

DTC	P0300	RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED
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DTC	P0301	CYLINDER 1 MISFIRE DETECTED
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DTC	P0302	CYLINDER 2 MISFIRE DETECTED
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DTC	P0303	CYLINDER 3 MISFIRE DETECTED
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DTC	P0304	CYLINDER 4 MISFIRE DETECTED
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CIRCUIT DESCRIPTION

When a misfire occurs in the engine, hydrocarbons (HC) enter the exhaust gas in high concentrations. If this HC concentration is high enough, there could be an increase in exhaust emission levels. High concentrations of HC can also cause temperature of the catalyst to increase, possibly damaging the catalyst. To prevent this increase in emissions and limit the possibility of thermal damage, the ECM monitors the misfire rate. When the temperature of the catalyst reaches a point of thermal degradation, the ECM will blink the MIL. For monitoring misfire, the ECM uses both the camshaft position sensor and the crankshaft position sensor. The camshaft position sensor is used to identify misfiring cylinders and the crankshaft position sensor is used to measure variations in the crankshaft rotation speed. The misfire counter increments when crankshaft rotation speed variations exceed threshold values.

If the misfiring rate exceeds the threshold and could cause emission deterioration, the ECM illuminates the MIL.

HINT:

- For any particular 200 revolutions of the engine, misfiring which could result in overheating of the catalyst is detected. This will cause the MIL to blink (1 trip detection logic).
- For any particular 1,000 revolutions of the engine, misfiring which could result in emission deterioration is detected. This will cause the MIL to illuminate (2 trip detection logic).

DTC No.	DTC Detection Condition	Trouble Area
P0300	Misfiring of random cylinders is detected	<ul style="list-style-type: none"> • Open or short in engine wire harness • Connector connection • Vacuum hose connection • Ignition system • Injector • Fuel pressure • Mass air flow meter • Engine coolant temperature sensor • Compression pressure • Valve clearance • Valve timing • PCV hose connection • PCV hose • ECM
P0301 P0302 P0303 P0304	Misfiring of each cylinder is detected	<ul style="list-style-type: none"> • Open or short in engine wire harness • Connector connection • Vacuum hose connection • Ignition system • Injector • Fuel pressure • Mass air flow meter • Engine coolant temperature sensor • Compression pressure • Valve clearance • Valve timing • PCV hose connection • PCV hose • ECM

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.

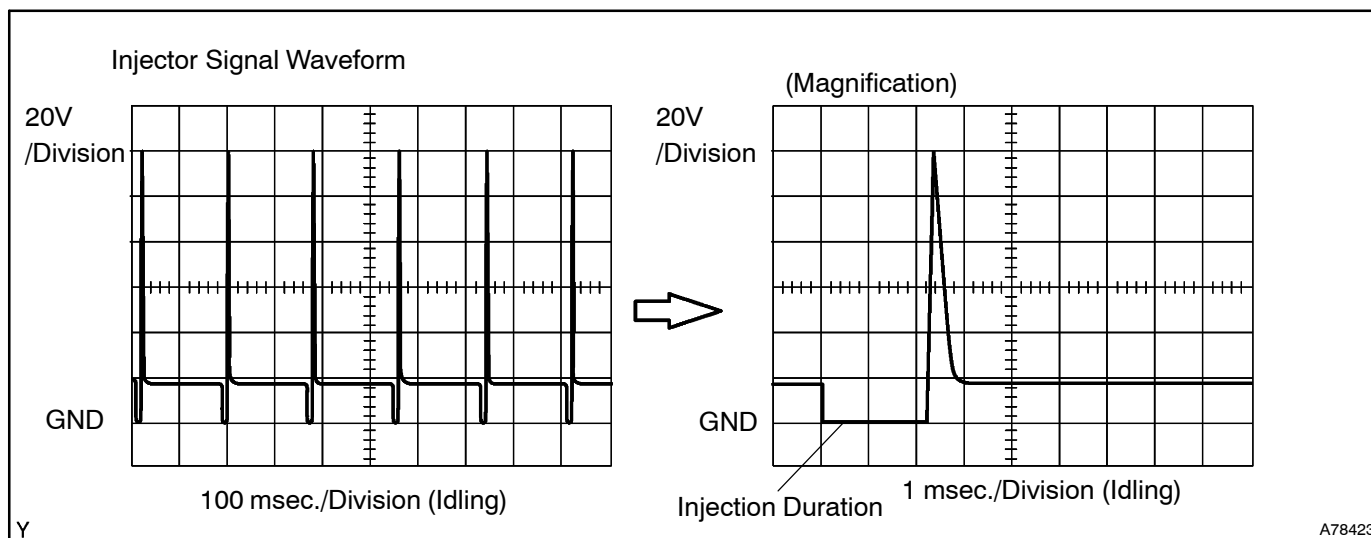
Reference: Inspection using the oscilloscope

