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

DTC	P0305	Cylinder 5 Misfire Detected

DTC	P0306	Cylinder 6 Misfire Detected

DESCRIPTION

When the engine misfires, high concentrations of hydrocarbons (HC) enter the exhaust gas. Extremely high HC concentration levels can cause increase 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 this increase 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 set a DTC.

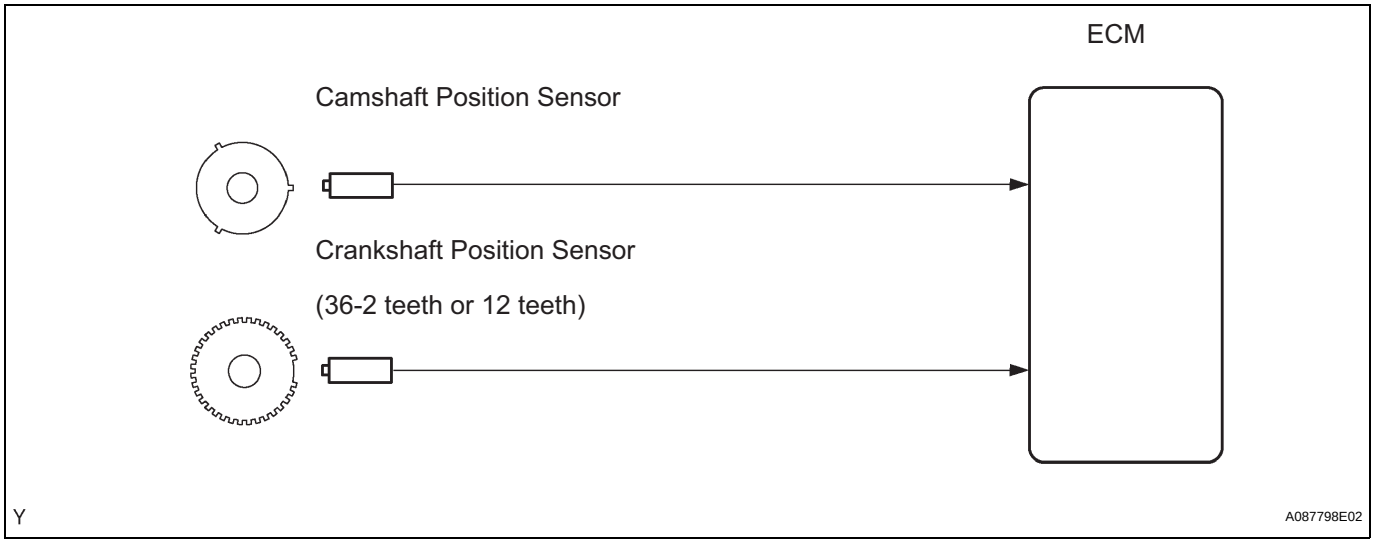
DTC No.	DTC Detection Condition	Trouble Area
P0300	Simultaneous misfiring of several cylinder detected (2 trip detection logic)	• Open or short in engine wire harness • Connector connection • Vacuum hose connections • Ignition system • Injector • Fuel pressure • Mass Air Flow (MAF) meter • Engine Coolant Temperature (ECT) sensor • Compression pressure • Valve clearance • Valve timing • PCV valve and hose • PCV hose connections • Air induction system • ECM

DTC No.	DTC Detection Condition	Trouble Area
P0301 P0302 P0303 P0304 P0305 P0306	Misfiring of specific cylinder detected (2 trip detection logic)	• Open or short in engine wire harness • Connector connection • Vacuum hose connections • Ignition system • Injector • Fuel pressure • Mass Air Flow (MAF) meter • Engine Coolant Temperature (ECT) sensor • Compression pressure • Valve clearance • Valve timing • PCV valve and hose • PCV hose connections • Air induction system • ECM

ES

When DTCs for misfiring cylinders are randomly set, but DTC P0300 is not set, it indicates that misfires have been detected in different cylinders at different times. DTC P0300 is only set when several misfiring cylinders are detected at the same time.

