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

DTC	P0305	CYLINDER 5 MISFIRE DETECTED

DTC	P0306	CYLINDER 6 MISFIRE DETECTED

DTC	P0307	CYLINDER 7 MISFIRE DETECTED

DTC	P0308	CYLINDER 8 MISFIRE DETECTED

CIRCUIT DESCRIPTION

Misfire: The ECM uses the crankshaft position sensor and camshaft position sensor to monitor changes in the crankshaft rotation for each cylinder.

The ECM counts the number of times the engine speed change rate indicates that misfire has occurred. And when the misfire rate equals to or exceeds the count of indicating that the engine condition has deteriorated, the MIL lights up.

If the misfire rate is high enough and the driving conditions will cause the catalyst to overheat, the MIL blinks when misfiring occurs.

HINT:

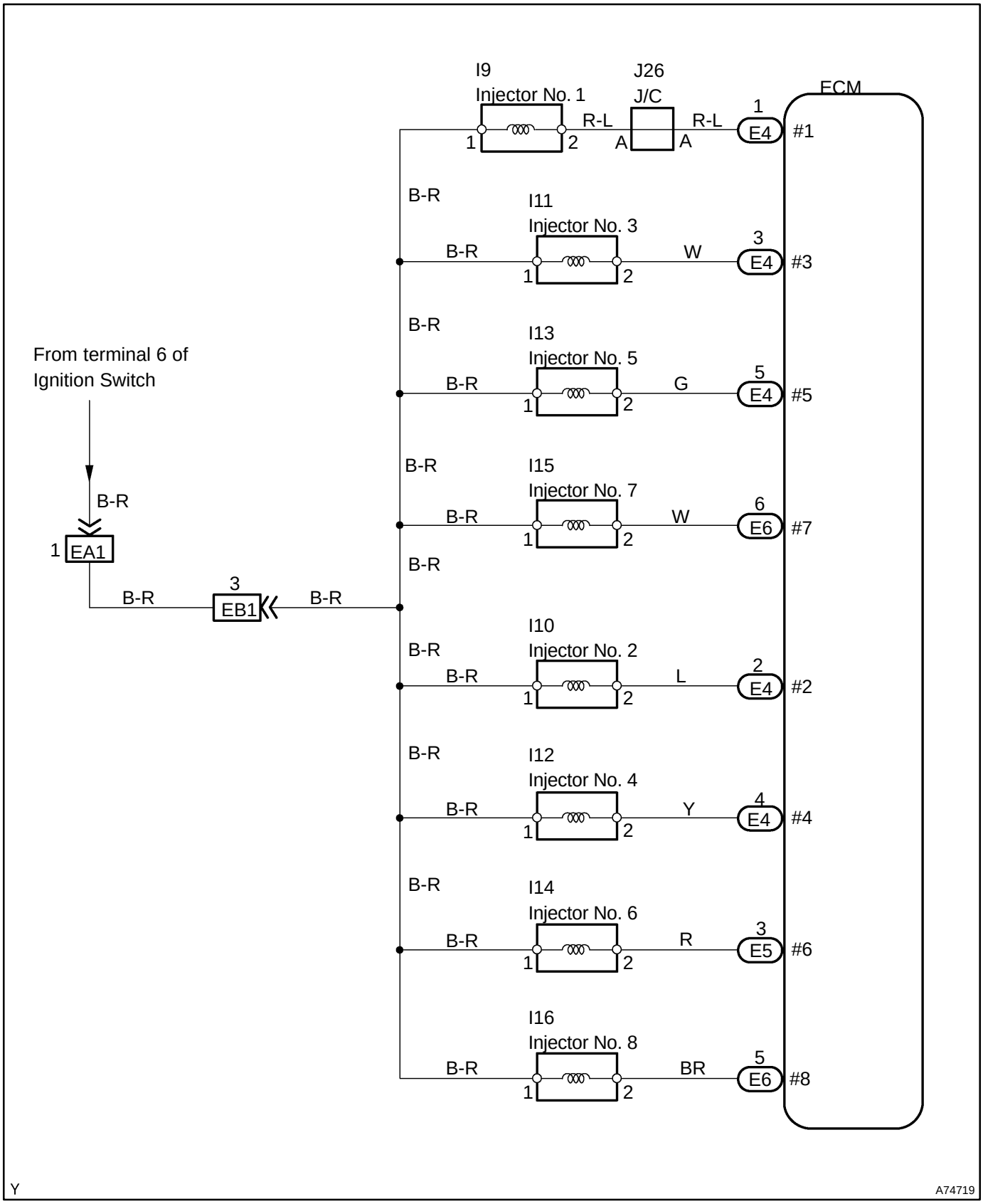
- For any particular 200 revolutions of engine, misfiring is detected, which can cause catalyst to overheat (This cause MIL to blink. 1 trip detection logic).
- For any particular 1,000 revolutions of engine, misfiring is detected, which causes a deterioration in emissions (This cause MIL to light up. 2 trip detection logic).

