If no conditions are specifically stated for "Idling", it means the A/C switch is OFF and all accessory switches are OFF.

NG

Go to step 11

OK

3 PERFORM ENGINE RPM ACCELERATION

HINT:

If the exhaust gas contains excessive black smoke, perform the following steps.

- (a) Accelerate the engine speed up to the maximum RPM with no load 20 times.
- (b) Check the volume of black smoke in the exhaust gas.

Result:

Result	Proceed To
Black smoke is faded	OK
Black smoke remains in the exhaust gas	NG

HINT:

Deposited soot in the exhaust system can be a source of excessive black smoke.

NG**Go to step 4****OK****END****4 CHECK AIR INTAKE SYSTEM AND EXHAUST SYSTEM**

- (a) Remove the air cleaner filter.
- (b) Inspect the EGR valve operation.
 - (1) Start the engine and warm it up.
 - (2) Check that clicking sounds are heard from the EGR valve when the vacuum hose is disconnected from EGR valve with the engine in an idling condition.
- (c) Inspect the intake shutter (throttle valve) operation.
 - (1) Start the engine.
 - (2) Check if the intake shutter fully opens when accelerating the engine speed.

HINT:

While revving up, the EGR valve is fully closed and the intake shutter is fully opened. If the systems are normal, the volume of black smoke will decrease.

NG**Go to step 5****OK****CHECK AND REPAIR LOCATION WHERE MALFUNCTION EXIST**

5 READ VALUE OF INTELLIGENT TESTER II(MASS AIR FLOW RATE)**HINT:**

DTC P0100 (1 trip detection logic) is set if there is an open or short malfunction in the Mass Air Flow (MAF) meter. DTC P0101 (2 trip detection logic) is set if there are any other malfunctions in the MAF meter.

- (a) Disconnect the throttle control motor connector.
- (b) Disconnect the EGR valve connector.
- (c) Connect the intelligent tester II to the DLC3.
- (d) Start the engine and turn the intelligent tester II ON.
- (e) Select the following menu items: Powertrain / Engine and ECT / Data List / MAF.
- (f) Read the value.

Result:

Engine Speed Condition	Air Flow Rate (gm/s)
750 rpm	7.7 to 10.6

- (g) Reconnect the throttle control motor connector.
- (h) Reconnect the EGR valve connector.

NG**REPLACE MASS AIR FLOW METER****OK****6 CHECK TURBOCHARGING PRESSURE
(See page 13-3 of Pub. No. RM864E AVENSIS VERSO/ PICNIC REPAIR MANUAL)****NG****REPLACE TURBOCHARGER SUB-ASSY
(See page 13-6 of Pub. No. RM864E AVENSIS
VERSO/ PICNIC REPAIR MANUAL)****OK**

7 READ VALUE OF INTELLIGENT TESTER

- (a) Connect the intelligent tester to the DLC3.
- (b) Start the engine and turn the intelligent tester ON.
- (c) Select the following menu items: Powertrain / Engine and ECT / Data List.
- (d) Select the following menu items in order and read the values displayed on the intelligent tester respectively.
- (1) Common Rail Pressure
 - (2) Pump VCM Angle
 - (3) Injection Volume
 - (4) M-INJ/PILOT ON
 - (5) M-INJ/PILOT OFF
 - (6) Pilot-Injection
 - (7) Injection Timing
 - (8) Revised Injection Volume #1, #2, #3 and #4

Reference:

Item	Engine Speed	Reference Value
Common Rail Pressure	Idling	20 to 40 MPa
Common Rail Pressure	2,000 rpm (No engine load)	40 to 80 MPa
Common Rail Pressure	3,000 rpm (No engine load)	50 to 85 MPa
Injection Volume	Idling	3 to 10 mm ³
Injection Volume	2,000 rpm (No engine load)	3 to 10 mm ³
Injection Volume	3,000 rpm (No engine load)	3 to 15 mm ³
M-INJ/PILOT ON	Idling	600 to 1,200 μs
M-INJ/PILOT OFF	Idling	0 μs
Pilot-Injection	Idling	400 to 700 μs
Injection Timing	Idling	-1 to 5 °CA
Injection Timing	2,000 rpm (No engine load)	-3 to 1 °CA
Injection Timing	3,000 rpm (No engine load)	0 to 6 °CA
Revised Injection Volume #1	Idling	-4.9 to 4.9 mm ³
Revised Injection Volume #2	Idling	-4.9 to 4.9 mm ³
Revised Injection Volume #3	Idling	-4.9 to 4.9 mm ³
Revised Injection Volume #4	Idling	-4.9 to 4.9 mm ³

*: If no conditions are specifically stated for "Idling", it means the A/C switch is OFF and all accessory switches are OFF.

