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

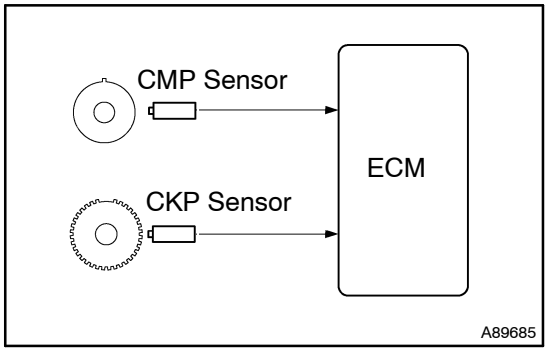
DTC	P0305	CYLINDER 5 MISFIRE DETECTED

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 the HC concentration is too high, exhaust emissions levels may increase. High concentrations of HC can also cause the 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 continuously flash the Malfunction Indicator Lamp (MIL). For monitoring misfire, the ECM uses both the Camshaft Position (CMP) sensor and the Crankshaft Position (CKP) sensor. The CMP sensor is used to identify misfiring cylinders and the CKP sensor is used to measure variations in the crankshaft rotation speed. The misfire counter records how many times the crankshaft rotation speed variations exceed threshold values.
If the misfiring rate exceeds the threshold value and could cause emissions deterioration, the ECM illuminates the MIL and sets a DTC.

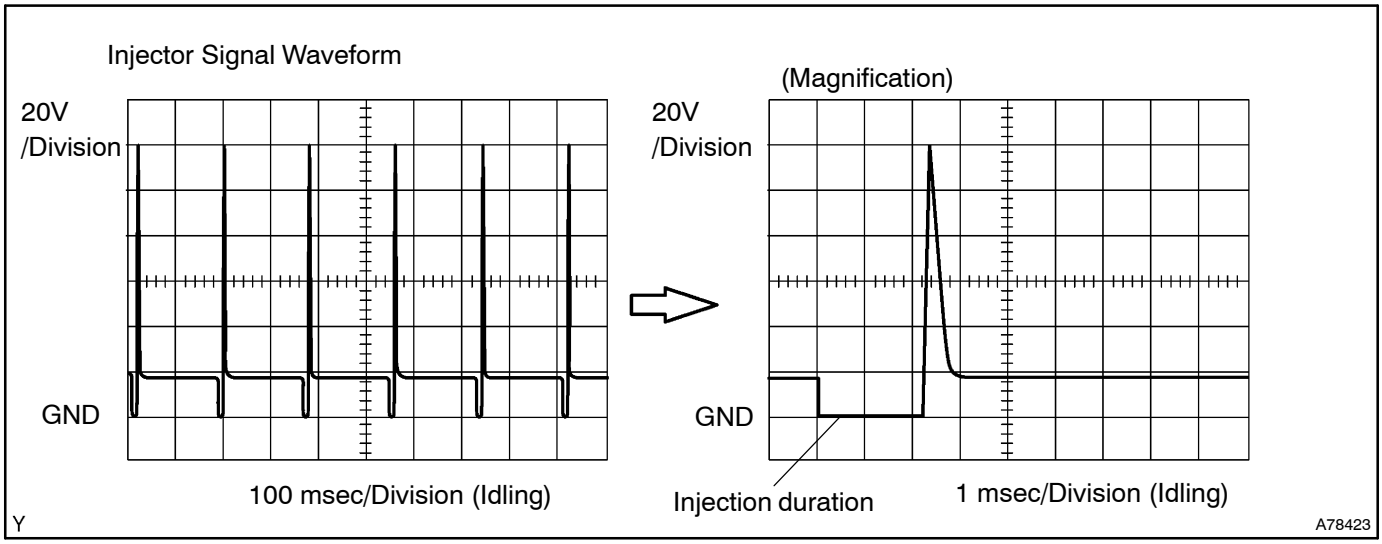
DTC No.	DTC Detection Condition	Trouble Area
P0300	Misfiring of random cylinders is detected	• Ignition coil • Fuel injector • Fuel pressure • Compression pressure • Valve timing • Valve clearance • Vacuum hose • PCV hose • Air induction system • Exhaust system • ECM
P0301 P0302 P0303 P0304 P0305 P0306 P0307 P0308	Misfiring of each cylinder is detected	• Ignition coil • Fuel injector • Fuel pressure • Compression pressure • Valve timing • Valve clearance • Vacuum hose • PCV hose • Air induction system • Exhaust system • ECM

