DIC2C–02

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

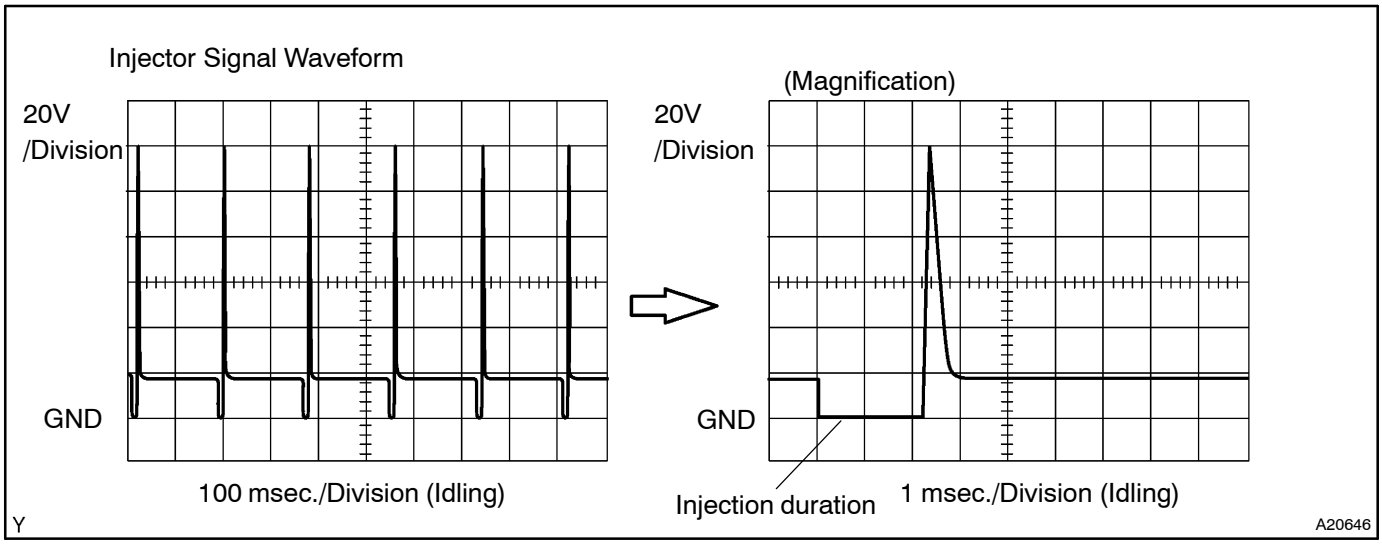
CIRCUIT DESCRIPTION

When a misfire occurs in the engine, hydrocarbons (HC) enter the exhaust in high concentrations. If this HC concentration is high enough, there could be an increase in exhaust emissions levels. High concentrations of HC can also cause to temperature of the catalyst to increase, possibly damaging the catalyst. To prevent this increase in emissions and limit the possibility of thermal damage, the engine control ECU monitors the misfire rate. When the temperature of the catalyst reaches a point of thermal degradation, the engine control ECU will blink the MIL. For monitoring misfire, the engine control ECU 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.