Result:

Result	Proceed To
Within the reference value	A
One of the INJ VOL FB #1 to #4 indicates out of the reference value	B
Other than above	C

B**GO TO DTC P1238 (See page 05-557)****C****Go to step 11****A**

8 INSPECT CYLINDER COMPRESSION PRESSURE (See page 14-72 of Pub. No. RM864E AVENSIS VERSO/ PICNIC REPAIR MANUAL)

NG

CHECK AND REPAIR ENGINE

OK

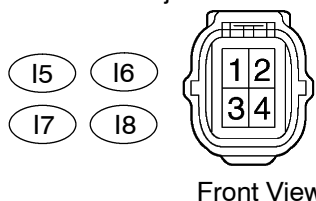
9 CHECK HARNESS AND CONNECTOR(INJECTOR - EDU)

HINT:

DTC P0200 (1 trip detection logic) is set if there is an open or short malfunction in the EDU circuit.

Wire Harness Side:

Injector Connector

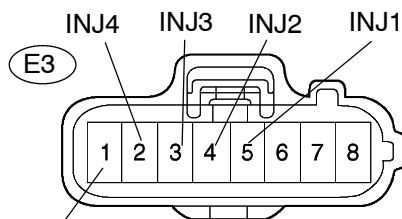


Front View

Y

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Wire Harness Side:



COM

EDU Connector

Front View

Y

A56874

- (a) Check the harness and connectors between the injector and EDU (INJ terminal).

- (1) Disconnect the I5, I6, I7, and I8 injector connectors.
- (2) Disconnect the E3 EDU connector.
- (3) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
Injector (I5-3) - INJ1 (E3-5)	Below 1 Ω
Injector (I6-3) - INJ2 (E3-4)	
Injector (I7-3) - INJ3 (E3-3)	
Injector (I8-3) - INJ4 (E3-2)	
Injector (I5-4) - COM (E3-1)	
Injector (I6-4) - COM (E3-1)	
Injector (I7-4) - COM (E3-1)	
Injector (I8-4) - COM (E3-1)	

Standard (Check for short):

Tester Connection	Specified Condition
Injector (I5-3) or INJ1 (E3-5) - Body ground	10 k Ω or higher
Injector (I6-3) or INJ2 (E3-4) - Body ground	
Injector (I7-3) or INJ3 (E3-3) - Body ground	
Injector (I8-3) or INJ4 (E3-2) - Body ground	
Injector (I5-4) or COM (E3-1) - Body ground	
Injector (I6-4) or COM (E3-1) - Body ground	
Injector (I7-4) or COM (E3-1) - Body ground	
Injector (I8-4) or COM (E3-1) - Body ground	

- (4) Reconnect the injector connector.
- (5) Reconnect the EDU connector.

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REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

10 PERFORM ACTIVE TEST BY INTELLIGENT TESTER II (INJECTOR CUT #1 TO #4)

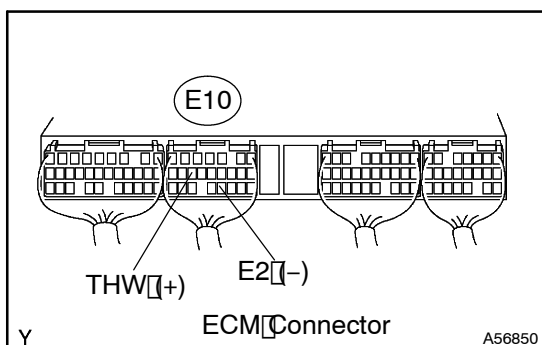
- Connect the intelligent tester II to the DLC3.
- Start the engine and turn the intelligent tester II ON.
- Select the following menu items: Powertrain / Engine and ECT / Active Test / Injector Cut #1, #2, #3 and #4.
- Check the engine idling condition while the fuel injection of each cylinder is cut using the intelligent tester II.