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

Item	Contents
Terminal	#10 to #40 - E01
Equipment Setting	20V/Division, 100 or 1 ms/Division
Condition	Idling

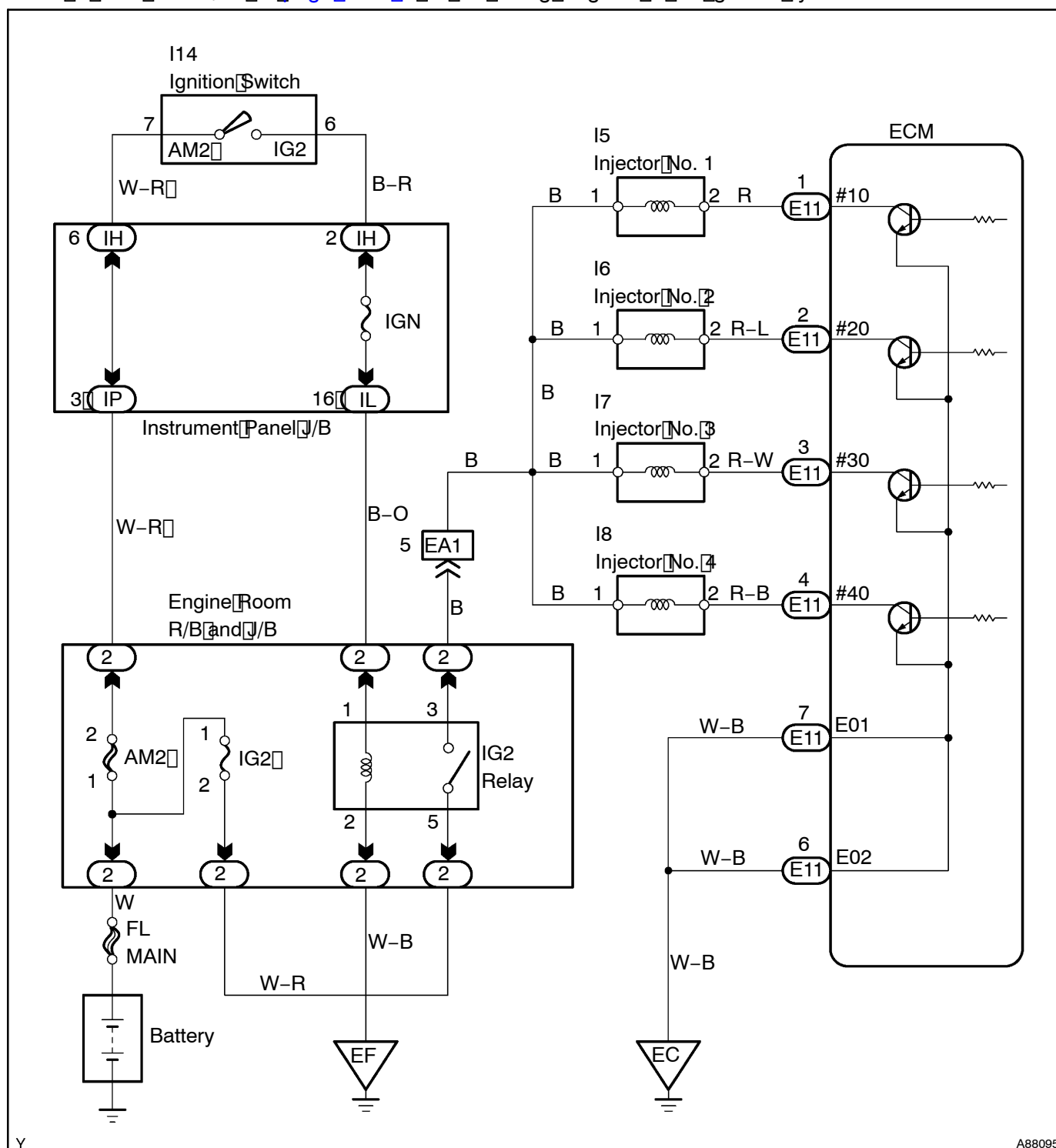
HINT:

The correct waveform is as shown.