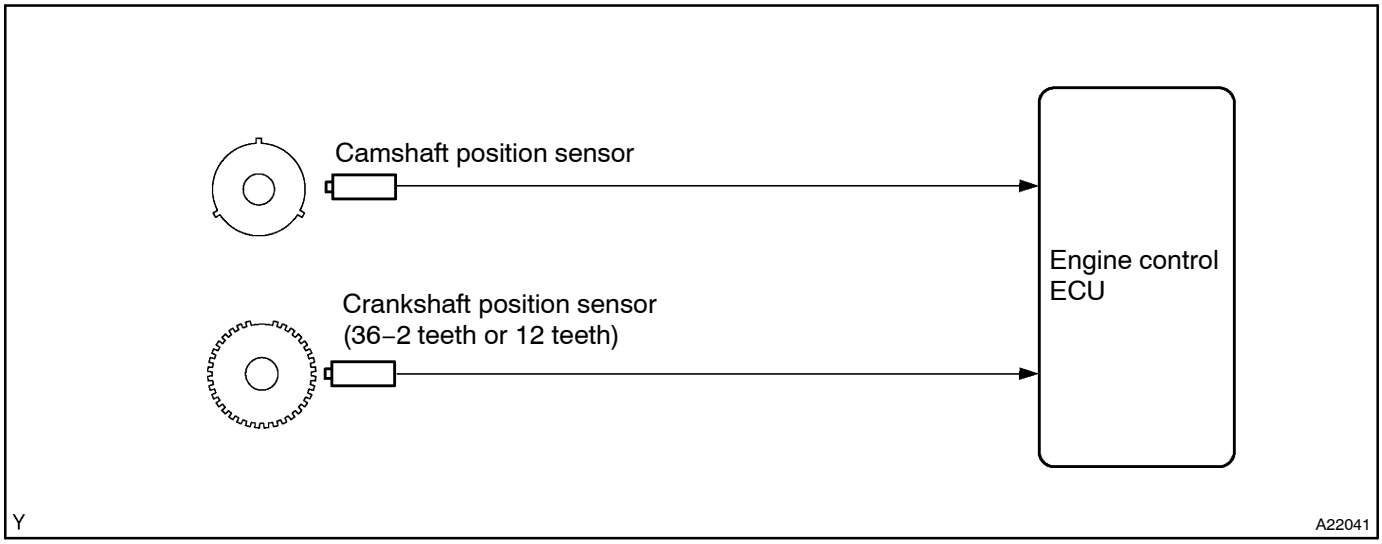
If the misfiring rate exceeds the threshold value and could cause emissions deterioration, the engine control ECU illuminates the MIL.

DTC No.	DTC Detecting Condition	Trouble Area
P0300	Misfiring of random cylinders is detected (2 trip detection logic)	• 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 piping • Engine control ECU
P0301 P0302 P0303 P0304 P0305 P0306 P0307 P0308	Misfiring of each cylinder is detected (2 trip detection logic)	

HINT:
Mill blink immediately when catalyst damage level misfire occur.
HINT:
When several 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.
Reference: Inspection using the oscilloscope.
With the engine idling, check the waveform between terminals #1 to #8 and E01 of the engine control ECU connectors.
HINT:
The correct waveform is as shown.



MONITOR DESCRIPTION



The ECM illuminates the MIL (2 trip detection logic) as follows (DTC is stored after 2 trip detection):

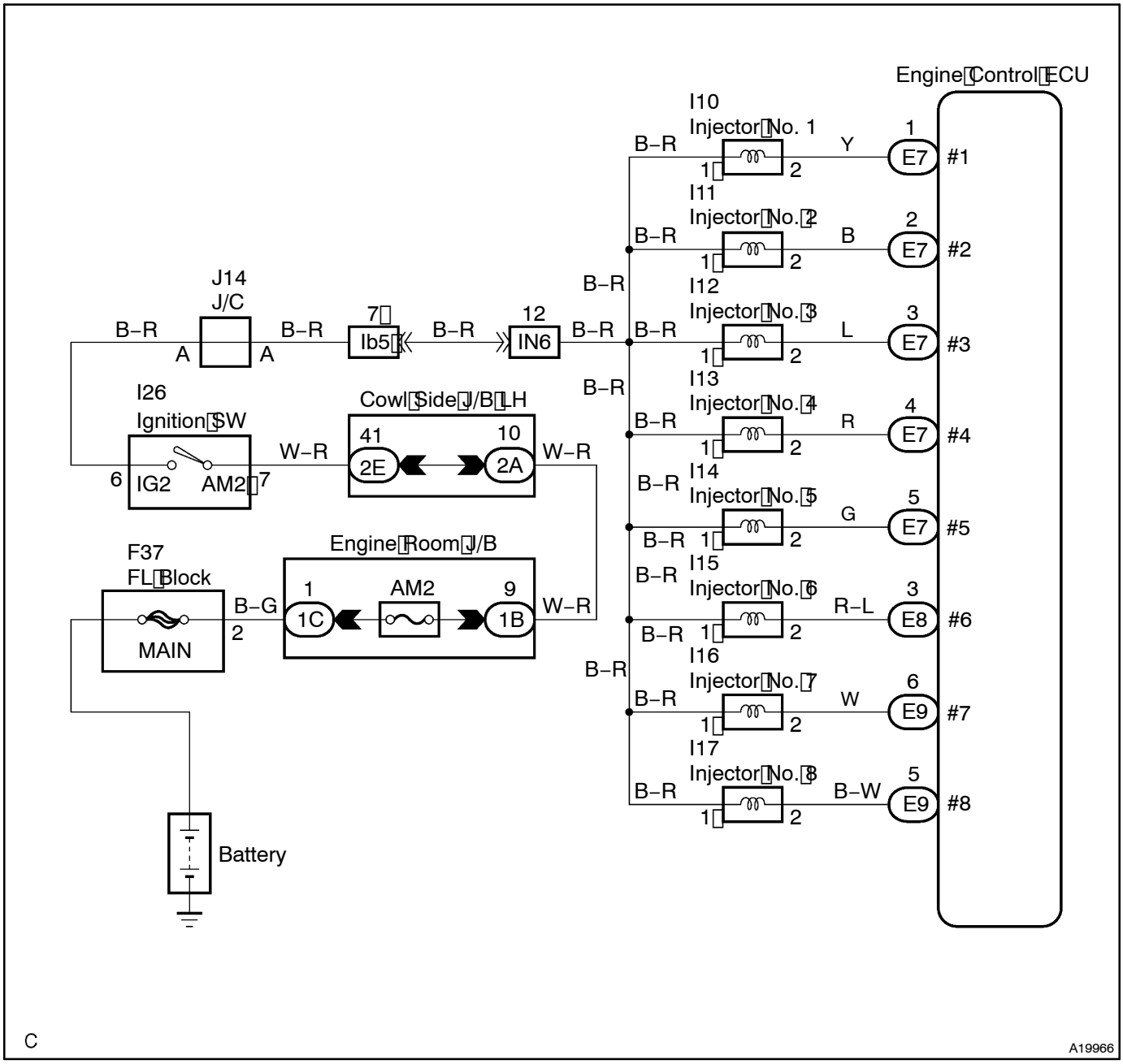
- The misfiring rate exceeds a threshold value and could cause emissions deterioration.
- An excessive misfire rate (approximately 20 to 60 misfires per 1,000 crankshaft revolutions) occurs 4 times.