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: Cylinder 1 misfire P0302: Cylinder 2 misfire P0303: Cylinder 3 misfire P0304: Cylinder 4 misfire P0305: Cylinder 5 misfire P0306: Cylinder 6 misfire
Required Sensors/Components (Main)	Injector, Ignition coil, Spark plug
Required Sensors/Components (Related)	Crankshaft, Camshaft, Engine coolant temperature and 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 damaged misfire
Sequence of Operation	None

ES

TYPICAL ENABLING CONDITIONS

Misfire:

Monitor runs whenever following DTCs not present	P0100, P0101, P0102, P0103 (MAF sensor), P0110, P0112, P0113 (IAT sensor), P0115, P0116, P0117, P0118 (ECT sensor), P0120, P0121, P0122, P0123, P0220, P0222, P0223, P2135 (TP sensor), P0125 (Insufficient ECT for closed loop), P0327, P0328, P0332, P0333 (Knock sensor), P0335 (CKP sensor), P0340, P0341 (CMP sensor), P0500 (VSS), P0510 (Idle switch)
Battery voltage	8 V or more
Throttle position learning	Completed
VVT system	No operate by scan tool
Engine RPM	450 to 5,900 rpm
All of the following conditions are met	Condition 1, 2 and 3
1. Engine Coolant Temperature (ECT)	-10°C (14°F) or more
2. Either of the following conditions is met	Condition (a) or (b)
(a) IAT	-10°C (14°F) or more
(b) ECT	75°C (167°F) or more
3. Either of the following conditions is met	Condition (a) or (b)
(a) ECT at engine start	More than -7°C (19.4°F)
(b) ECT	More than 20°C (68°F)
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 catalyst-damaged-misfire (MIL blinks):

All of following conditions 1, 2 and 3 met	Crankshaft 200 revolutions x 3
1. Driving cycles	1 set
2. Check mode	OFF
3. Engine RPM	Less than 3,000 rpm
Except above	Crankshaft 200 revolutions x 3

TYPICAL MALFUNCTION THRESHOLDS

Monitor period of emission-related-misfire:

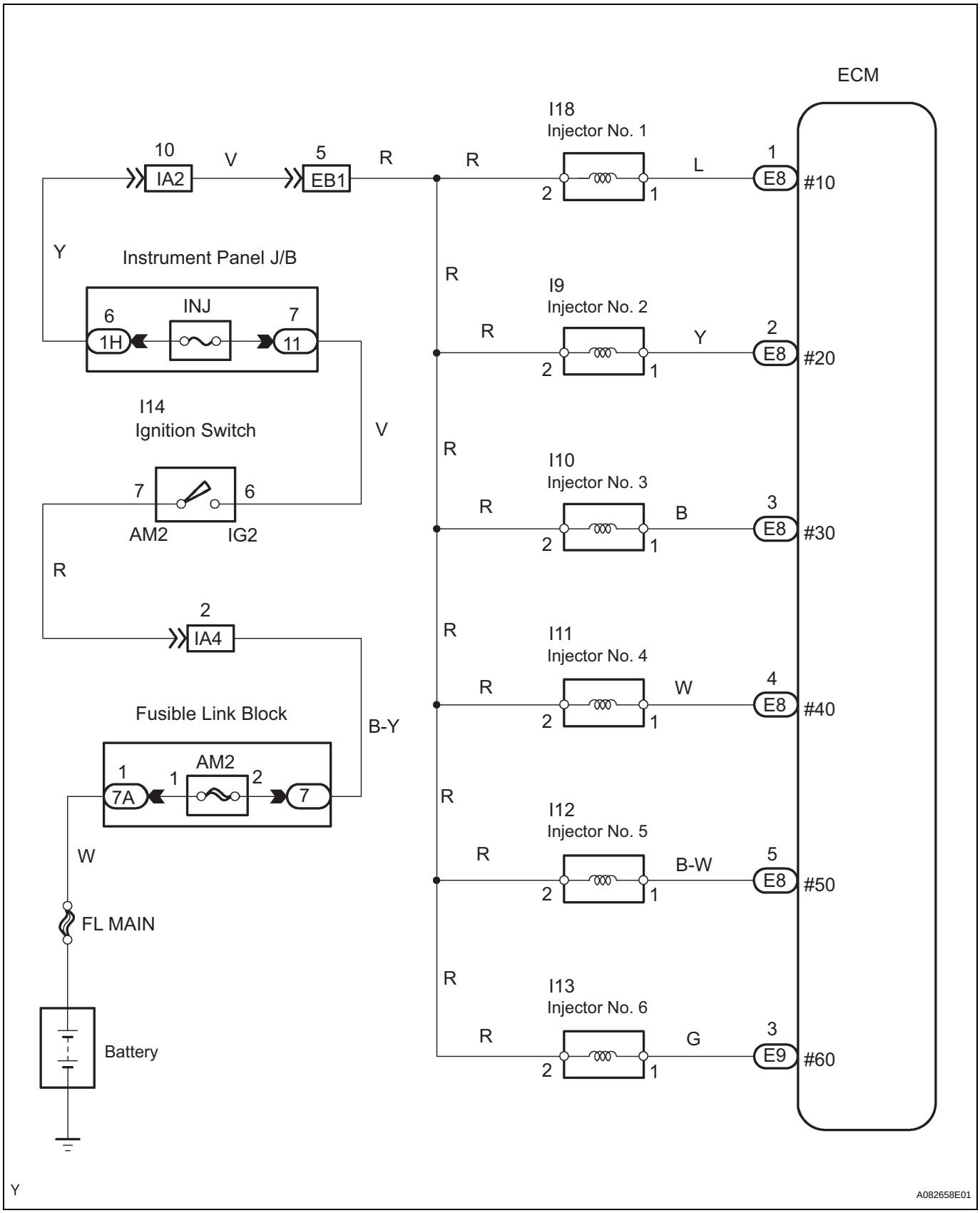
Misfire rate	1.82 % or more

Monitor period of catalyst-damage-misfire (MIL blinks):

Number of misfire per 200 revolutions	77or more (varies with intake air amount and RPM)
Paired cylinders misfire	Detected

WIRING DIAGRAM

Refer to DTC P0351 for the wiring diagram of the ignition system (See page ES-186).



HINT:

- If DTCs besides misfire DTCs are memorized simultaneously, troubleshoot the non-misfire DTCs first.

- Read freeze frame data using the intelligent tester or the OBD II scan tool. The ECM records vehicle and driving condition information as freeze frame data the moment a DTC is stored. When troubleshooting, it is useful for determining whether the vehicle was running or stopped, the engine was warmed up or not, the air-fuel ratio was lean or rich, etc. at the time of the malfunction.
- If the misfire does not occur when the vehicle is brought to the workshop, the misfire can be confirmed by reproducing the condition of the freeze frame data. Also, after finishing the repair, confirm that there is no misfire (see confirmation driving pattern).
- On 6 and 8 cylinder engines, cylinder specific misfire fault codes are disabled at high engine speeds. If the misfire starts in a high engine speed area or the misfire occurs only in a high engine speed area, only the general fault code P0300 will be stored.
  When only a general misfire fault code like P0300 is stored:
  (a) Erase the general misfire fault code from the ECM using the intelligent tester or OBD II scan tool.
  (b) Start the engine and drive the confirmation pattern.
  (c) Read the value of the misfire ratio for each cylinder. Or read the DTC.
  (d) Perform repairs on the cylinder that has a high misfire ratio. Or repair the cylinder indicated by the DTC.
  (e) After finishing repairs, drive the confirmation pattern again and confirm that no misfire occurs.
- When either of SHORT FT #1, LONG FT #1, SHORT FT #2 or LONG FT #2 in the freeze frame data is over the range of +-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 of misfire only during engine warm-up.
- If the 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 is contaminated.
- Be sure to check the value on the misfire counter after the repair.

ES

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

(a) Read the DTC using the intelligent tester or the OBD II scan tool.

Result

Display (DTC Output)	Proceed to
Only "P0300, P0301, P0302, P0303, P0304, P0305 and/or P0306" are output	A
"P0300, P0301, P0302, P0303, P0304, P0305 or P0306" and other DTCs are output	B

HINT:
If any other codes besides "P0300, P0301, P0302, P0303, P0304, P0305 or P0306" are output, perform the troubleshooting for those DTCs first.

B → GO TO RELEVANT DTC CHART

A

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

(a) Check the connection conditions of the wire harness and connector.
(b) Check for the disconnection, piping and break of the vacuum hose.

NG → REPAIR OR REPLACE, THEN CONFIRM THAT THERE IS NO MISFIRE

OK

3	CHECK PCV HOSE

NG → REPAIR OR REPLACE PCV HOSE

OK

ES

4	READ VALUE OF INTELLIGENT TESTER OR OBD II SCAN TOOL (NUMBER OF MISFIRE)

(a) Connect the intelligent tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the intelligent tester or the OBD II scan tool main switch ON.
(c) Start the engine.
(d) Select the item "DIAGNOSIS/ENHANCED OBD II/DATA LIST/ALL/CYL#1 - CYL#6".
(e) Read the number of misfire on the intelligent tester or the OBD II scan tool.
HINT:
When a misfire is not reproduced, be sure to branch below based on the stored DTC.

