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

CIRCUIT DESCRIPTION

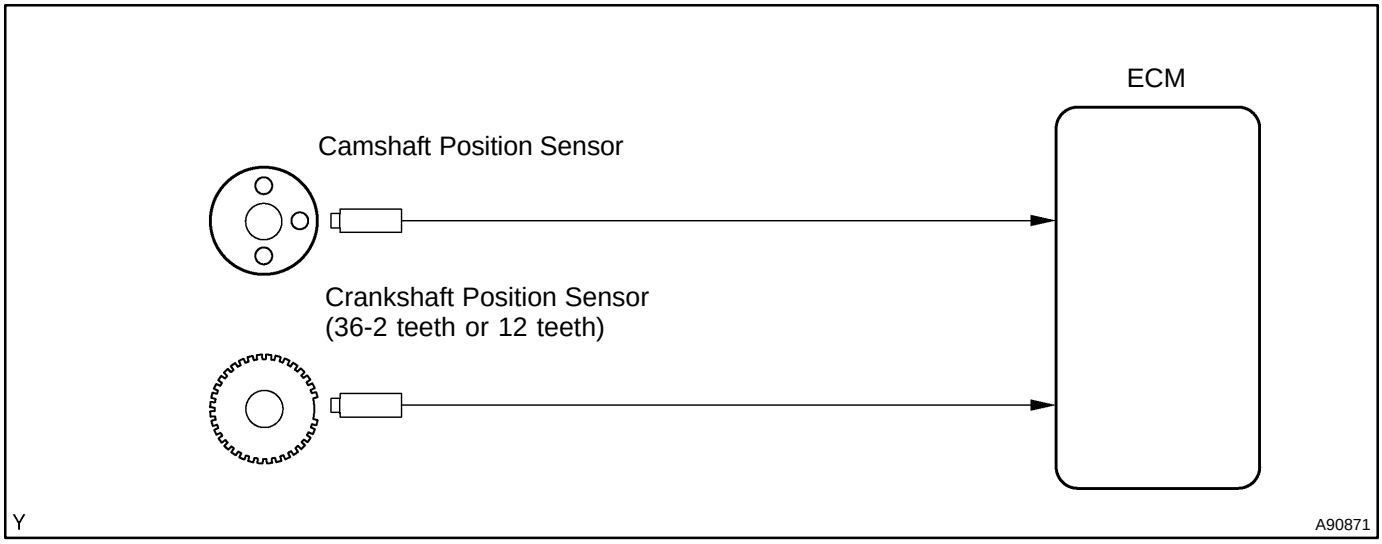
When a misfire occurs in the engine, hydrocarbons (HC) are output in high concentrations. If this HC concentration is high enough, there could be an increase in exhaust emission levels. High concentrations of HC can also cause the temperature of the catalyst to increase, possibly damaging the catalyst. To prevent increases 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 misfires, 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. A misfire is counted when crankshaft rotation speed variations exceed threshold values.

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

DTC No.	DTC Detection Condition	Trouble Area
P0300	Misfiring of random cylinders is detected	• Open or short in engine wire • Connector connection • Vacuum hose connection • Ignition system • Injector • Fuel pressure • MAF meter • ECT sensor • Compression pressure • Valve clearance • Valve timing • PCV hose connection • PCV hose • ECM
P0301 P0302 P0303 P0304	Misfiring of each cylinder is detected	• Same as DTC No. P0300

HINT:
When several codes for a misfiring cylinder are recorded repeatedly but no random misfire code is recorded, the misfires have been detected and recorded at different times.

MONITOR DESCRIPTION



The ECM illuminates the MIL (2 trip detection logic) if:

- The misfiring rate exceeds a threshold value and could cause emission deterioration.
- During the first 1,000 engine revolutions after the engine starts, an excessive misfire rate (approximately 20 to 50 misfires per 1,000 engine revolutions) occurs 1 time.
- After the first 1,000 engine revolutions after the engine starts, an excessive misfire rate (approximately 20 to 50 misfires per 1,000 engine revolutions) occurs 4 times.