The ECM flashes the MIL (MIL flashes immediately) as follows (DTC is stored after 2 trip detection):

- Within 200 crankshaft revolutions at a high rpm, the threshold for ”percent of misfire causing catalyst damage” is reached once.
- Within 200 crankshaft revolutions at a normal rpm, the threshold for ”percent of misfire causing catalyst damage” is reached 3 times.

WIRING DIAGRAM

Refer to DTC P0351 on page DI–161 for the wiring diagram of the ignition system.



CONFIRMATION DRIVING PATTERN

(a) Connect the hand–held tester to the DLC3.
(b) Record DTC and the freeze frame data.
(c) Use the hand–held tester to set to the check mode. (See page DI–3).
(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 in the DATA LIST for the following period of time. Take care not to turn the ignition switch OFF. Turning the ignition switch OFF switches the diagnosis system from check 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 if there is misfire and DTC and the freeze frame data. Record the DTC's, freeze frame data and misfire counter data.
(g) Turn the ignition switch OFF and wait at least 5 seconds.

INSPECTION PROCEDURE

HINT:

- If DTCs besides misfire DTCs are memorized simultaneously, troubleshoot the non–misfire DTCs first.
- 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 a general misfire fault code P0300 is stored instead of a cylinder specific misfire fault code (P0301 to P0308).
  If the misfire starts in a high engine speed area or the misfire occurs only in a high engine speed area, only code P0300 may be stored.

When only a general misfire fault code like P0300 is stored:

- Erase the general misfire fault code from the hand–held tester.
- Start the engine and drive the confirmation patten.
- Read the value of the misfire ratio for each cylinder. Or read the DTC.
- Perform repairs on the cylinder that has a high misfire ratio. Or repair the cylinder indicated by the DTC.
- 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.

1	**Are there any other codes (besides DTC P0300, P0301, P0302, P0303, P0304 P0305, P0306, P0307 or P0308) being output?**

PREPARATION:

(a) Connect the hand–held tester to the DLC3.

(b) Turn the ignition switch ON and push the hand–held tester main switch ON.

(c) When using hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DTC INFO / CURRENT CODES.

CHECK:

Read the DTC using hand–held tester.

RESULT:

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

HINT:

If any other codes besides "P0300, P0301, P0302, P0303, P0304, P0305, P0306, P0307 or P0308" are output, perform the troubleshooting for those DTC.