WIRING DIAGRAM

Refer to DTC P0351/14 on page 05-132 for the wiring diagram of the Ignition system.



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CONFIRMATION DRIVING PATTERN

- (a) Connect the Intelligent Tester II to the DLC3.
- (b) Turn the ignition switch to ON and turn the Intelligent Tester II ON.
- (c) Note down the DTC(s) and freeze frame data.
- (d) Switch the ECM from normal mode to check mode using the Intelligent Tester II (see page 05-22).
- (e) Check the misfire counter values for each cylinder when idling. If the misfire counter value indicates 0, perform the following procedure of the confirmation driving pattern.
- (f) Drive the vehicle several times using an engine speed (Engine Speed), engine load (Calculate Load) and other data stored in the freeze frame data.

If you have no intelligent tester II, turn the ignition switch to OFF after the symptom is simulated once. Then repeat the simulation process again.

HINT:

In order to memorize the misfire DTCs, it is necessary to drive around Misfire RPM and Misfire Load in Data List for the following period of time. Do not turn the ignition switch to OFF. Turning the ignition switch to OFF switches the diagnosis system from check mode to normal mode. So all DTCs and other data will be erased.

Engine Speed	Time
Idling	3 minutes 30 seconds or more
1,000 rpm	3 minutes or more
2,000 rpm	1 minute 30 seconds or more
3,000 rpm	1 minute or more

- (g) Check if there is the DTC(s) to verify whether misfires have occurred. If the DTC(s) is present, record the DTC and freeze frame data.
- (h) Turn the ignition switch to OFF and wait for at least 5 seconds.

INSPECTION PROCEDURE

HINT:

- If DTCs besides the misfire DTCs are set simultaneously, first perform troubleshooting for them.
- If a misfire does not occur when the vehicle is brought to the workshop, a misfire can be confirmed by reproducing the condition of the freeze frame data. Also, after finishing repairs, confirm that misfires do not recur (see the confirmation driving pattern).
- Read freeze frame data using the Intelligent Tester II. Freeze frame data record 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.
- On 6 and 8 cylinder engines, misfiring cylinder identification cannot be identified at high engine speed and only a general misfire DTC P0300 is stored instead of the individual misfiring cylinder DTCs (P0301 to P0308).

If a misfire starts in a high engine speed area or a misfire occurs only in a high engine speed area, only DTC P0300 may be stored.

When only a general misfire DTC P0300 is stored:

- Erase the general misfire DTC from the ECM using the Intelligent Tester II.
- Start the engine and perform the confirmation driving pattern.
- Check the value of the misfire ratio for each cylinder. Or check the DTC(s).
- Perform repairs on the cylinder that has a high misfire ratio. Or repair the cylinder indicated by the DTC.
- After finishing repairs, perform the confirmation driving pattern again and confirm that no misfire occurs.
- When either of Short FT #1 and Long FT #1 in the freeze frame data is over the range of $\pm 20\%$, there is a possibility that the air-fuel ratio is becoming rich (-20% or less) or lean ($+20\%$ or more).
- When Coolant Temp in the freeze frame data is less than 80°C (176°F), there is a possibility that misfires occur only during engine warm-up.
- If a misfire cannot be reproduced, the following reasons may apply: 1) The vehicle has low fuel, 2) Improper fuel is being used, and 3) The ignition plug has been contaminated.
- Be sure to check the misfire counter value after repairs.

1 CHECK OTHER DTC OUTPUT (IN ADDITION TO MISFIRE DTCs)

- 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
P0300, P0301, P0302, P0303 and/or P0304	A
P0300, P0301, P0302, P0303 or P0304 and other DTCs	B

HINT:

If any other DTCs besides P0300, P0301, P0302, P0303 or P0304 are output, perform troubleshooting for those DTCs.