HINT:

When several codes for misfired cylinders are recorded repeatedly but no random misfire codes are recorded, this indicates that the misfires were detected and recorded at different times. Random misfire codes are recorded only when several misfires occur at the same time.

Reference: Inspection using an oscilloscope.

With the engine idling, check the waveform between terminals #10 to #80 and E1 of the ECM connectors. 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):

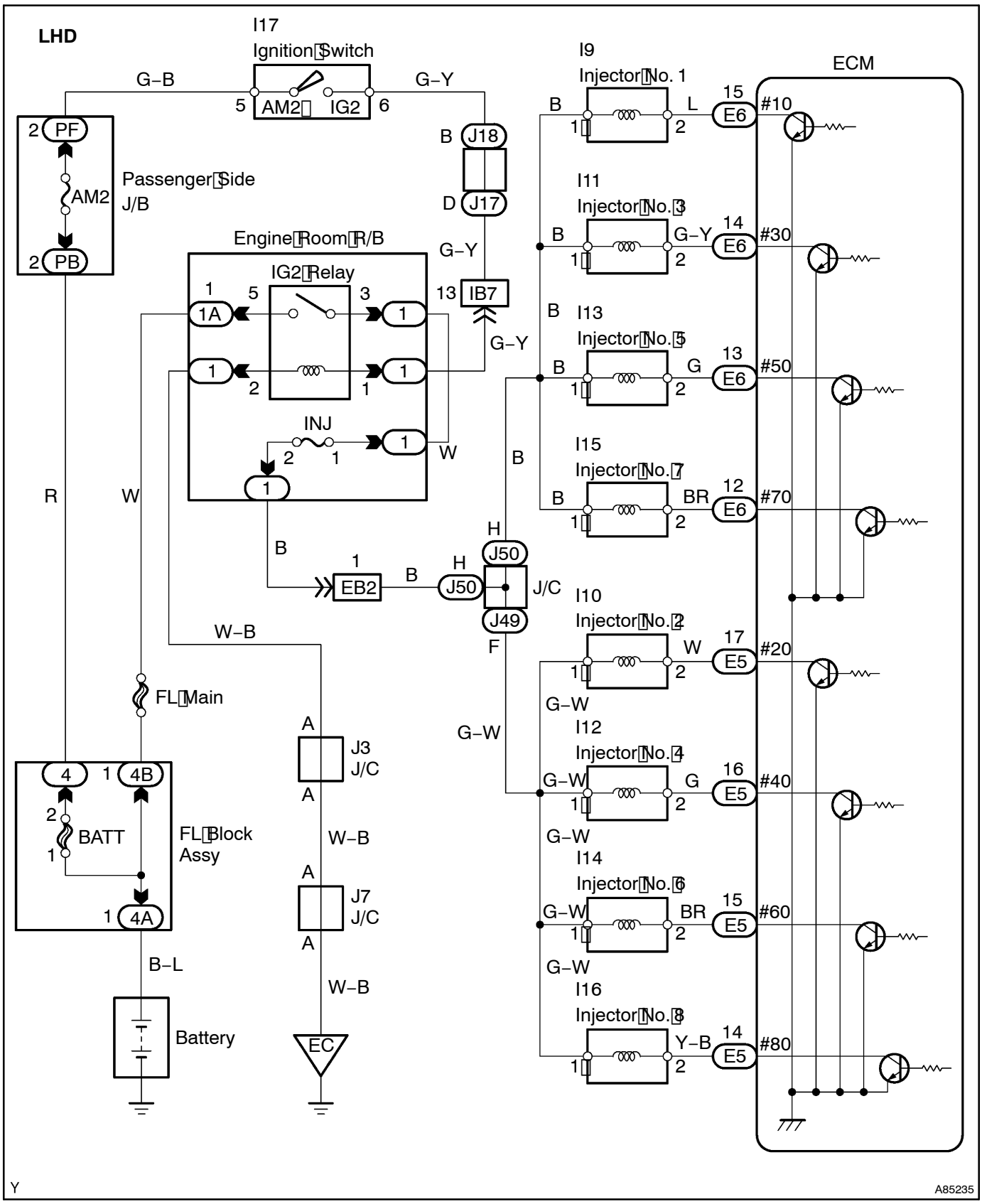
- The misfiring rate exceeds a threshold value and could cause emissions deterioration.
- An excessive misfire rate (approximately 20 to 60 misfires per 1,000 crankshaft revolutions) occurs 4 times.