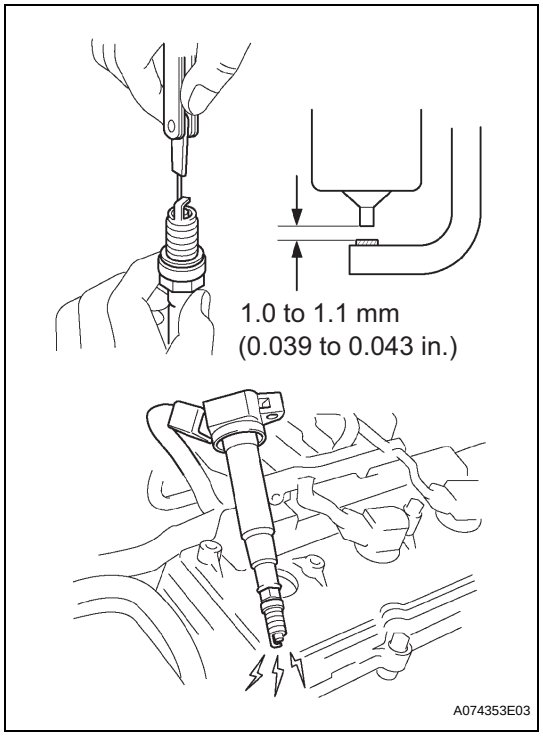
Result

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:

DENSO made	SK20R11
NGK made	IFR6A11

(d) Check the spark plug electrode gap.
Electrode gap:
1.0 to 1.1 mm (0.039 to 0.043 in.)
Maximum electrode gap:
1.3 mm (0.051 in.)
NOTICE:
If adjusting the gap of a new spark plug, bend only the base the ground electrode. Do not touch the tip. Never attempt to adjust the gap on a used plug.
(e) Check the electrode for carbon deposits.
(f) Perform a spark test.
CAUTION:
Absolutely disconnect the each injector connectors.
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 spark occurs while the engine is being cranked.
Standard:
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

(a) Change to the normal spark plug.
(b) Perform a spark test.
CAUTION:
Absolutely 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 spark occurs while the engine is being cranked.

Standard:
Spark jumps across electrode gap.

OK → **REPLACE SPARK PLUG**

NG

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

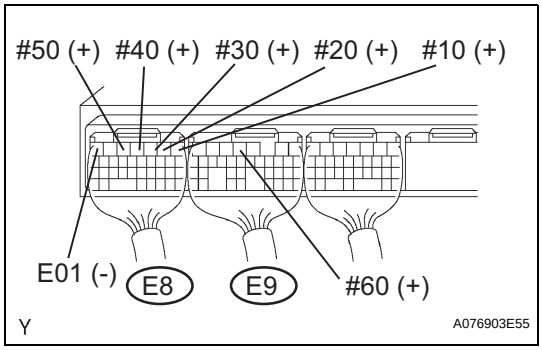
OK → **REPLACE IGNITION COIL ASSEMBLY (THEN CONFIRM THAT THERE IS NO MISFIRE)**

ES

NG

REPAIR OR REPLACE HARNESS OR CONNECTOR

8	INSPECT ECM TERMINAL OF MISFIRING CYLINDER (#10, #20, #30, #40, #50 OR #60 VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage between the applicable terminals of the E8 and E9 ECM connectors.
Standard voltage

Tester Connection	Specified Condition
#10 (E8-1) - E01 (E8-7)	9 to 14 V
#20 (E8-2) - E01 (E8-7)	9 to 14 V
#30 (E8-3) - E01 (E8-7)	9 to 14 V
#40 (E8-4) - E01 (E8-7)	9 to 14 V
#50 (E8-5) - E01 (E8-7)	9 to 14 V
#60 (E9-31) - E01 (E8-7)	9 to 14 V