B

GO TO RELEVANT DTC CHART
(See page 05-29)

A

2 CHECK WIRE HARNESS, CONNECTOR AND VACUUM HOSE IN ENGINE ROOM

- (a) Check the connection condition of the wire harnesses and connector.
- (b) Check the piping of the vacuum hose.
- (c) Check the vacuum hose for disconnection or breakage.

OK: Connected correctly and no damage on the wire harnesses.

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REPAIR OR REPLACE, THEN CONFIRM THAT THERE IS NO MISFIRE

OK

3 CHECK CONNECTION OF PCV HOSE

OK: The RCV hose is connected correctly, and the PCV hose has no damage.

NG

REPAIR OR REPLACE PCV HOSE

OK

4 READ VALUE OF INTELLIGENT TESTER II (NUMBER OF MISFIRING CYLINDERS)

- (a) Connect the intelligent tester II to the DLC3.
- (b) Turn the ignition switch to ON and turn the intelligent tester II ON.
- (c) Start the engine.
- (d) On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Data List / Cylinder #1 Misfire Rate – Cylinder #4 Misfire Rate.
- (e) Check the number of misfiring cylinders on the intelligent tester II.

HINT:

When a misfire is not reproduced, be sure to branch below based on the stored DTC.

Result:

High Misfire Rate Cylinder	Proceed To
1 or 2 cylinders	A
More than 3 cylinders	B

B

Go to step 15

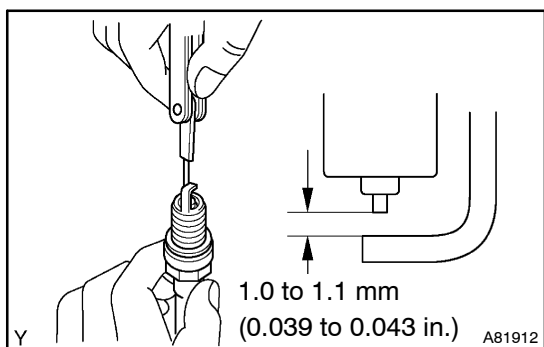
A

5 CHECK SPARK PLUG AND SPARK OF MISFIRING CYLINDER

- (a) Remove the ignition coil assembly.
- (b) Remove the spark plug.
- (c) Check the spark plug type.

Recommended spark plug:

Supplier	Type
DENSO	SK20R11
NGK	IFR6A11



- (d) Check the spark plug electrode gap.
Standard: 1.0 to 1.1 mm (0.039 to 0.043 in.)
Maximum: 1.3 mm (0.047 in.)

NOTICE:

If adjusting the gap of a new spark plug, bend only the ground electrode. Do not touch the tip. Never attempt to adjust the gap of a used plug.

- (e) Check the electrode for carbon deposits.
- (f) Perform a spark test.

CAUTION:

Absolutely disconnect each injector connector.

NOTICE:

Do not crank the engine for more than 5 to 10 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 a spark occurs while the engine is being cranked.

OK: A spark jumps across electrode gap.

- (g) Reinstall the spark plug.
- (h) Reinstall the ignition coil assembly.

OK

Go to step 8

NG

6	CHANGE NORMAL SPARK PLUG AND CHECK SPARK OF MISFIRING CYLINDER
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- (a) Change the spark plug with the normal spark plug.
- (b) Perform a spark test.

CAUTION:

Absolutely disconnect each injector connector.

NOTICE:

Do not crank the engine for more than 5 to 10 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 a spark occurs while the engine is being cranked.

OK: A spark jumps across electrode gap.

OK

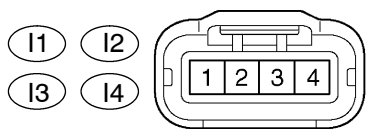
REPLACE SPARK PLUG

NG

7 CHECK HARNESS AND CONNECTOR OF MISFIRING CYLINDER(IGNITION COIL ASSY - ECM)

Wire Harness Side:

Ignition Coil with Igniter Connector



Front View

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- (a) Check the harness and the connectors between the ignition coil with igniter and ECM (IGF1 terminal).