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 • Mass air flow meter • Engine coolant temperature sensor • Compression pressure • Valve clearance • Valve timing • PCV hose connection • PCV hose • ECM
P0301 P0302 P0303 P0304 P0305 P0306 P0307 P0308	Misfiring of each cylinder is detected	

HINT:

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

WIRING DIAGRAM



CONFIRMATION DRIVING PATTERN

(a) Connect the hand-held tester or the OBD II scan tool to the DLC3.
(b) Record DTC and the freeze frame data.
(c) Use the hand-held tester to set the check mode (See page 05-5).
(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 DTC of misfire, it is necessary to drive around MISFIRE RPM, MISFIRE LOAD for the following period of time in the data list. Take care not to turn the ignition switch OFF. Turning the ignition switch OFF switches the diagnosis system from check (test) mode to normal mode. So all DTCs, etc., 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 whether there is misfire or not by monitoring DTC and the freeze frame data. After that, record them.
(g) Turn the ignition switch OFF and wait at least 5 seconds.

INSPECTION PROCEDURE

HINT:

- If DTCs besides misfire are memorized simultaneously, first perform the troubleshooting for them.
- Read freeze frame data using the hand−held tester or the OBD II scan tool, as freeze frame data records the engine conditions when a malfunction is detected. 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, misfiring cylinder identification is disabled at high engine speed and only an general misfire fault code P0300 is stored instead of a cylinder specific misfire fault code (i. e., P0301 - P0308). Under the following conditions, only P0300 code may be stored.
  Misfire starts in the high engine speed area or misfire occurs only in the high engine speed area.
  Therefore, when a general misfire fault code (i.e., P0300) is only stored, erase the DTCs after read freeze frame data with the hand-held tester or OBD II scan tool. Start the engine and drive the confirmation patten (See the CONFIRMATION DRIVING PATTERN) and read the value of the misfire ratio for each cylinder (or DTC). Perform the repair correspond to the high misfire ratio cylinder (or the misfiring cylinder indicated by DTC). After completing the repair, confirm no misfire is occurring by driving the confirmation pattern.
- 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 inclining either 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 warming up the engine.

- If the misfire cannot be reproduced, the reason may be because of the driving the vehicle with lack of fuel, the use of improper fuel, a stain on the ignition plug, etc.
- Be sure to check the value on the misfire counter after the repair.

1	CHECK OTHER DTC OUTPUT(BESIDES MISFIRE DTCS)

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

Display (DTC output)	Proceed to
Only "P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307 and/or P0308" are output	A
"P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307 or P0308" and other DTCs are output	B

HINT:
If any other codes besides "P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307 and/or P0308" are output, perform the troubleshoot on that DTC before.