The ECM blinks the MIL (MIL blinks immediately) if:

- Within 200 engine revolutions at a high rpm, the threshold for ”percentage of misfire causing catalyst damage” is reached 1 time.
- Within 200 engine revolutions at a normal rpm, the threshold for ”percentage of misfire causing catalyst damage” is reached 3 times. (for the 2nd trip, reaching the threshold once will cause the MIL to flash)

MONITOR STRATEGY

Related DTCs	P0300: Multiple cylinder misfire P0301: cylinder 1 misfire P0302: cylinder 2 misfire P0303: cylinder 3 misfire P0304: cylinder 4 misfire
Required sensors / components (Main)	Injector, ignition coil, spark plug
Required sensors / components (Related)	CKP, CMP, ECT, IAT and MAF meter
Frequency of operation	Continuous
Duration	1,000 revolutions: Emission-related-misfire 200 revolutions: Catalyst-damaged-misfire
MIL operation	2 driving cycles (MIL flashes immediately when Catalyst-damaged-misfire occurs)
Sequence of operation	None

TYPICAL ENABLING CONDITIONS

All:

The monitor will run whenever these DTCs are not present	See page 05-16
Battery voltage	8 V or more
Throttle position learning	Completed
VVT system	Not operated by scan tool
Engine RPM	400 to 6,200 rpm
All of the following conditions are met:	Condition 1 and 2
1. Engine Coolant Temperature (ECT)	-10 °C (14°F) or more
2. 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 × 4

Monitor Period of Catalyst-damage-misfire (MIL blinks):

All of the following conditions 1, 2 and 3 met:	Crankshaft 200 revolutions
1. Driving cycles	1st
2. Check Mode	OFF
3. Engine RPM	Less than 3,800 rpm
Except above	Crankshaft 200 revolutions x 3

TYPICAL MALFUNCTION THRESHOLDS

Monitor Period of Emission-related-misfire:

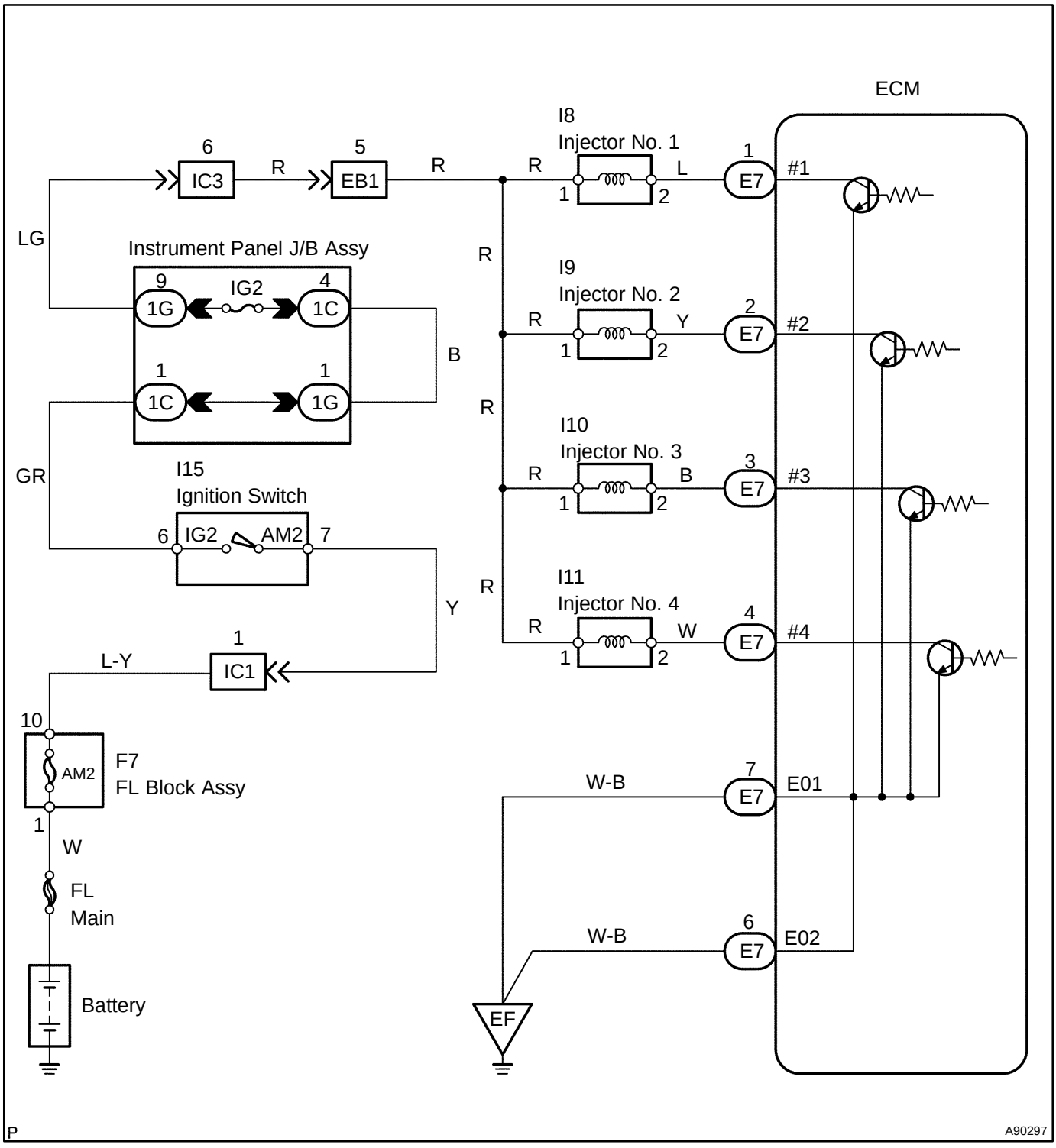
Misfire rate	4.0 % or more

Monitor Period of Catalyst-damage-misfire (MIL blinks):

Number of misfire per 200 revolutions	129 or more (varies with intake air amount and engine RPM)

WIRING DIAGRAM

Refer to DTC P0351 on page 05-174 for the wiring diagram of the ignition system.



CONFIRMATION DRIVING PATTERN

(a) Connect the hand-held tester to the DLC3.
(b) Record the DTCs, freeze frame data and misfire counter data.
(c) Set the hand-held tester to check mode (see page 05-40).
(d) Read the value on the misfire counter for each cylinder when idling. If the value is displayed on the misfire counter, skip the following procedure of confirmation driving.
(e) Drive the vehicle several times with the engine speed, load and its surrounding range shown with ENGINE SPD, CALC LOAD in the freeze frame data or MISFIRE RPM, MISFIRE LOAD in the DATA LIST.

If you have no hand-held tester, turn the ignition switch OFF after the symptom is simulated once. Then repeat the simulation process again.

HINT:

In order to memorize the misfire DTC, it is necessary to drive with MISFIRE RPM, MISFIRE LOAD in the DATA LIST for the period of time in the chart below. Take care not to turn the ignition switch OFF. Turning the ignition switch OFF switches the diagnosis system from check mode to normal mode and all DTCs, freeze frame data and other data are 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

(f) Check if there is misfire or not by monitoring, DTC and the freeze frame data. Record the DTCs, freeze frame data and misfire counter data.
(g) Turn the ignition switch OFF and wait for at least 5 seconds.

INSPECTION PROCEDURE

HINT:

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

  (1) Erase the general misfire fault code from the ECM using the hand-held tester or OBD II scan tool.
  (2) Start the engine and drive the confirmation pattern.
  (3) Read the value of the misfire ratio for each cylinder. Or read the DTC.
  (4) Perform repairs on the cylinder that has a high misfire ratio. Or repair the cylinder indicated by the DTC.
  (5) After finishing repairs, drive the confirmation pattern again and confirm that no misfire occurs.
- When either of SHORT FT #1, LONG FT #1 in the freeze frame data is over the range of ±20 %, there is a possibility that the air-fuel ratio is becoming to 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.