Result:

Engine Idling Condition	Proceed To
Becomes Unstable	A
Does Not Change	B

HINT:

Replace the injector mounted on the cylinder that causes rough idling.

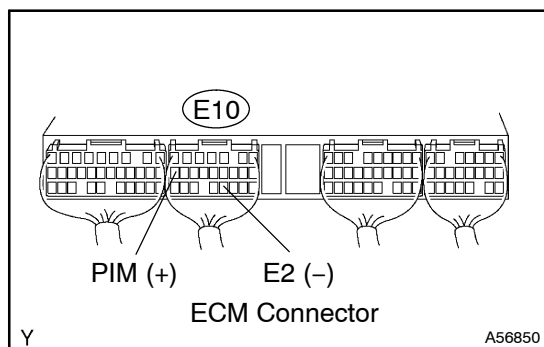
B**GO TO DTC P1238 (See page 05-557)****A****REPLACE INJECTOR DRIVER****11 INSPECT ECM (THW VOLTAGE)**

- Start the engine.
- Measure the voltage between the specified terminals of the E10 ECM connector.

Standard:

Tester Connection	Condition	Specified Condition
THW (E10-14) - E2 (E10-20)	Idling, engine coolant temperature at 60° to 120°C (140° to 248°F)	0.2 to 1.0 V

NG**Go to step 17****OK**

12 INSPECT ECM(PIM VOLTAGE)

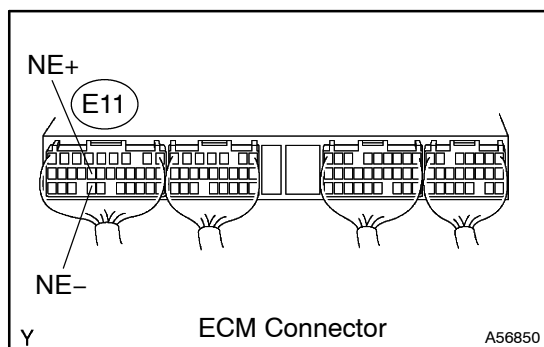
- (a) Turn the ignition switch to ON.
- (b) Measure the voltage between the terminals of the E10 connector.

Standard:

Tester Connection	Condition	Specified Condition
PIM (E10-16) - E2 (E10-20)	Applied negative pressure of 40 kPa (300 mmHg, 11.8 in.Hg)	1.4 to 2.0 V
PIM (E10-16) - E2 (E10-20)	Same as atmospheric pressure	2.0 to 2.6 V
PIM (E10-16) - E2 (E10-20)	Applied positive pressure of 69 kPa (518 mmHg, 20.4 in.Hg)	3.0 to 3.6 V

HINT:

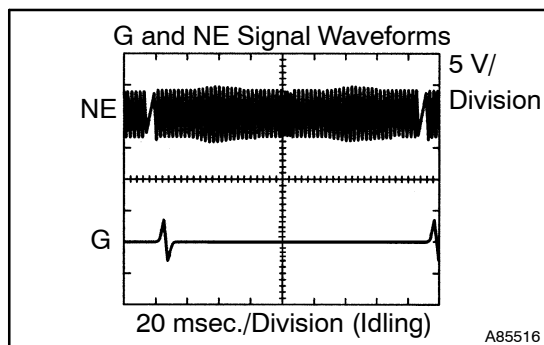
Even when the voltage output from the manifold absolute pressure sensor is within the standard level, there may be a problem in the sensor caused by age deterioration.

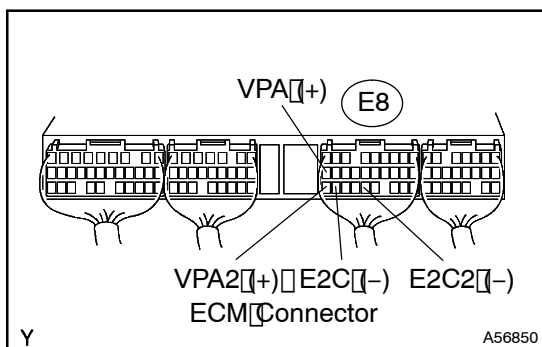
NG**Go to step 18****OK****13 INSPECT ECM(NE SIGNAL)**

- (a) Inspect using the oscilloscope.
- (b) During idling, check the waveform between the specified terminals of the E11 ECM connector.