B → **GO TO RELEVANT DTC CHART (See page 05-18)**

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 CONNECTION OF PCV HOSE (See page 12-3)

NG → **REPAIR OR REPLACE PCV HOSE**

OK

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

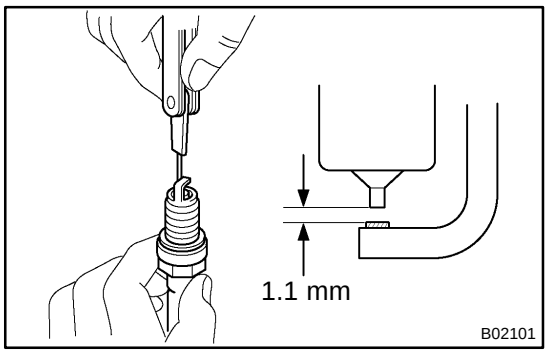
(a) Connect the hand-held tester or the OBD II scan tool to the DLC3.
(b) Turn the ignition switch ON and push the hand-held tester or the OBD II scan tool main switch ON.
(c) Start the engine.
(d) Select the item "DIAGNOSIS/ENHANCED OBD II/DATA LIST/ALL/CYL#1 - CYL#8".
(e) Read the number of misfire 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 assy.
(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.
Maximum electrode gap for used spark plug:
1.3 mm (0.051 in.)
Correct electrode gap for new spark plug:
1.1 mm (0.043 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:
To prevent excess fuel from being injected from the injectors during this test, do not crank the engine for more than 5 - 10 seconds at a time.

(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	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 the each injector connectors.
NOTICE:
To prevent excess fuel from being injected from the injectors during this test, do not crank the engine for more than 5 - 10 seconds at a time.

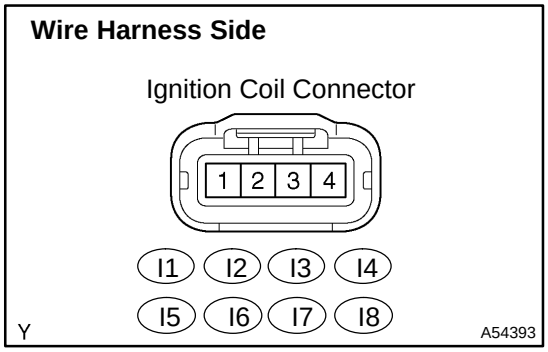
(1) Install the spark plug to the ignition coil, and connect the ignition coil connector.
(2) Disconnect the injector connector.
(3) Ground the spark plug.
(4) Check if spark occurs while the engine is being cranked.

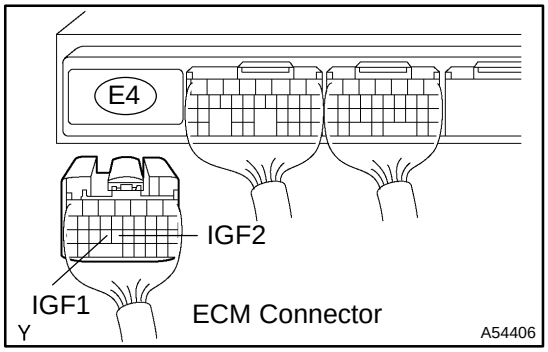
Standard: Spark jumps across electrode gap.

OK → **REPLACE SPARK PLUG**

NG

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





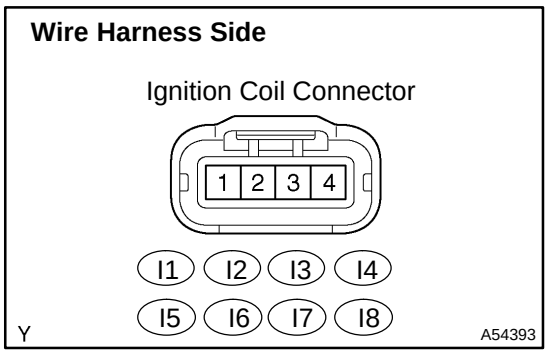
(a) Check the harness and connector between the ignition coil and ECM (IGF terminal) connectors
(1) Disconnect the I1, I2, I3, I4, I5, I6, I7 or I8 ignition coil connector.
(2) Disconnect the ECM E4 connector.
(3) Check the continuity between the wire harness side connectors.