B → **Go to relevant DTC chart (See page DI–19).**

A

2	**Check wire harness, connector and vacuum hose in engine room.**

CHECK:

(a) Check the connection conditions of the wire harness and connector.

(b) Check for the disconnection, piping and brake of the vacuum hose.

NG → **Repair or replace, then confirm that there is no misfire (See confirmation driving pattern).**

OK

3	**Check connection of PCV piping.**

NG → **Repair or replace PCV piping.**

OK

4	**Connect hand–held tester, and read the number of misfire.**

PREPARATION:

(a) Connect the hand–held tester to the DLC3.
(b) Turn the ignition switch ON and push the hand–held tester main switch ON.
(c) Start the engine.
(d) When using hand–held tester, enter the following menus: DIAGNOSIS / OBD/MOBD / DATA LIST / ALL / CYL#1 to CYL#8.

CHECK:

Read the number of misfire on the hand–held tester.

HINT:

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

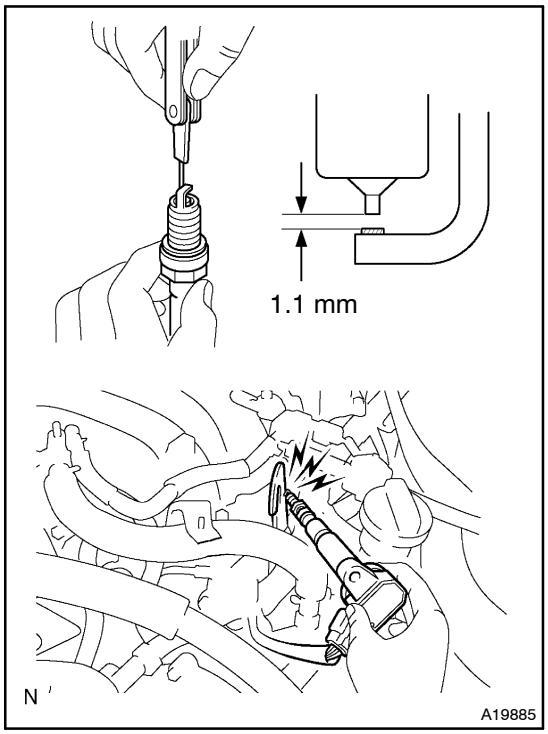
RESULT:

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.**



PREPARATION:

(a) Remove the ignition coil assembly.
(b) Remove the spark plug.

CHECK:

(a) Check the electrode for carbon deposits.
(b) Check the spark plug type.
(c) Check electrode gap.

OK:

No large carbon deposit present.
Not wet with gasoline or oil.
Electrode gap:

	Type	Specified Condition
DENSO made	SK20R11	1.0 to 1.3 mm (0.039 to 0.050 in.)
NGK made	IFR6A11	1.0 to 1.3 mm (0.039 to 0.050 in.)
DENSO made*	K20R–U	0.7 to 1.0 mm (0.027 to 0.039 in.)
NGK made*	BKR6EYA	0.7 to 1.0 mm (0.027 to 0.039 in.)

*: Australia spec only

NOTICE:

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

PREPARATION:

(a) Install the spark plug to the ignition coil assembly.
(b) Disconnect the injector connector.
(c) Ground spark plug.

CHECK:

Check if spark occurs while engine is being cracked.

CAUTION:

Always disconnect each injector connector.

NOTICE:

Do not crank the engine for more than 2 seconds.

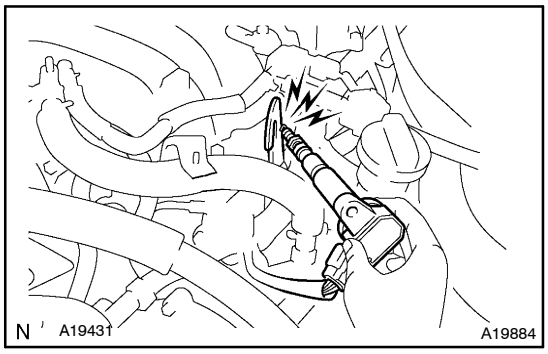
OK:

Spark occurs across electrode gap.

OK	**Go to step 8.**

NG

6	Change normal spark plug and check spark of misfiring cylinder.



PREPARATION:

(a) Change to the normal spark plug.
  (1) Remove the spark plug that may be faulty from the ignition coil assembly.
  (2) Install the spark plug to the ignition coil assembly.
(b) Disconnect the injector connector.
(c) Ground the spark plug.