Standard:

Tester Connection	Specified Condition
NE+ (E11-17) - NE- (E11-28)	Correct waveform is as shown

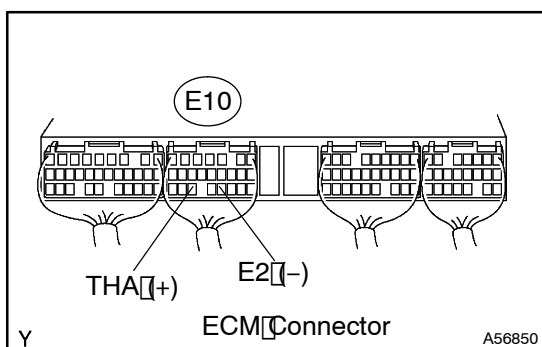
**NG****Go to step 19****OK**

14 INSPECT ECM (VPA AND VPA2 VOLTAGE)

- (a) Turn the ignition switch to ON.
 (b) Measure the voltage between the specified terminals of the E8 ECM connector.

Standard:

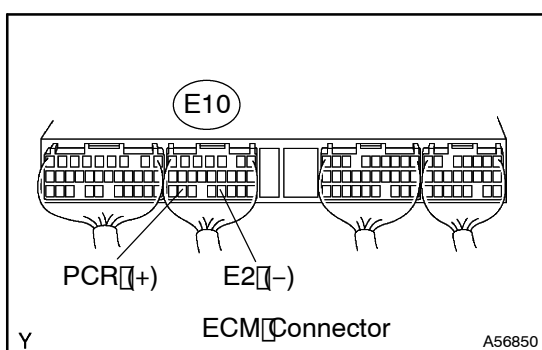
Accelerator Pedal Position	Tester Connection	Specified Condition
Released	VPA (E8-19)	0.5 to 1.1 V
Depressed	- E2C (E8-27)	2.6 to 4.5 V
Released	VPA2 (E8-28)	1.2 to 2.0 V
Depressed	- E2C2 (E8-24)	3.4 to 5.3 V

NG**Go to step 20****OK****15 INSPECT ECM (THA VOLTAGE)**

- (a) Start the engine.
 (b) Measure the voltage between the specified terminals of the E10 ECM connector.

Standard:

Tester Connection	Condition	Specified Condition
THA (E10-22) - E2 (E10-20)	Idling, Intake air temperature at 20°C (68°F)	0.5 to 3.4 V

NG**Go to step 21****OK****16 INSPECT ECM (PCR VOLTAGE)**

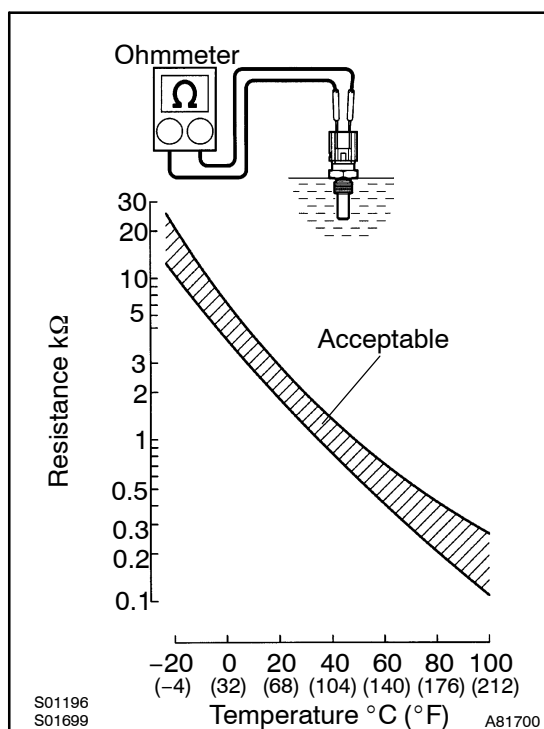
- (a) Turn the ignition switch to ON.
 (b) Measure the voltage between the specified terminals of the E10 ECM connector.