- (1) Disconnect the I1, I2, I3 and/or I4 ignition coil with igniter connector.
- (2) Disconnect the E11 ECM connector.
- (3) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
Ignition coil (I1-2) - IGF1 (E11-24)	Below 1 Ω
Ignition coil (I2-2) - IGF1 (E11-24)	Below 1 Ω
Ignition coil (I3-2) - IGF1 (E11-24)	Below 1 Ω
Ignition coil (I4-2) - IGF1 (E11-24)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Ignition coil (I1-2) or IGF1 (E11-24) - Body ground	10 k Ω or higher
Ignition coil (I2-2) or IGF1 (E11-24) - Body ground	10 k Ω or higher
Ignition coil (I3-2) or IGF1 (E11-24) - Body ground	10 k Ω or higher
Ignition coil (I4-2) or IGF1 (E11-24) - Body ground	10 k Ω or higher

- (4) Reconnect the ignition coil with igniter connector.
- (5) Reconnect the ECM connector.

- (b) Check the harness and the connectors between the ignition coil with igniter and ECM (IGT terminal).

- (1) Disconnect the I1, I2, I3 and/or I4 ignition coil with igniter connector.
- (2) Disconnect the E11 ECM connector.
- (3) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
Ignition coil (I1-3) - IGT1 (E11-8)	Below 1 Ω
Ignition coil (I2-3) - IGT2 (E11-9)	Below 1 Ω
Ignition coil (I3-3) - IGT3 (E11-10)	Below 1 Ω
Ignition coil (I4-3) - IGT4 (E11-11)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Ignition coil (I1-3) or IGT1 (E11-8) - Body ground	10 k Ω or higher
Ignition coil (I2-3) or IGT2 (E11-9) - Body ground	10 k Ω or higher
Ignition coil (I3-3) or IGT3 (E11-10) - Body ground	10 k Ω or higher
Ignition coil (I4-3) or IGT4 (E11-11) - Body ground	10 k Ω or higher

- (4) Reconnect the ignition coil with igniter connector.
- (5) Reconnect the ECM connector.

OK

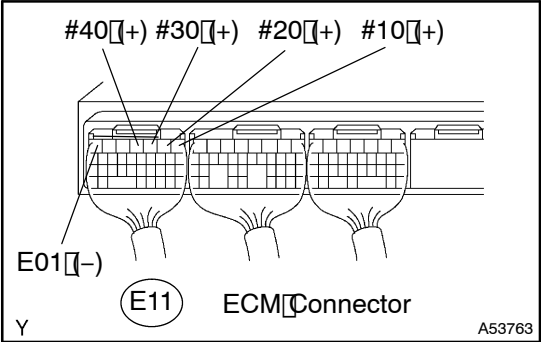
REPLACE IGNITION COIL ASSY

NG

REPAIR OR REPLACE HARNESS OR CONNECTOR

8

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



- (a) Turn the ignition switch to ON.
- (b) Measure the voltage between the specified terminals of the E11 ECM connector.

Standard:

Tester Connection	Specified Condition
#10 (E11-1) - E01 (E11-7)	9 to 14 V
#20 (E11-2) - E01 (E11-7)	9 to 14 V
#30 (E11-3) - E01 (E11-7)	9 to 14 V
#40 (E11-4) - E01 (E11-7)	9 to 14 V

OK

Go to step 11

NG

9

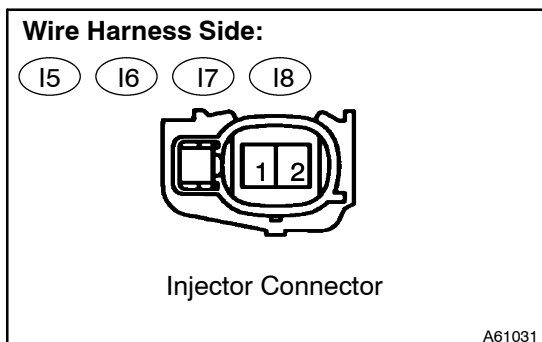
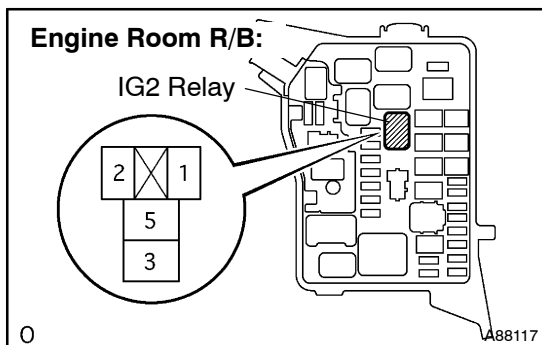
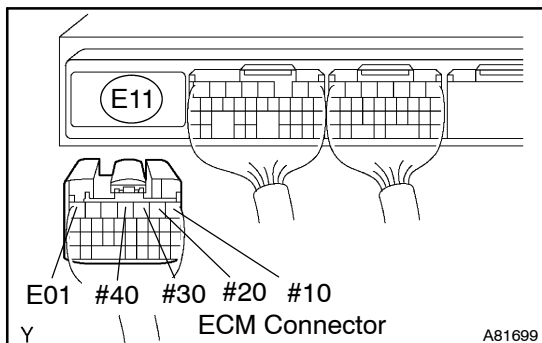
INSPECT FUEL INJECTOR RESISTANCE OF MISFIRING CYLINDER
(See page 11-8)