CHECK:

Check if spark occurs while the engine is being cranked.

CAUTION:

Always disconnect each injector connector.

NOTICE:

Do not crank the engine for more than 2 seconds.

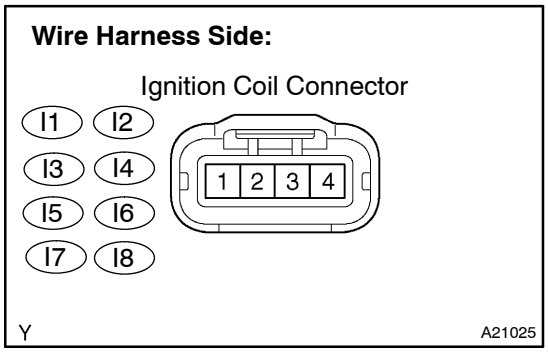
OK:

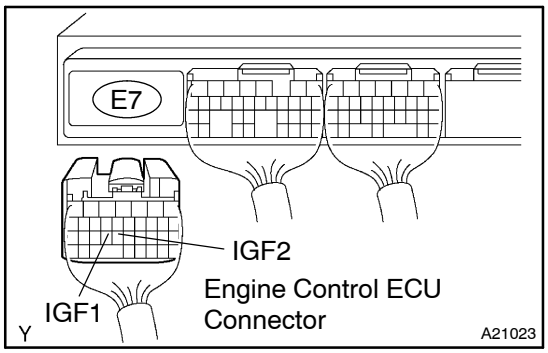
Spark jumps across electrode gap.

OK	Replace spark plug.

NG

7	**Check for open and short in harness and connector between ignition coil and engine control ECU.**





Check the harness and connector between the ignition coil and the engine control ECU (IGF terminal) connectors:

PREPARATION:

(a) Disconnect the I1, I2, I3, I4, I5, I6, I7 or I8 ignition coil connector.

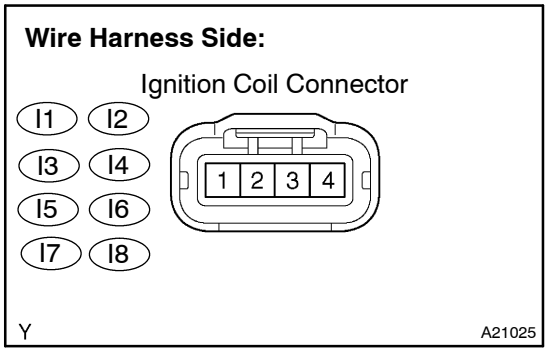
(b) Disconnect the E7 engine control ECU connector.

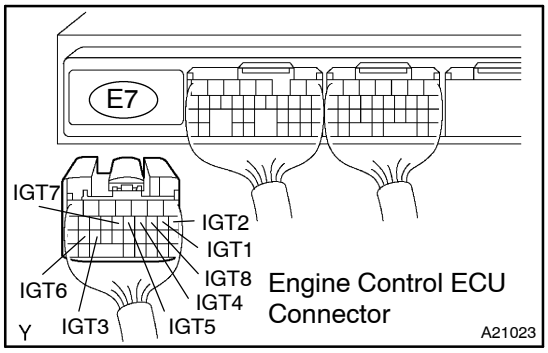
CHECK:

Check the resistance between the wire harness side connectors.

OK:

Tester Connection	Specified Condition
Ignition coil (I1–2) – IGF1 (E7–24)	Below 1 Ω
Ignition coil (I2–2) – IGF2 (E7–23)	Below 1 Ω
Ignition coil (I3–2) – IGF1 (E7–24)	Below 1 Ω
Ignition coil (I4–2) – IGF2 (E7–23)	Below 1 Ω
Ignition coil (I5–2) – IGF1 (E7–24)	Below 1 Ω
Ignition coil (I6–2) – IGF2 (E7–23)	Below 1 Ω
Ignition coil (I7–2) – IGF1 (E7–24)	Below 1 Ω
Ignition coil (I8–2) – IGF2 (E7–23)	Below 1 Ω
Ignition coil (I1–2) or IGF1 (E7–24) – Body ground	10 kΩ or higher
Ignition coil (I2–2) or IGF2 (E7–23) – Body ground	10 kΩ or higher
Ignition coil (I3–2) or IGF1 (E7–24) – Body ground	10 kΩ or higher
Ignition coil (I4–2) or IGF2 (E7–23) – Body ground	10 kΩ or higher
Ignition coil (I5–2) or IGF1 (E7–24) – Body ground	10 kΩ or higher
Ignition coil (I6–2) or IGF2 (E7–23) – Body ground	10 kΩ or higher
Ignition coil (I7–2) or IGF1 (E7–24) – Body ground	10 kΩ or higher
Ignition coil (I8–2) or IGF2 (E7–23) – Body ground	10 kΩ or higher