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

(a) Read the DTC using the hand-held tester to the OBD II scan tool.
Result:

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

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

B → **GO TO RELEVANT DTC CHART (See page 05-48)**

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.
OK: Connected correctly and no damage on wire harness.

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

OK

3	CHECK CONNECTION OF PCV HOSE

OK: PCV hose is connected correctly and PCV hose has no damage.

NG → **REPAIR OR REPLACE PCV HOSE**

OK

4	READ VALUE OF HAND-HELD TESTER OR OBD II SCAN TOOL (NUMBER OF MISFIRE)

(a) Connect the hand-held tester or the OBD II scan tool to the DLC3.
(b) Turn ON the ignition switch. Push the hand-held tester or the OBD II scan tool main switch ON.
(c) Start the engine.
(d) Enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / CYL#1 to CYL#4.
(e) Read the number of misfires on the hand-held tester or the OBD II scan tool.

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

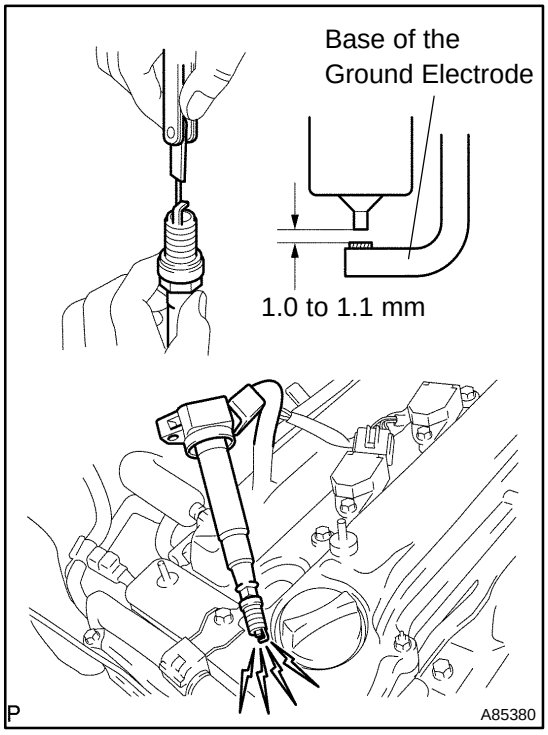
Result:

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.
(b) Remove the spark plug.
(c) Check the spark plug type.

Recommended spark plug:

DENSO made	SK20R11
NGK made	IFR6A11

(d) Measure the spark plug electrode gap.

Standard: 1.0 to 1.1 mm (0.039 to 0.043 in.)
Maximum: 1.3 mm (0.051 in.)

NOTICE:

If adjusting the gap of a new spark plug, bend only the base of 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:

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 spark occurs while the engine is being cranked.

OK: Spark jumps across electrode gap.

OK → **Go to step 8**

NG

6	CHANGE 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.

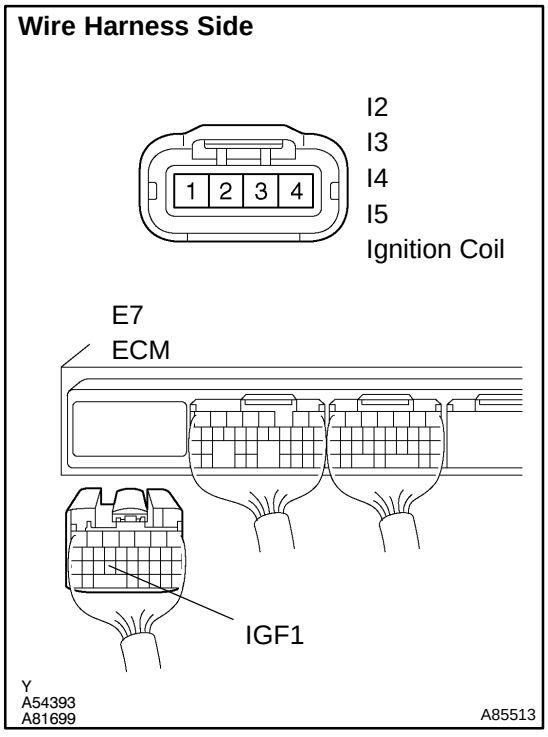
(1) Install the spark plug to the ignition coil and connect the ignition coil connector.
(2) Disconnect the injector connector.
(3) Ground the spark plug.
(4) Check if spark occurs while the engine is being cranked.