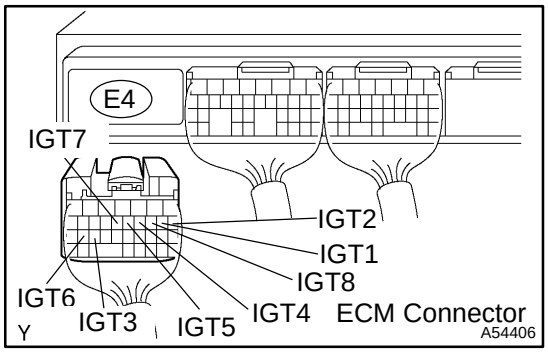
Standard (Check for open):

Symbols (Terminal No.)	Specified condition
Ignition coil (I1-2) ⇔ IGF1 (E4-24)	Continuity
Ignition coil (I2-2) ⇔ IGF2 (E4-23)	
Ignition coil (I3-2) ⇔ IGF2 (E4-23)	
Ignition coil (I4-2) ⇔ IGF1 (E4-24)	
Ignition coil (I5-2) ⇔ IGF2 (E4-23)	
Ignition coil (I6-2) ⇔ IGF1 (E4-24)	
Ignition coil (I7-2) ⇔ IGF1 (E4-24)	
Ignition coil (I8-2) ⇔ IGF2 (E4-23)	

Standard (Check for short):

Symbols (Terminal No.)	Specified condition
Ignition coil (I1-2) or IGF1 (E4-24) ⇔ Body ground	No continuity
Ignition coil (I2-2) or IGF2 (E4-23) ⇔ Body ground	
Ignition coil (I3-2) or IGF2 (E4-23) ⇔ Body ground	
Ignition coil (I4-2) or IGF1 (E4-24) ⇔ Body ground	
Ignition coil (I5-2) or IGF2 (E4-23) ⇔ Body ground	
Ignition coil (I6-2) or IGF1 (E4-24) ⇔ Body ground	
Ignition coil (I7-2) or IGF1 (E4-24) ⇔ Body ground	
Ignition coil (I8-2) or IGF2 (E4-23) ⇔ Body ground	





(b) Check the harness and connector between the ignition coil and ECM (IGT terminal) connectors
(1) Disconnect the I1, I2, I3, I4, I5, I6, I7 or I8 ignition coil connector.
(2) Disconnect the ECM E4 connector.
(3) Check the continuity between the wire harness side connectors.

Standard (Check for open):

Symbols (Terminal No.)	Specified condition
Ignition coil (I1-3) ⇔ IGT1 (E4-9)	Continuity
Ignition coil (I2-3) ⇔ IGT2 (E4-8)	
Ignition coil (I3-3) ⇔ IGT3 (E4-25)	
Ignition coil (I4-3) ⇔ IGT4 (E4-11)	
Ignition coil (I5-3) ⇔ IGT5 (E4-12)	
Ignition coil (I6-3) ⇔ IGT6 (E4-26)	
Ignition coil (I7-3) ⇔ IGT7 (E4-13)	
Ignition coil (I8-3) ⇔ IGT8 (E4-10)	

Standard (Check for short):

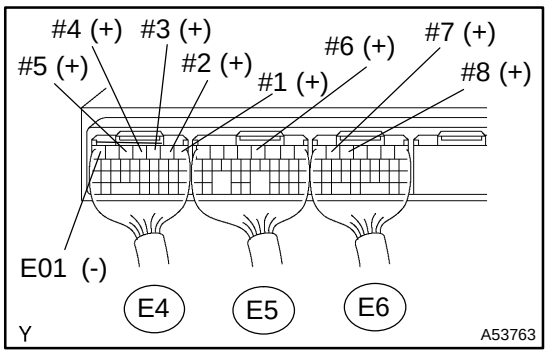
Symbols (Terminal No.)	Specified condition
Ignition coil (I1-3) or IGT1 (E4-9) ⇔ Body ground	No continuity
Ignition coil (I2-3) or IGT2 (E4-8) ⇔ Body ground	
Ignition coil (I3-3) or IGT3 (E4-25) ⇔ Body ground	
Ignition coil (I4-3) or IGT4 (E4-11) ⇔ Body ground	
Ignition coil (I5-3) or IGT5 (E4-12) ⇔ Body ground	
Ignition coil (I6-3) or IGT6 (E4-26) ⇔ Body ground	
Ignition coil (I7-3) or IGT7 (E4-13) ⇔ Body ground	
Ignition coil (I8-3) or IGT8 (E4-10) ⇔ Body ground	