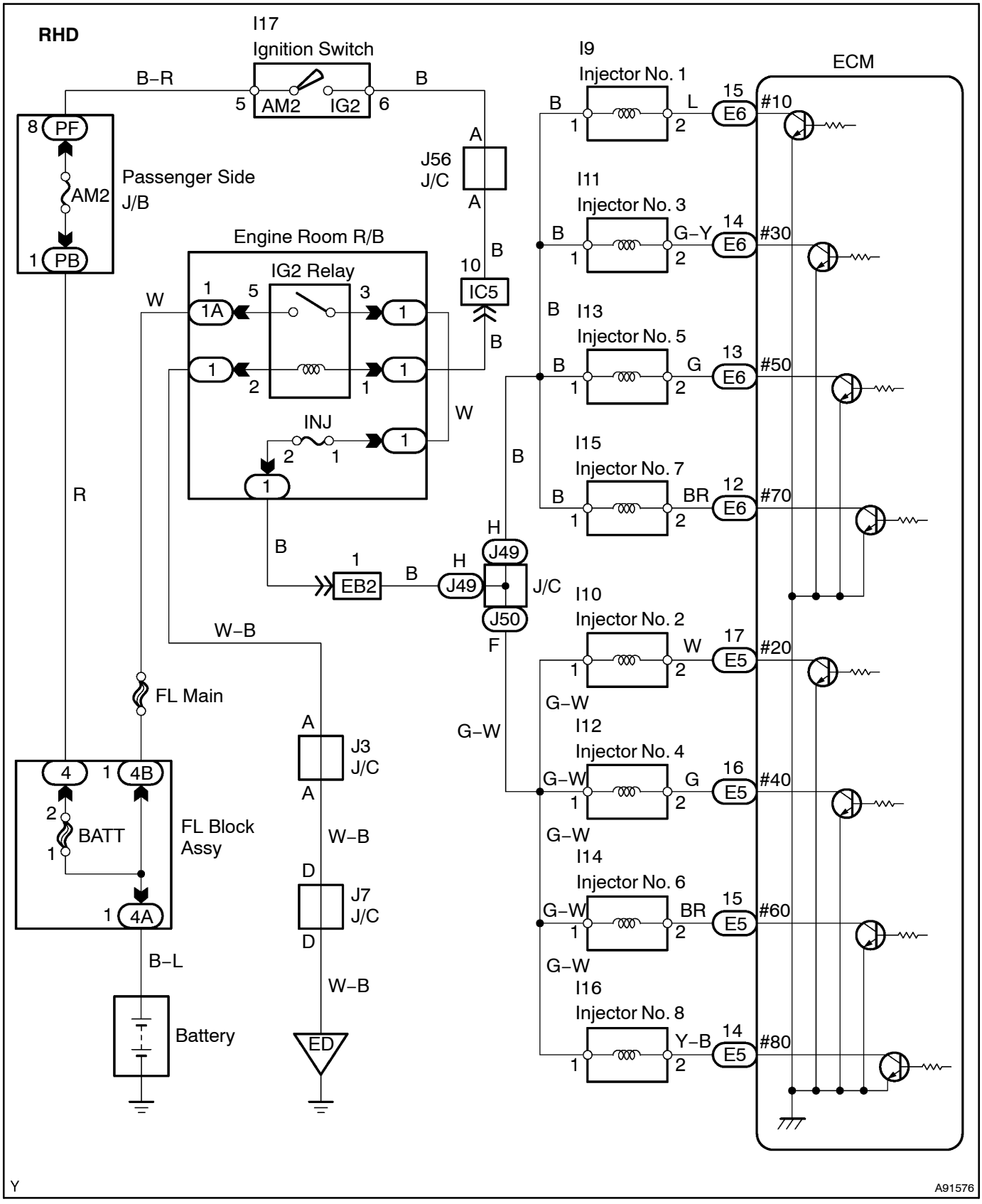
The ECM flashes the MIL continuously (MIL flashes immediately) as follows (DTC is stored after 2 trip detection):