OK: Spark jumps across electrode gap.

OK → **REPLACE SPARK PLUG**

NG

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



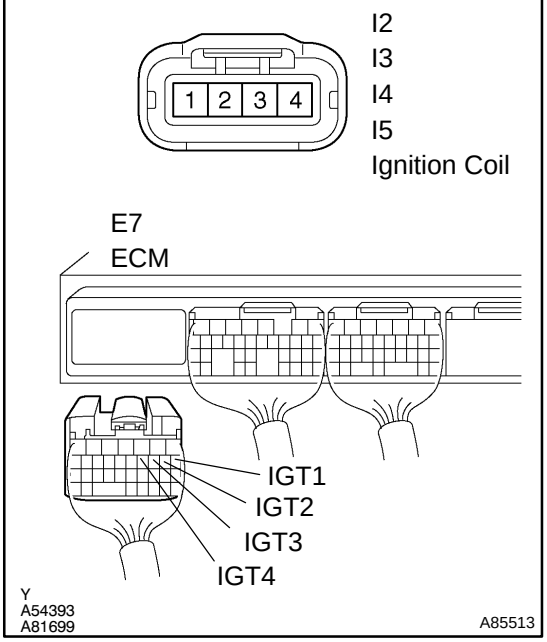
(a) Check the wire harness between the ignition coil and ECM.
(1) Disconnect the I2, I3, I4 and I5 ignition coil connectors.
(2) Disconnect the E7 ECM connector.
(3) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
I2-2 - E7-24 (IGF1) I3-2 - E7-24 (IGF1) I4-2 - E7-24 (IGF1) I5-2 - E7-24 (IGF1)	Below 1 Ω
I2-2 or E7-24 (IGF1) - Body ground I3-2 or E7-24 (IGF1) - Body ground I4-2 or E7-24 (IGF1) - Body ground I5-2 or E7-24 (IGF1) - Body ground	10 kΩ or higher

(4) Disconnect the I2, I3, I4 and I5 ignition coil connectors.

Wire Harness Side



(b) Check the wire harness between the ignition coil and ECM.
(1) Disconnect the I2, I3, I4 and I5 ignition coil connectors.
(2) Disconnect the E7 ECM connector.
(3) Measure the resistance of the wire harness side connectors.

Standard:

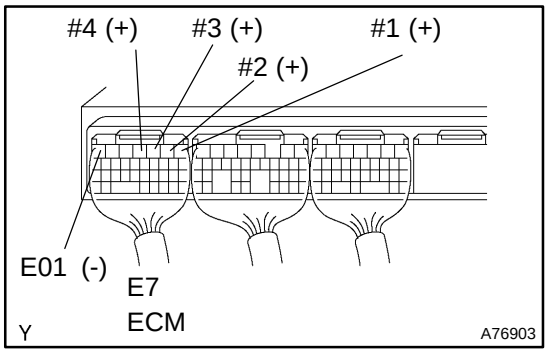
Tester Connection	Specified Condition
I2-3 - E7-8 (IGT1) I3-3 - E7-9 (IGT2) I4-3 - E7-10 (IGT3) I5-3 - E7-11 (IGT4)	Below 1 Ω
I2-3 or E7-8 (IGT1) - Body ground I3-3 or E7-9 (IGT2) - Body ground I4-3 or E7-10 (IGT3) - Body ground I5-3 or E7-11 (IGT4) - Body ground	10 kΩ or higher