Check the harness and connector between the ignition coil and the engine control ECU (IGT terminal) connectors:

PREPARATION:

(a) Disconnect the I1, I2, I3, I4, I5, I6, I7 or I8 ignition coil connector.

(b) Disconnect the E7 engine control ECU connector.

CHECK:

Check the resistance between the wire harness side connectors.

OK:

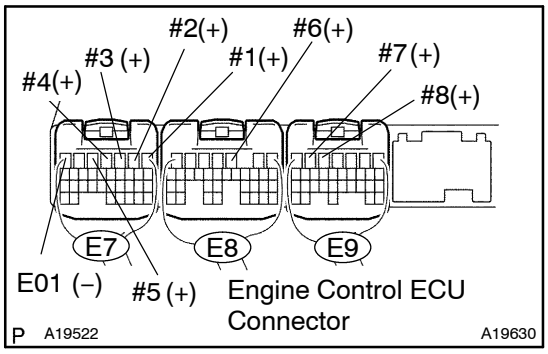
Tester Connection	Specified Condition
Ignition coil (I1–3) – IGT1 (E7–9)	Below 1 Ω
Ignition coil (I2–3) – IGT2 (E7–8)	Below 1 Ω
Ignition coil (I3–3) – IGT3 (E7–25)	Below 1 Ω
Ignition coil (I4–3) – IGT4 (E7–11)	Below 1 Ω
Ignition coil (I5–3) – IGT5 (E7–12)	Below 1 Ω
Ignition coil (I6–3) – IGT6 (E7–26)	Below 1 Ω
Ignition coil (I7–3) – IGT7 (E7–13)	Below 1 Ω
Ignition coil (I8–3) – IGT8 (E7–10)	Below 1 Ω
Ignition coil (I1–3) or IGT1 (E7–9) – Body ground	10 kΩ or higher
Ignition coil (I2–3) or IGT2 (E7–8) – Body ground	10 kΩ or higher
Ignition coil (I3–3) or IGT3 (E7–25) – Body ground	10 kΩ or higher
Ignition coil (I4–3) or IGT4 (E7–11) – Body ground	10 kΩ or higher
Ignition coil (I5–3) or IGT5 (E7–12) – Body ground	10 kΩ or higher
Ignition coil (I6–3) or IGT6 (E7–26) – Body ground	10 kΩ or higher
Ignition coil (I7–3) or IGT7 (E7–13) – Body ground	10 kΩ or higher
Ignition coil (I8–3) or IGT8 (E7–10) – Body ground	10 kΩ or higher

OK → **Replace ignition coil with igniter, then confirm that there is no misfire.**

NG

Repair or replace harness or connector.

8	Check engine control ECU terminal of misfiring cylinder.



PREPARATION:

Turn the ignition switch ON.

CHECK:

Measure the voltage between the terminals of the E7, E8 and E9 engine control ECU connectors.

OK:

Tester Connection	Specified Condition
#1 (E7–1) – E01 (E7–7)	9 to 14 V
#2 (E7–2) – E01 (E7–7)	9 to 14 V
#3 (E7–3) – E01 (E7–7)	9 to 14 V
#4 (E7–4) – E01 (E7–7)	9 to 14 V
#5 (E7–5) – E01 (E7–7)	9 to 14 V
#6 (E8–3) – E01 (E7–7)	9 to 14 V
#7 (E9–6) – E01 (E7–7)	9 to 14 V
#8 (E9–5) – E01 (E7–7)	9 to 14 V