Standard:

Tester Connection	Specified Condition
PCR (E10-23) - E2 (E10-20)	1.0 to 4.0 V

NG**Go to step 22****OK****REPLACE ECM (See page 10-30)**

17 INSPECT ENGINE COOLANT TEMPERATURE SENSOR



- Remove the engine coolant temperature sensor.
- Measure the resistance between the terminals.

Standard:

2.32 to 2.59 kΩ at 20°C (68°F)

0.310 to 0.326 kΩ at 80°C (176°F)

NOTICE:

If you check the engine coolant temperature sensor in water, be careful not to allow water to get in contact with the terminals. After checking, dry the sensor.

HINT:

Alternative procedure: Connect an ohmmeter to the installed engine coolant temperature sensor and read the resistance. Use an infrared thermometer to measure the engine temperature in the immediate vicinity of the sensor. Compare these values against the resistance/temperature graph. Change the engine temperature (warm up or allow to cool down) and repeat the test.

- Reinstall the engine coolant temperature sensor.

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REPLACE ENGINE COOLANT TEMPERATURE SENSOR

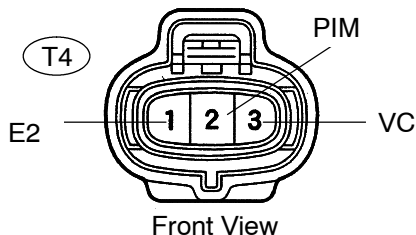
OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

18 CHECK HARNESS AND CONNECTOR(TURBO PRESSURE SENSOR - ECM)

Wire Harness Side:

Turbo Pressure Sensor Connector



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- Disconnect the T4 turbo pressure sensor connector.
- Disconnect the E10 ECM connector.
- Check the resistance.

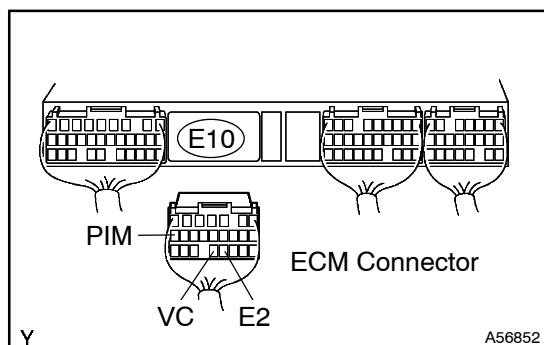
Standard (Check for open):

Tester Connection	Specified Condition
PIM (T4-2) - PIM (E10-16)	Below 1 Ω
VC (T4-3) - VC (E10-21)	
E2 (T4-1) - E2 (E10-20)	

Standard (Check for short):

Tester Connection	Specified Condition
PIM (T4-2) or PIM (E10-16) - Body ground	10 kΩ or higher
VC (T4-3) or VC (E10-21) - Body ground	
E2 (T4-1) or E2 (E10-20) - Body ground	

- Reconnect the ECM connector.
- Reconnect the turbo pressure sensor connector.



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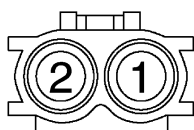
REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

REPLACE MANIFOLD ABSOLUTE PRESSURE SENSOR

19 INSPECT CRANKSHAFT POSITION SENSOR

Component Side:



Crankshaft Position Sensor

A78431

- (a) Disconnect the C4 crankshaft position sensor connector.
(b) Measure the resistance between terminals 1 and 2.

Standard:

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

NOTICE:

Terms "cold" and "hot" refer to the temperature of the coils. "Cold" means approximately -10° to 50°C (14° to 122°F). "Hot" means approximately 50° to 100°C (122° to 212°F).

- (c) Reconnect the crankshaft position sensor connector.