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

NG

REPAIR OR REPLACE HARNESS OR CONNECTOR

8	INSPECT ECM TERMINAL OF MISFIRING CYLINDER(#1, #2, #3, #4, #5, #6, #7 OR #8 VOLTAGE)



(a) Turn the ignition switch ON.

(b) Measure the voltage between the applicable terminals of the E4, E5 and E6 ECM connectors.

Standard:

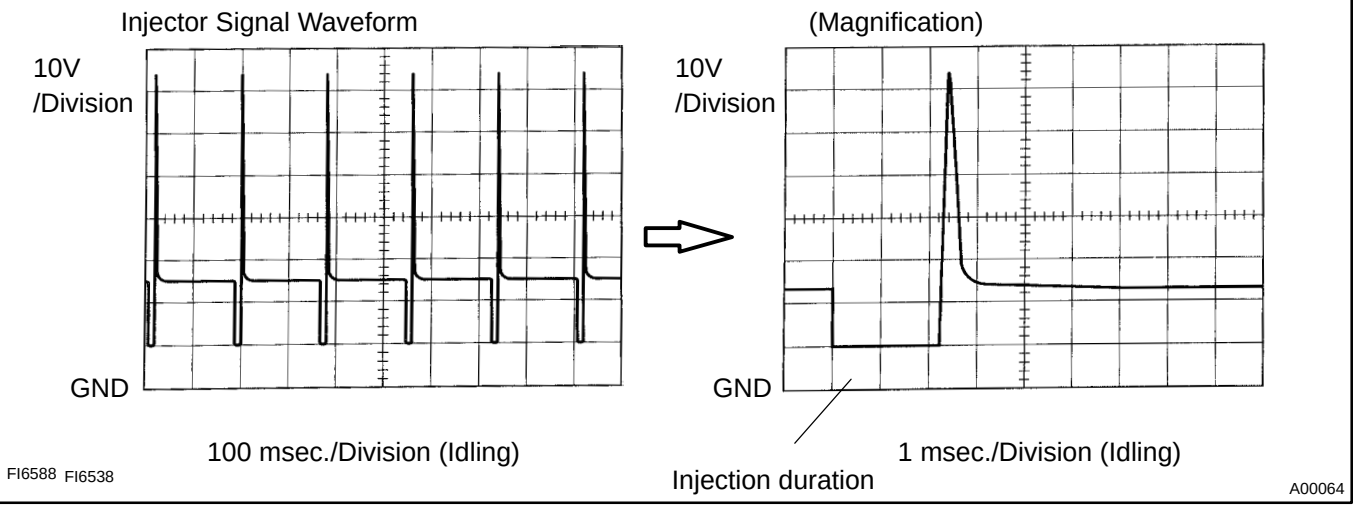
Symbols (Terminal No.)	Specified condition
#1 (E4-1) ⇔ E01 (E4-7)	9 - 14 V
#2 (E4-2) ⇔ E01 (E4-7)	
#3 (E4-3) ⇔ E01 (E4-7)	
#4 (E4-4) ⇔ E01 (E4-7)	
#5 (E4-5) ⇔ E01 (E4-7)	
#6 (E5-3) ⇔ E01 (E4-7)	
#7 (E6-6) ⇔ E01 (E4-7)	
#8 (E6-5) ⇔ E01 (E4-7)	

Reference: INSPECTION USING OSCILLOSCOPE

With the engine idling, check the waveform between terminals #1 - #8 and E01 of the ECM connectors.

HINT:

The correct waveform is as shown.