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

NG

REPAIR OR REPLACE HARNESS AND CONNECTOR

8	INSPECT ECM TERMINAL OF MISFIRING CYLINDER (#1, #2, #3, #4 VOLTAGE)



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

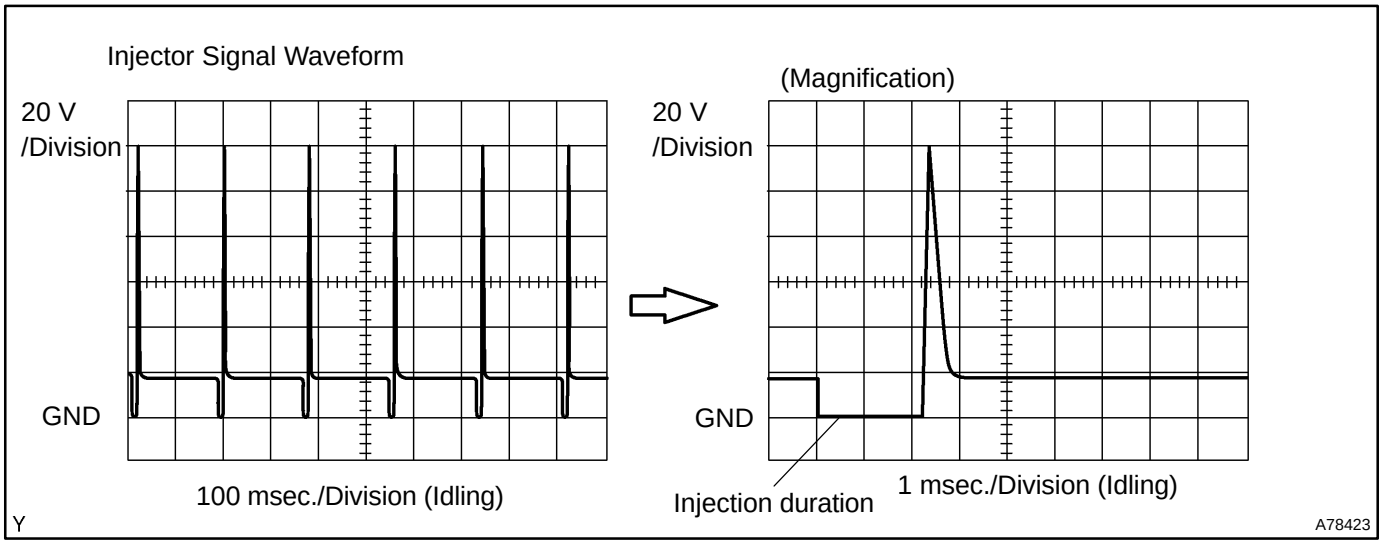
Standard:

Tester Connection	Specified Condition
E7-1 (#1) - E7-7 (E01) E7-2 (#2) - E7-7 (E01) E7-3 (#3) - E7-7 (E01) E7-4 (#4) - E7-7 (E01)	9 to 14 V

HINT:
Reference: Inspection using an oscilloscope.
Check the waveform of the ECM connectors.

Standard:

Tester Connection	Condition	Specified Condition
#1 to #4 - E01	Engine idling	Connect waveform is as shown