NG

REPLACE FUEL INJECTOR ASSY
(See page 11-11)

OK

10 CHECK HARNESS AND CONNECTOR OF MISFIRING CYLINDER(INJECTOR - ECM, INJECTOR - IG2 RELAY)



(a) Check the harness and connectors between the injector and ECM.

- (1) Disconnect the I5, I6, I7 and/or I8 injector connector.
- (2) Disconnect the E11 ECM connector.
- (3) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
Injector (I5-2) - #10 (E11-1)	Below 1 Ω
Injector (I6-2) - #20 (E11-2)	Below 1 Ω
Injector (I7-2) - #30 (E11-3)	Below 1 Ω
Injector (I8-2) - #40 (E11-4)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Injector (I5-2) or #10 (E11-1) - Body ground	10 k Ω or higher
Injector (I6-2) or #20 (E11-2) - Body ground	10 k Ω or higher
Injector (I7-2) or #30 (E11-3) - Body ground	10 k Ω or higher
Injector (I8-2) or #40 (E11-4) - Body ground	10 k Ω or higher

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

(b) Check the harness and connectors between the injector and IG2 relay.

- (1) Disconnect the I5, I6, I7 and/or I8 injector connector.
- (2) Remove the IG2 relay from the engine room R/B.
- (3) Check the resistance.

Standard (Check for open):

Tester Connection	Specified Condition
Injector (I5-1) - Engine room R/B (IG2 relay terminal 3)	Below 1 Ω
Injector (I6-1) - Engine room R/B (IG2 relay terminal 3)	Below 1 Ω
Injector (I7-1) - Engine room R/B (IG2 relay terminal 3)	Below 1 Ω
Injector (I8-1) - Engine room R/B (IG2 relay terminal 3)	Below 1 Ω

Standard (Check for short):

Tester Connection	Specified Condition
Injector (I5-1) or Engine room R/B (IG2 relay terminal 3) - Body ground	10 k Ω or higher
Injector (I6-1) or Engine room R/B (IG2 relay terminal 3) - Body ground	10 k Ω or higher
Injector (I7-1) or Engine room R/B (IG2 relay terminal 3) - Body ground	10 k Ω or higher
Injector (I8-1) or Engine room R/B (IG2 relay terminal 3) - Body ground	10 k Ω or higher

- (4) Reconnect the injector connector.
- (5) Reinstall the IG2 relay.

NG

REPAIR OR REPLACE HARNESS OR CONNECTOR

OK

11 INSPECT FUEL INJECTOR INJECTION AND INJECTION VOLUME OF MISFIRING CYLINDER (See page 11-8)

NG

REPLACE FUEL INJECTOR ASSY
(See page 11-11)

OK

12 CHECK CYLINDER COMPRESSION PRESSURE OF MISFIRING CYLINDER
(See page 14-1 of Pub. No. RM864E AVENSIS VERSO/PICNIC)

NG

REPAIR OR REPLACE

OK

13 CHECK VALVE CLEARANCE OF MISFIRING CYLINDER
(See page 14-40 of Pub. No. RM864E AVENSIS VERSO/PICNIC)

NG

ADJUST VALVE CLEARANCE
(See page 14-40 of Pub. No. RM864E AVENSIS VERSO/PICNIC)

OK

14 SWITCH STEP BY NUMBER OF MISFIRING CYLINDER (REFER RESULT OF STEP 4)

HINT:

- If the result of step 4 is "1 or 2 cylinders", proceed to A.
- If the result of step 4 is "more than 3 cylinders", proceed to B.