OK → **Go to step 11**

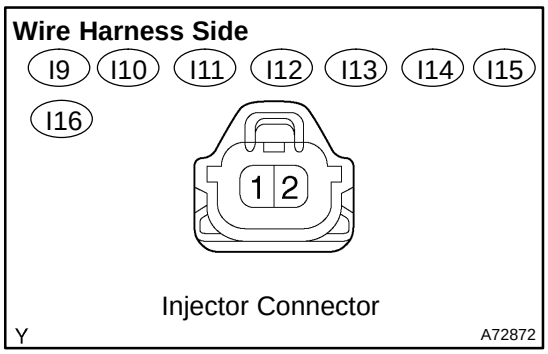
NG

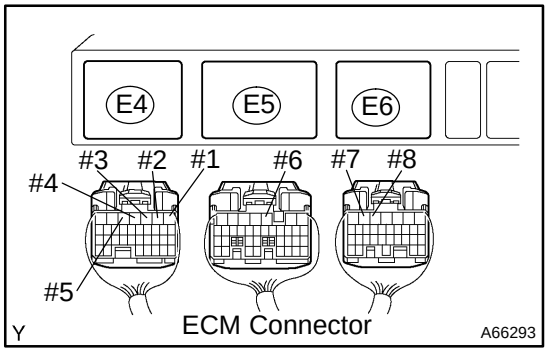
9	INSPECT FUEL INJECTOR RESISTANCE OF MISFIRING CYLINDER (See page 11-7)

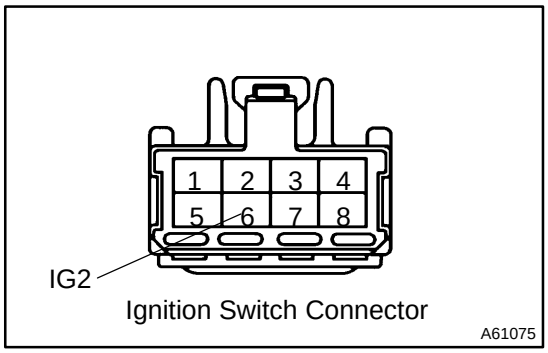
NG → **REPLACE FUEL INJECTOR ASSY**

OK

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







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

(1) Disconnect the I9, I10, I11, I12, I13, I14, I15 or I16 injector connector.

(2) Disconnect the E4, E5 or E6 ECM connector.

(3) Check the continuity between the wire harness side connectors.

Standard (Check for open):

Symbols (Terminal No.)	Specified condition
Injector (I9-2) ⇔ #1 (E4-1)	Continuity
Injector (I10-2) ⇔ #2 (E4-2)	
Injector (I11-2) ⇔ #3 (E4-3)	
Injector (I12-2) ⇔ #4 (E4-4)	
Injector (I13-2) ⇔ #5 (E4-5)	
Injector (I14-2) ⇔ #6 (E5-3)	
Injector (I15-2) ⇔ #7 (E6-6)	
Injector (I16-2) ⇔ #8 (E6-5)	

Standard (Check for short):

Symbols (Terminal No.)	Specified condition
Injector (I9-2) or #1 (E4-1) ⇔ Body ground	No continuity
Injector (I10-2) or #2 (E4-2) ⇔ Body ground	
Injector (I11-2) or #3 (E4-3) ⇔ Body ground	
Injector (I12-2) or #4 (E4-4) ⇔ Body ground	
Injector (I13-2) or #5 (E4-5) ⇔ Body ground	
Injector (I14-2) or #6 (E5-3) ⇔ Body ground	
Injector (I15-2) or #7 (E6-6) ⇔ Body ground	
Injector (I16-2) or #8 (E6-5) ⇔ Body ground	

(b) Check the harness and connector between the injector connector and ignition switch connector.

(1) Disconnect the I9, I10, I11, I12, I13, I14, I15 or I16 injector connector.

(2) Disconnect the ignition switch connector.

(3) Check the continuity between the wire harness side connectors.