OK → **Go to step 11**

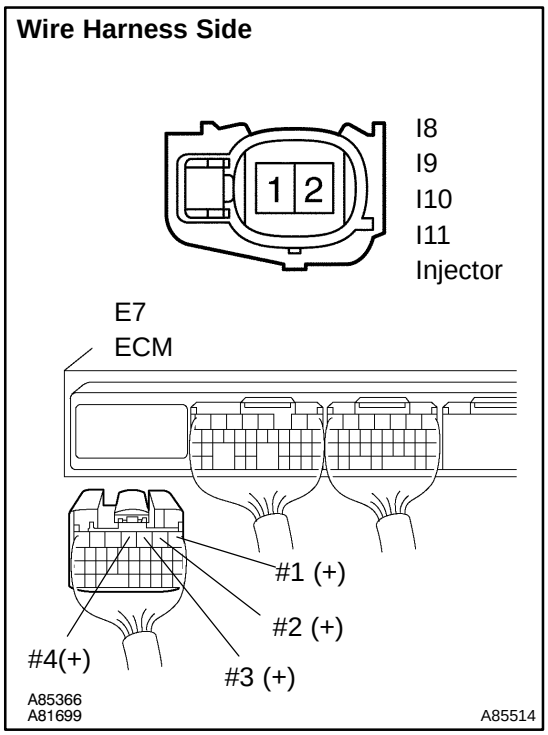
NG

9	INSPECT FUEL INJECTOR RESISTANCE OF MISFIRING CYLINDER (See page 11-7)

NG → **REPLACE FUEL INJECTOR ASSY (See page 11-10)**

OK

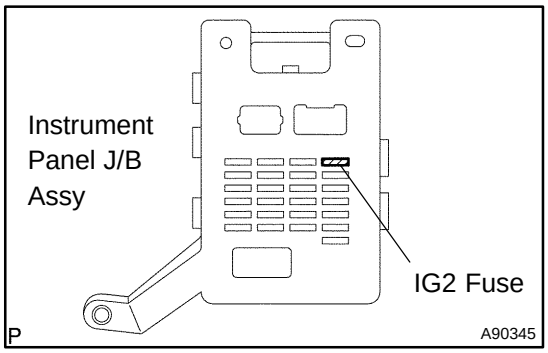
10	**CHECK WIRE HARNESS OF MISFIRING CYLINDER (INJECTOR - ECM, INJECTOR - IGNITION SWITCH)**



(a) Check the wire harness between the injector and ECM.
(1) Disconnect the I8, I9, I10 and I11 injector connectors.
(2) Disconnect the E7 ECM connector.
(3) Measure the resistance of the wire harness side connectors.

Standard:

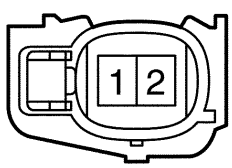
Tester Connection	Specified Condition
I8-1 - E7-1 (#1) I9-1 - E7-2 (#2) I10-1 - E7-3 (#3) I11-1 - E7-4 (#4)	Below 1 Ω
I8-1 or E7-1 (#1) - Body ground I9-1 or E7-2 (#2) - Body ground I10-1 or E7-3 (#3) - Body ground I11-1 or E7-4 (#4) - Body ground	10 kΩ or higher



(b) Check the IG2 fuse.
(1) Remove the IG2 fuse from the instrument panel J/B.
(2) Measure the resistance of the IG2 fuse.

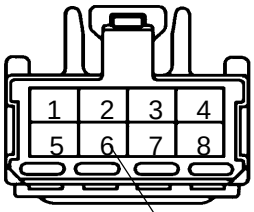
Standard: Below 1 Ω

Wire Harness Side



I8
I9
I10
I11
Injector

I15
Ignition Switch



A85366
A61075
A90538

(c) Check the wire harness between the injector and ignition switch.
(1) Disconnect the I8, I9, I10 and I11 injector connectors.
(2) Disconnect the I15 ignition switch connector.
(3) Measure the resistance of the wire harness side connectors.

Standard:

Tester Connection	Specified Condition
I8-2 - I15-6 (IG2) I9-2 - I15-6 (IG2) I10-2 - I15-6 (IG2) I11-2 - I15-6 (IG2)	Below 1 Ω
I8-2 or I15-6 (IG2) - Body ground I9-2 or I15-6 (IG2) - Body ground I10-2 or I15-6 (IG2) - Body ground I11-2 or I15-6 (IG2) - Body ground	10 kΩ or higher

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

OK

11	**INSPECT FUEL INJECTOR INJECTION AND VOLUME OF MISFIRING CYLINDER (See page 11-7)**

Standard:

Injection Volume	Difference Between Each Injector
76 to 91 cm^3 (4.6 to 5.5 cu in.) / 15 seconds	15 cm^3 (0.9 cu in.) or less