OK → **Go to step 11**

NG

9	INSPECT FUEL INJECTOR RESISTANCE OF MISFIRING CYLINDER

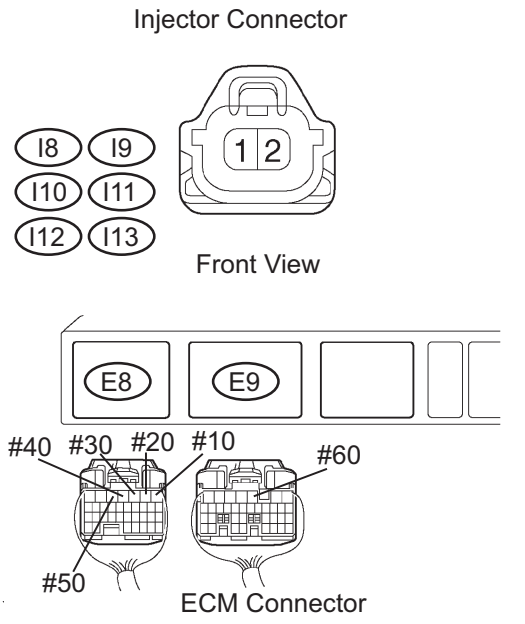
(a) Inspect the fuel injector. (See page FU-13)

NG → **REPLACE FUEL INJECTOR ASSEMBLY**

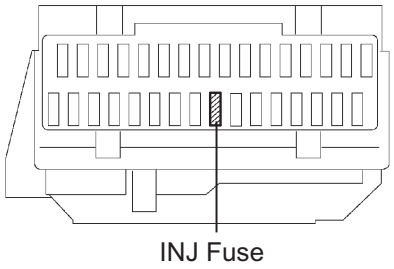
OK

10	CHECK HARNESS AND CONNECTOR OF MISFIRING CYLINDER (INJECTOR - ECM, INJECTOR - IGNITION SWITCH)

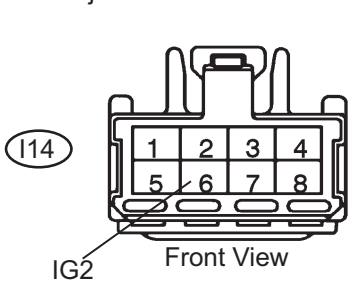
Wire Harness Side:



Instrument Panel J/B:



Wire Harness Side:



A124476E01

(a) Check the harness and the connector between the injector connector and the ECM connector.
  (1) Disconnect the I8, I9, I10, I11, I12 or I13 injector connector.
  (2) Disconnect the E8 or E9 ECM connector.
  (3) Check the resistance between the wire harness side connectors.
  Standard resistance

Tester Connection	Specified Condition
Injector (I8-1) - #10 (E8-1)	Below 1 Ω
Injector (I9-1) - #20 (E8-2)	Below 1 Ω
Injector (I10-1) - #30 (E8-3)	Below 1 Ω
Injector (I11-1) - #40 (E8-4)	Below 1 Ω
Injector (I12-1) - #50 (E8-5)	Below 1 Ω
Injector (I13-1) - #60 (E9-3)	Below 1 Ω
Injector (I8-1) or #10 (E8-1) - Body ground	10 kΩ or higher
Injector (I9-1) or #20 (E8-2) - Body ground	10 kΩ or higher
Injector (I10-1) or #30 (E8-3) - Body ground	10 kΩ or higher
Injector (I11-1) or #40 (E8-4) - Body ground	10 kΩ or higher
Injector (I12-1) or #50 (E8-5) - Body ground	10 kΩ or higher
Injector (I13-1) or #60 (E9-3) - Body ground	10 kΩ or higher

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

(b) Check the harness and the connector between the injector connector and the ignition switch connector.
  (1) Check the INJ fuse.
    • Remove the INJ fuse from the instrument panel J/B.
    • Measure the resistance of the INJ fuse.
    Standard resistance:
    Below 1 Ω
    • Reinstall the INJ fuse.
  (2) Disconnect the I8, I9, I10, I11, I12 or I13 injector connector.
  (3) Disconnect the I14 ignition switch connector.
  (4) Check the resistance between the wire harness side connectors.
  Standard resistance

Tester Connection	Specified Condition
Injector (I8-2) - IG2 (I14-6)	Below 1 Ω
Injector (I9-2) - IG2 (I14-6)	Below 1 Ω
Injector (I10-2) - IG2 (I14-6)	Below 1 Ω
Injector (I11-2) - IG2 (I14-6)	Below 1 Ω
Injector (I12-2) - IG2 (I14-6)	Below 1 Ω
Injector (I13-2) - IG2 (I14-6)	Below 1 Ω
Injector (I8-2) or IG2 (I14-6) - Body ground	10 kΩ or higher
Injector (I9-2) or IG2 (I14-6) - Body ground	10 kΩ or higher

ES

Tester Connection	Specified Condition
Injector (I10-2) or IG2 (I14-6) - Body ground	10 kΩ or higher
Injector (I11-2) or IG2 (I14-6) - Body ground	10 kΩ or higher
Injector (I12-2) or IG2 (I14-6) - Body ground	10 kΩ or higher
Injector (I13-2) or IG2 (I14-6) - Body ground	10 kΩ or higher

(5) Reconnect the injector connector.
(6) Reconnect the ignition switch connector.