Standard (Check for open):

Symbols (Terminal No.)	Specified condition
Injector (I9-1) ⇔ IG2 (6)	Continuity
Injector (I10-1) ⇔ IG2 (6)	
Injector (I11-1) ⇔ IG2 (6)	
Injector (I12-1) ⇔ IG2 (6)	
Injector (I13-1) ⇔ IG2 (6)	
Injector (I14-1) ⇔ IG2 (6)	
Injector (I15-1) ⇔ IG2 (6)	
Injector (I16-1) ⇔ IG2 (6)	

Standard (Check for short):

Symbols (Terminal No.)	Specified condition
Injector (I9-1) or IG2 (6) ⇔ Body ground	No continuity
Injector (I10-1) or IG2 (6) ⇔ Body ground	
Injector (I11-1) or IG2 (6) ⇔ Body ground	
Injector (I12-1) or IG2 (6) ⇔ Body ground	
Injector (I13-1) or IG2 (6) ⇔ Body ground	
Injector (I14-1) or IG2 (6) ⇔ Body ground	
Injector (I15-1) or IG2 (6) ⇔ Body ground	
Injector (I16-1) or IG2 (6) ⇔ Body ground	

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

OK

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

NG → **REPLACE FUEL INJECTOR ASSY**

OK

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

NG → **REPAIR OR REPLACE**

OK

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

NG → **ADJUST VALVE CLEARANCE**

OK

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

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

B → **CHECK FOR INTERMITTENT PROBLEMS (See page 05-5)**

A

15	CHECK VALVE TIMING(CHECK FOR LOOSE AND JUMPING TEETH OF TIMING BELT) (See page 14-107)

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

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 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) Select the item ”DIAGNOSIS/ENHANCED OBD II/DATA LIST/ALL/INTAKE AIR” and read its value displayed on the hand-held 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 hand-held tester or the OBD II scan tool.

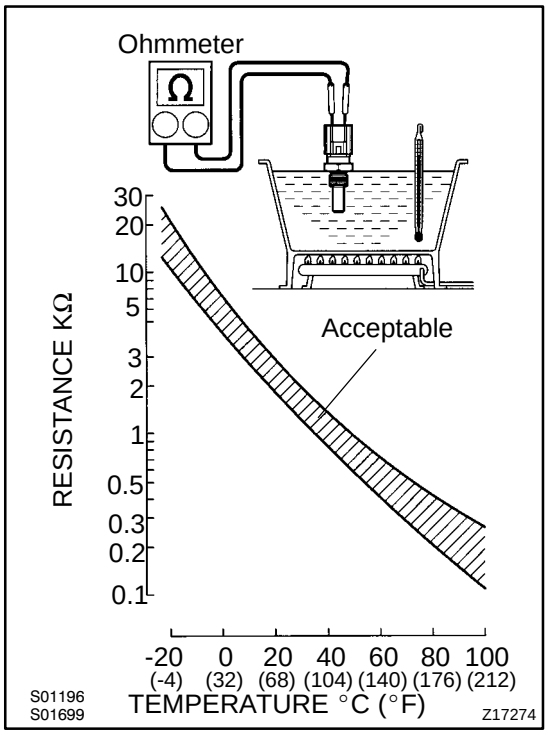
  Standard:

Condition	Air flow rate (gm/s)
Ignition switch On (do not start engine)	0
Idling	4 - 6
Racing without load (2,500 rpm)	13 - 20
Idling ⇔ Racing	Air flow rate fluctuates

NG → REPLACE MASS AIR FLOW METER

OK

18	INSPECT ENGINE COOLANT TEMPERATURE SENSOR(RESISTANCE)



(a) Measure the resistance between terminals.

Resistance:

Approx. 20 °C (68 °F) 2.32 - 2.59 kΩ

Approx. 80 °C (176 °F) 0.310 - 0.326 kΩ

NOTICE:

In case of checking the engine coolant temperature sensor in the water, be careful not to allow water to go into the terminals, and after checking, wipe out the sensor.

NG → **REPLACE ENGINE COOLANT TEMPERATURE SENSOR**

OK

19	SWITCH STEP BY NUMBER OF MISFIRE CYLINDER(REFER RESULT OF STEP 4)

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

B → **AGAIN GO TO STEP5**

A

CHECK FOR INTERMITTENT PROBLEMS (See page 05-5)