OK → **Go to step 11.**

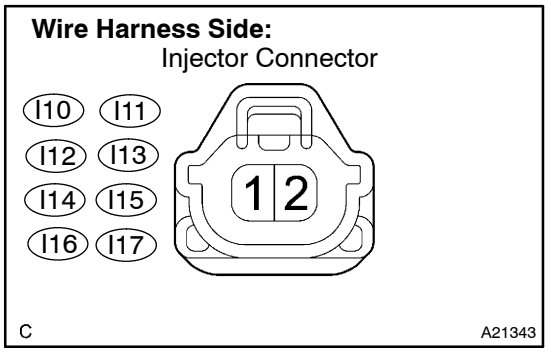
NG

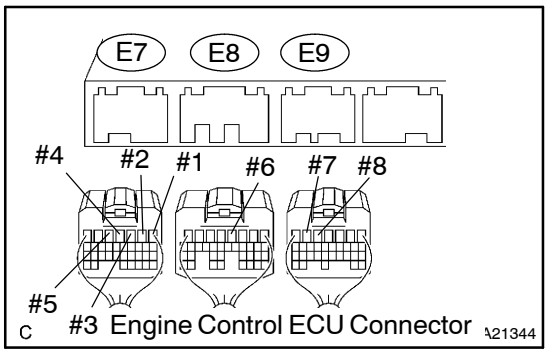
9	Check injector resistance of misfiring cylinder (See Pub. No. RM630E, page FI–24).

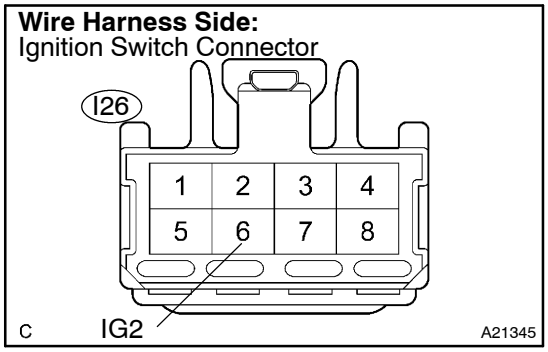
NG → **Replace injector.**

OK

10	**Check for open and short in harness and connector between ignition SW and injector, injector and engine control ECU of misfiring cylinder.**







Check the harness and the connector between the injector connector and the engine control ECU connector:

PREPARATION:

(a) Disconnect the I10, I11, I12, I13, I14, I15 I16 or I17 injector connector.

(b) Disconnect the E7, E8 or E9 engine control ECU connector.

CHECK:

Measure the resistance between the wire harness side connectors.

OK:

Tester Connection	Specified Condition
Injector (I10–2) – #1 (E7–1)	Below 1 Ω
Injector (I11–2) – #2 (E7–2)	Below 1 Ω
Injector (I12–2) – #3 (E7–3)	Below 1 Ω
Injector (I13–2) – #4 (E7–4)	Below 1 Ω
Injector (I14–2) – #5 (E7–5)	Below 1 Ω
Injector (I15–2) – #6 (E8–3)	Below 1 Ω
Injector (I16–2) – #7 (E9–6)	Below 1 Ω
Injector (I17–2) – #8 (E9–5)	Below 1 Ω
Injector (I10–2) or #1 (E7–1) – Body ground	10 kΩ or higher
Injector (I11–2) or #2 (E7–2) – Body ground	10 kΩ or higher
Injector (I12–2) or #3 (E7–3) – Body ground	10 kΩ or higher
Injector (I13–2) or #4 (E7–4) – Body ground	10 kΩ or higher
Injector (I14–2) or #5 (E7–5) – Body ground	10 kΩ or higher
Injector (I15–2) or #6 (E8–3) – Body ground	10 kΩ or higher
Injector (I16–2) or #7 (E9–6) – Body ground	10 kΩ or higher
Injector (I17–2) or #8 (E9–5) – Body ground	10 kΩ or higher

Check the harness and connector between the injector connector and the ignition switch:

PREPARATION:

(a) Disconnect the I10, I11, I12, I13, I14, I15, I16 or I17 injector connector.

(b) Disconnect the I26 ignition switch connector.

CHECK:

Measure the resistance between the wire harness side connectors.