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REPLACE CRANKSHAFT POSITION SENSOR

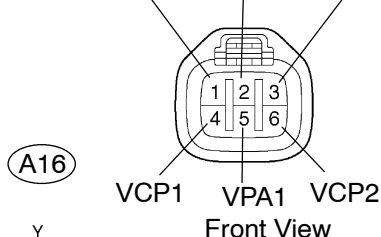
OK

REPAIR OR REPLACE HARNESS OR CONNECTOR

20 CHECK HARNESS AND CONNECTOR(ACCELERATOR PEDAL POSITION SENSOR - ECM)

Wire Harness Side (RHD):

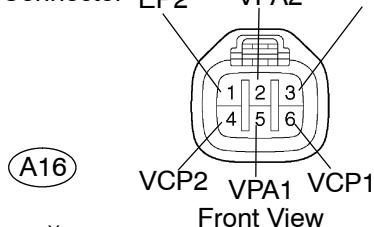
Accelerator Pedal Position Sensor Connector EP1 VPA2 EP2



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Wire Harness Side (LHD):

Accelerator Pedal Position Sensor Connector EP2 VPA2 EP1



A84847

- Disconnect the A16 accelerator pedal position sensor connector.
- Disconnect the E8 ECM connector.
- Check the resistance.

Standard (Check for open) (RHD):

Tester Connection	Specified Condition
VPA1 (A16-5) - VPA (E8-22)	Below 1 Ω
EP1 (A16-1) - E2C (E8-28)	
VCP1 (A16-4) - VCC (E8-26)	
VPA2 (A16-2) - VPA2 (E8-23)	
EP2 (A16-3) - E2C2 (E8-29)	
VCP2 (A16-6) - VCC2 (E8-27)	

Standard (Check for open) (LHD):

Tester Connection	Specified Condition
VPA1 (A16-5) - VPA (E8-19)	Below 1 Ω
EP1 (A16-3) - E2C (E8-27)	
VCP1 (A16-6) - VCC (E8-8)	
VPA2 (A16-2) - VPA2 (E8-28)	
EP2 (A16-1) - E2C2 (E8-24)	
VCP2 (A16-4) - VCC2 (E8-13)	

Standard (Check for short) (RHD):

Tester Connection	Specified Condition
VPA1 (A16-5) or VPA (E8-19) - Body ground	10 k Ω or higher
EP1 (A16-1) or E2C (E8-27) - Body ground	
VCP1 (A16-4) or VCC (E8-8) - Body ground	
VPA2 (A16-2) or VPA2 (E8-28) - Body ground	
EP2 (A16-3) or E2C2 (E8-24) - Body ground	
VCP2 (A16-6) or VCC2 (E8-13) - Body ground	

Standard (Check for short) (LHD):

Tester Connection	Specified Condition
VPA1 (A16-5) or VPA (E8-19) - Body ground	10 k Ω or higher
EP1 (A16-3) or E2C (E8-27) - Body ground	
VCP1 (A16-6) or VCC (E8-8) - Body ground	
VPA2 (A16-2) or VPA2 (E8-28) - Body ground	
EP2 (A16-1) or E2C2 (E8-24) - Body ground	
VCP2 (A16-4) or VCC2 (E8-13) - Body ground	

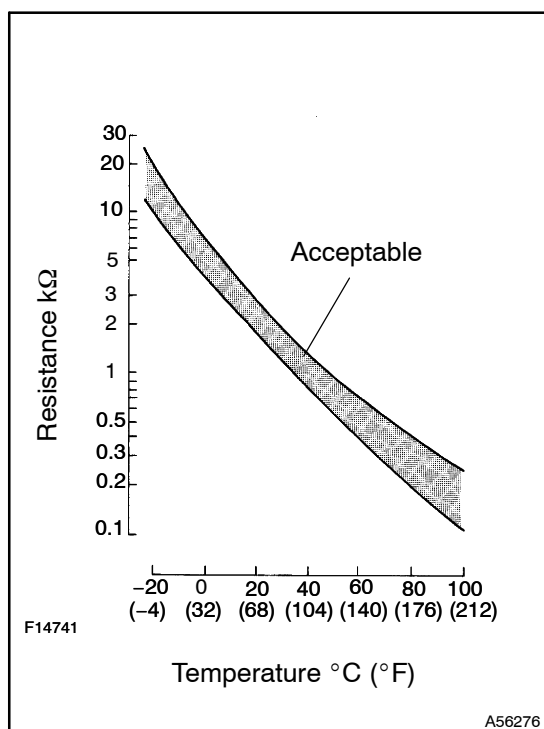
- Reconnect the accelerator pedal position sensor connector.
- Reconnect the ECM connector.