B

CHECK FOR INTERMITTENT PROBLEMS
(See page 05-9)

A

15 CHECK VALVE TIMING (CHECK FOR LOOSENESS AND JUMPED TOOTH OF TIMING CHAIN) (See page 14-40 of Pub. No. RM864E AVENSIS VERSO/PICNIC)

OK: The matchmarks of the crankshaft pulley and camshaft pulley are aligning.

NG

ADJUST VALVE TIMING
(See page 14-40 of Pub. No. RM864E AVENSIS VERSO/PICNIC)

OK

16 CHECK FUEL PRESSURE (See page 11-5)**NG****CHECK AND REPLACE FUEL PUMP,
PRESSURE REGULATOR, FUEL PIPE LINE AND
FILTER****OK****17 READ VALUE OF INTELLIGENT TESTER II (INTAKE AIR TEMPERATURE AND
MASS AIR FLOW RATE)**

- (a) Connect the intelligent tester II to the DLC3.
- (b) Turn the ignition switch to ON.
- (c) Check the intake air temperature.
 - (1) On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Data List / Intake Air.
 - (2) Read the value.
- Standard: Equivalent to ambient temperature.**
- (d) Check the mass air flow rate.
 - (1) On the intelligent tester II, select the following menu items: Powertrain / Engine and ECT / Data List / AFM.
 - (2) Read the values.

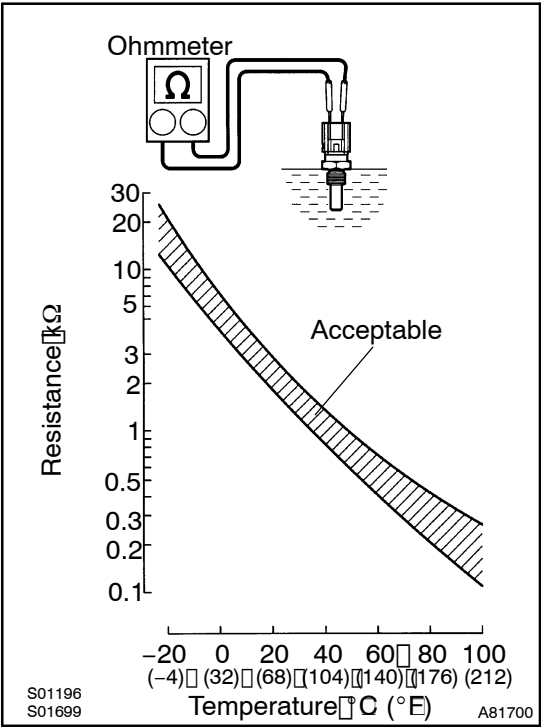
Standard:

Condition	Mass Air Flow Rate (gm/s)
Ignition switch ON (do not start engine)	0
Idling	3.2 to 4.7
Revving up without load (2,500 rpm)	13.1 to 18.9
Idling – Revving up	Mass air flow rate fluctuates

NG**REPLACE MASS AIR FLOW METER****OK**

18

INSPECT ENGINE COOLANT TEMPERATURE SENSOR (RESISTANCE)



- (a) Remove the engine coolant temperature sensor.
- (b) Measure the resistance between the terminals.

Standard:

Tester Connection	Specified Condition
1 - 2	2.32 to 2.59 kΩ at 20°C (68°F)
1 - 2	0.310 to 0.326 kΩ at 80°C (176°F)

NOTICE:
When checking the engine coolant temperature sensor in water, be careful not to allow water to contact the terminals. After the check, dry the sensor.

HINT:
Alternate 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 to the resistance/temperature graph. Change the engine temperature (warm up or allow to cool down) and repeat the test.

NG **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK

19

SWITCH STEP BY NUMBER OF MISFIRING CYLINDER (REFER RESULT OF STEP 4)

- HINT:
- If the result of step 4 is "1 or 2 cylinders", proceed to A.
 - If the result of step 4 is "more than 3 cylinders", proceed to B.

B **AGAIN GO TO STEP 5**

A

CHECK FOR INTERMITTENT PROBLEMS (See page 05-9)