NG → **REPLACE FUEL INJECTOR ASSY**

OK

12	**CHECK CYLINDER COMPRESSION PRESSURE OF MISFIRING CYLINDER (See page 14-1)**

Standard:

Item	Specified Condition
Compression pressure	1.360 MPa (13.9 kgf/cm^2, 198 psi)
Minimum pressure	0.98 MPa (10 kgf/cm^2, 142 psi)
Difference between each cylinder	0.1 MPa (1.0 kgf/cm^2, 14 psi)

NG → **REPAIR OR REPLACE**

OK

13	CHECK VALVE CLEARANCE OF MISFIRING CYLINDER (See page 14-6)

Standard (cold):

Item	Specified Condition
Intake	0.19 to 0.29 mm (0.0075 to 0.0114 in.)
Exhaust	0.30 to 0.40 mm (0.0118 to 0.0157 in.)

NG → **ADJUST VALVE CLEARANCE (See page 14-6)**

OK

14	SWITCH STEP BY NUMBER OF MISFIRE CYLINDER (REFER TO RESULTS 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 (See page 14-68)

(a) Check for loose or jumped tooth of the timing chain.
OK: The matchmarks of the crankshaft pulley and camshaft pulley are alined.

NG → **ADJUST VALVE TIMING (See page 14-68)**

OK

16	CHECK FUEL PRESSURE (See page 11-4)

Standard:

Item	Specified Condition
Fuel pressure	304 to 343 kPa (3.1 to 3.5 kgf/cm^2, 44 to 55 psi)

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

OK

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

(a) Connect the hand-held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON.
(c) Check the intake air temperature.
  (1) On the hand-held tester or the OBD II scan tool, enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / INTAKE AIR. Read the values.

  Temperature: Equivalent to ambient temperature
(d) Check the air flow rate.
  (1) On the hand-held tester or the OBD II scan tool, enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / MAF. Read the values.

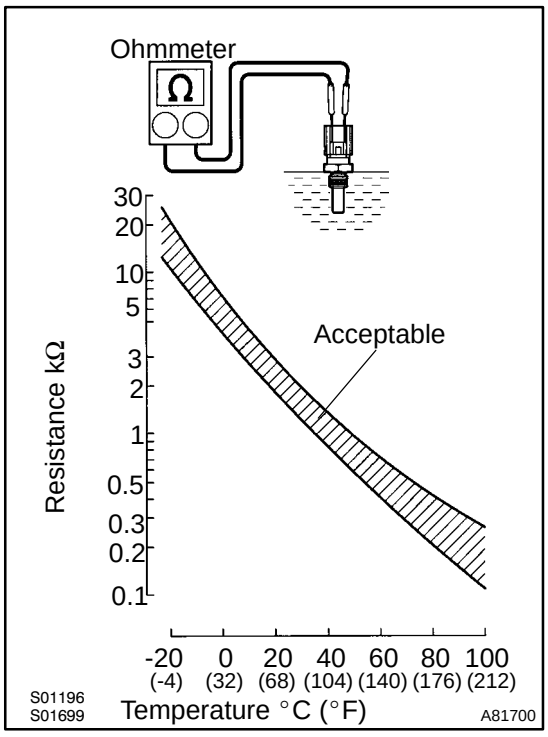
  Standard:

Condition	Air Flow Rate (gm/s)
Ignition switch ON (do not start engine)	0
Idling	0.5 to 5
Running without load (2,500 rpm)	3 to 10
Idling to quickly accelerating	Air flow rate fluctuates

NG → **REPLACE MASS AIR FLOW METER**

OK

18	INSPECT ENGINE COOLANT TEMPERATURE SENSOR (RESISTANCE)



(a) Remove the ECT sensor.
(b) Measure the resistance between the terminals.

  Standard:

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

NOTICE:

If checking the ECT 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 ECT 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 MISFIRE CYLINDER (REFER TO RESULTS 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)