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

OK

ES

11 INSPECT FUEL INJECTOR INJECTION AND VOLUME OF MISFIRING CYLINDER

(a) Inspect the fuel injector. (See page FU-13)

NG → **REPLACE FUEL INJECTOR ASSEMBLY**

OK

12 CHECK CYLINDER COMPRESSION PRESSURE OF MISFIRING CYLINDER

(a) Inspect cylinder compression pressure. (See page EM-3)

NG → **REPAIR OR REPLACE CYLINDER HEAD ASSEMBLY**

OK

13 CHECK VALVE CLEARANCE OF MISFIRING CYLINDER

(a) Inspect the valve clearance. (See page EM-10)

NG → **ADJUST VALVE CLEARANCE**

OK

14 SWITCH STEP BY NUMBER OF MISFIRE 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**

A

15	CHECK VALVE TIMING

(a) Check for looseness or jumping teeth of the timing belt (See page EM-25).

NG → **ADJUST VALVE TIMING (REPAIR OR REPLACE TIMING BELT)**

OK

16	CHECK FUEL PRESSURE

(a) Check the fuel pressure (See page FU-3).
Standard:
304 to 343 kPa (3.1 to 3.5 kgf/cm^2, 44.1 to 49.7 psi)

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

OK

17	READ VALUE OF INTELLIGENT TESTER OR OBD II SCAN TOOL (INTAKE AIR TEMPERATURE AND MASS AIR FLOW RATE)

(a) Connect the intelligent tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON.
(c) Check the intake air temperature.
  (1) Select the item "DIAGNOSIS/ENHANCED OBD II/ DATA LIST/ALL/INTAKE AIR" and read its value displayed on the intelligent tester or the OBD II scan tool.
  Temperature:
  Equivalent to ambient temperature
(d) Check the air flow rate.
  (1) Select the item "DIAGNOSIS/ENHANCED OBD II/ DATA LIST/ALL/MAF" and read its value displayed on the intelligent tester or the OBD II scan tool.

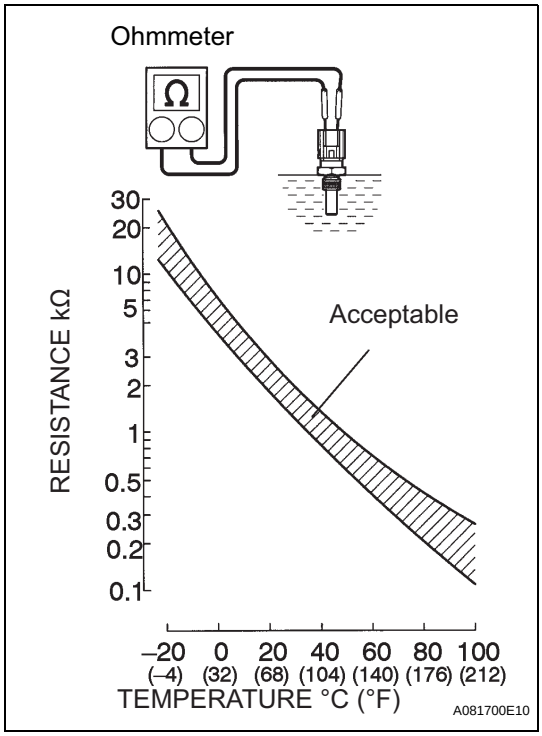
Standard

Condition	Air Flow Rate (gm/s)
Ignition switch ON (do not start engine)	0
Idling	4 to 6
Running without load (2,500 rpm)	13 to 20
Idling to quickly accelerating	Air flow rate fluctuates

NG → **REPLACE MASS AIR FLOW SENSOR**

OK

18	INSPECT ENGINE COOLANT TEMPERATURE SENSOR (RESISTANCE)



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

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

NOTICE:
In case of checking the engine coolant temperature sensor in the water, be careful not to allow water to go into the terminals. After checking, 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.
(c) Reinstall the engine coolant temperature sensor.

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 → **Go to step 5**

A

CHECK FOR INTERMITTENT PROBLEMS