NG

REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

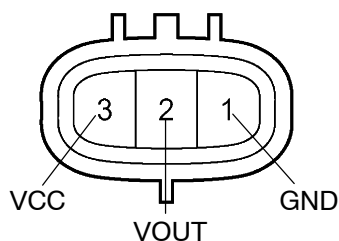
REPLACE ACCELERATOR PEDAL ASSY (ACCELERATOR PEDAL POSITION SENSOR)
(See page 10-66 of Pub. No. RM1018E AVENSIS REPAIR MANUAL)

21 INSPECT DIESEL TURBO INLET AIR TEMPERATURE SENSOR

- Remove the diesel turbo inlet air temperature sensor.
- Measure the resistance between the terminals.
Standard:
2.21 to 2.65 kΩ at 20°C (68°F)
- Reinstall the diesel turbo inlet air temperature sensor.

NG**REPLACE DIESEL TURBO INLET AIR TEMPERATURE SENSOR****OK****REPAIR OR REPLACE HARNESS OR CONNECTOR****22 INSPECT COMMON RAIL ASSY(FUEL PRESSURE SENSOR)****Component Side:**

Fuel Pressure Sensor



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- Disconnect the F13 fuel pressure sensor connector.
- Measure the resistance between the terminals of the fuel pressure sensor.

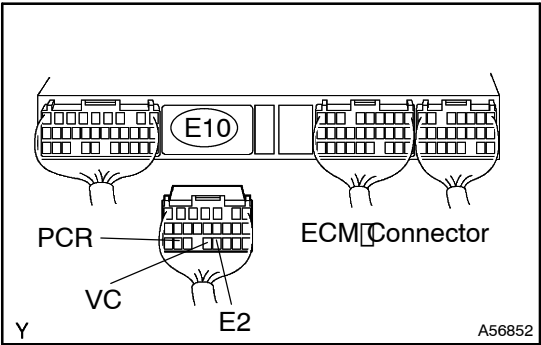
Standard:

Tester Connection	Specified Condition
GND (F13-1) - VOUT (F13-2)	16.4 kΩ or less
VOUT (F13-2) - VCC (F13-3)	3 kΩ or less

- Reconnect the fuel pressure sensor connector.

NG**REPLACE COMMON RAIL ASSY**
(See page 14-91 of Pub. No. RM864E AVENSIS VERSO/ PICNIC REPAIR MANUAL)**OK**

23 CHECK HARNESS AND CONNECTOR (FUEL PRESSURE SENSOR – ECM)



- (a) Disconnect the F13 fuel pressure sensor connector.
- (b) Disconnect the E10 ECM connector.
- (c) Check the resistance.

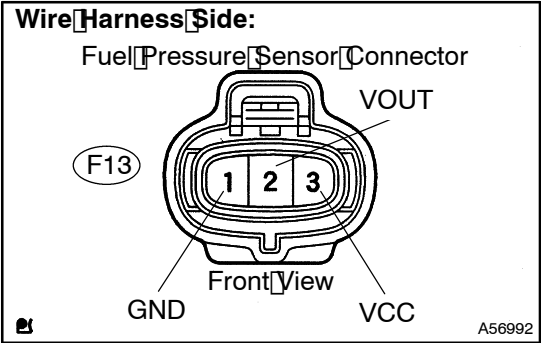
Standard (Check for open):

Tester Connection	Specified Condition
PCR (E10-23) – VOUT (F13-2)	Below 1 Ω
VC (E10-21) – VCC (F13-3)	
E2 (E10-20) – GND (F13-1)	

Standard (Check for short):

Tester Connection	Specified Condition
PCR (E10-23) or VOUT (F13-2) – Body Ground	10 kΩ or higher
VC (E10-21) or VCC (F13-3) – Body Ground	
E2 (E10-20) or E2 (F13-1) – Body Ground	

- (d) Reconnect the ECM connector.



NG REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

24 REPLACE ECM (See page 10-30)

NG REPLACE INJECTION OR SUPPLY PUMP ASSY (See page 11-31 of Pub. No. RM864E AVENSIS VERSO/ PICNIC REPAIR MANUAL)

OK

END