OK:

Tester Connection	Specified Condition
Injector (I10–1) – IG2 (I26–6)	Below 1 Ω
Injector (I11–1) – IG2 (I26–6)	Below 1 Ω
Injector (I12–1) – IG2 (I26–6)	Below 1 Ω
Injector (I13–1) – IG2 (I26–6)	Below 1 Ω
Injector (I14–1) – IG2 (I26–6)	Below 1 Ω
Injector (I15–1) – IG2 (I26–6)	Below 1 Ω
Injector (I16–1) – IG2 (I26–6)	Below 1 Ω
Injector (I17–1) – IG2 (I26–6)	Below 1 Ω
Injector (I10–1) or IG2 (I26–6) – Body ground	10 kΩ or higher
Injector (I11–1) or IG2 (I26–6) – Body ground	10 kΩ or higher
Injector (I12–1) or IG2 (I26–6) – Body ground	10 kΩ or higher
Injector (I13–1) or IG2 (I26–6) – Body ground	10 kΩ or higher
Injector (I14–1) or IG2 (I26–6) – Body ground	10 kΩ or higher
Injector (I15–1) or IG2 (I26–6) – Body ground	10 kΩ or higher
Injector (I16–1) or IG2 (I26–6) – Body ground	10 kΩ or higher
Injector (I17–1) or IG2 (I26–6) – Body ground	10 kΩ or higher

NG → **Repair or replace harness or connector.**

OK

11	Check injector injection of misfiring cylinder (See Pub. No. RM630E, page FI–29).

NG → Replace injector.

OK

12	Check compression pressure of misfiring cylinder (See Pub. No. RM630E, page EM–3).

NG → Repair or replace.

OK

13	Check valve clearance of misfiring cylinder (See Pub. No. RM630E, page EM–6).

NG → Adjust valve clearance.

OK

14	Check result of step 4 switch step by number of misfire cylinder.

High misfire rate cylinder	Proceed to
1 or 2 cylinders	A
More than 3 cylinders	B

B → Check for intermittent problems (See page DI–3).

A

15	**Check valve timing (Check for looseness or a jumped tooth of timing belt) (See Pub. No. RM630E, page EM–14).**

NG → **Adjust valve timing (Repair or replace timing belt).**

OK

16	**Check fuel pressure (See Pub. No. RM630E, page FI–1).**

NG → **Check and repair fuel pump, pressure regulator, fuel pipe line and filter (See Pub. No. RM630E, page FI–7).**

OK

17	Check intake air temperature and air flow rate.

PREPARATION:

(a) Connect the hand–held tester to the DLC3.

(b) Turn the ignition switch ON.

CHECK:

Check the intake air temperature.

(1) Select the item ”DIAGNOSIS/OBD/MOBD/DATA LIST/ALL/INTAKE AIR”.

(2) Read its value displayed on the hand–held tester.

OK:

Equivalent to ambient temperature

CHECK:

Check the air flow rate.

(1) Select the item ”DIAGNOSIS/OBD/MOBD/DATA LIST/ALL/MAF”.

(2) Read its value displayed on the hand–held tester.

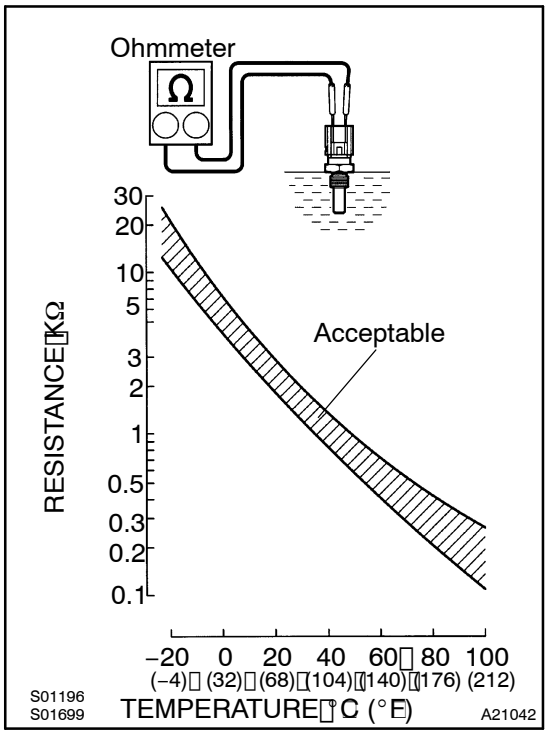
OK:

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 air flow meter.**

OK

18	Check engine coolant temperature sensor.



PREPARATION:

Remove the engine coolant temperature sensor.

CHECK:

Measure the resistance between the terminals of the engine coolant temperature sensor.

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.

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 → Go to step 5.

A

Check for intermittent problems (See page DI–3).