- 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 05–152 for the wiring diagram of the ignition system.




RHD
I17
Ignition Switch
B–R
B
5
AM2
IG2
6
8
PF
AM2
Passenger Side
J/B
1
PB
A
J56
J/C
A
B
10
IC5
B
Engine Room R/B
IG2 Relay
1
5
3
W
1A
1
1
2
1
1
INJ
2
1
1
W
R
B
1
EB2
B
H
J49
J/C
J50
F
W–B
FL Main
A
J3
J/C
A
W–B
D
J7
J/C
D
W–B
ED
4
1
4B
2
BATT
1
FL Block
Assy
1
4A
B–L
Battery
I9
Injector No. 1
B
1
L
2
15
E6
#10
I11
Injector No. 3
B
1
G–Y
2
14
E6
#30
B
I13
Injector No. 5
B
1
G
2
13
E6
#50
B
I15
Injector No. 7
B
1
BR
2
12
E6
#70
I10
Injector No. 2
1
W
2
17
E5
#20
G–W
G–W
I12
Injector No. 4
G–W
1
G
2
16
E5
#40
G–W
I14
Injector No. 6
G–W
1
BR
2
15
E5
#60
G–W
I16
Injector No. 8
1
Y–B
2
14
E5
#80
ECM
Y
A91576

CONFIRMATION DRIVING PATTERN

(a) Connect the Intelligent Tester II to the DLC3.
(b) Record DTC and the freeze frame data.
(c) Select check mode on the Intelligent Tester II (see page 05–27).
(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 MISFIRE RPM, MISFIRE LOAD from the Data List.

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 RPM	Time
Idling	210 seconds (3.5 minutes) or more
1,000 rpm	180 seconds (3 minutes) or more
2,000 rpm	90 seconds (1.5 minutes) or more
3,000 rpm	60 seconds (1 minute) or more

(f) Check a misfire occurs or not by monitoring DTC and the freeze frame data. After that, 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 Intelligent Tester II. 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 scantool.
  (2) Start the engine and drive the confirmation patten (see confirmation driving 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, 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 warming–up.
- If the misfire cannot be reproduced, the following reasons may apply: 1) the vehicle has low fuel, 2) improper fuel is being used, 3) the ignition plug is contaminated, or 4) another problem.
- Be sure to check the value on the misfire counter after the repair.

1	CHECK DTC

(a) Connect the Intelligent Tester II to the DLC3.
(b) Read and note DTCs and the freeze frame data.
Result:

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

B → **GO TO RELEVANT DTC CHART** (See page 05–36)

A

2	CHECK MISFIRE RPM AND MISFIRE LOAD

Read and note the MISFIRE RPM and the MISFIRE LOAD (engine load) with the Data List.
HINT:
The MISFIRE RPM and MISFIRE LOAD indicate the vehicle conditions in which misfire occurs.

NEXT

3	CHECK CONNECTION OF PCV HOSE

OK: PCV hose is connected correctly and is not damaged.

NG → **REPAIR OR REPLACE PCV HOSE**

OK

4	CHECK MISFIRE COUNT (CYLINDER #1, #2, #3, #4, #5, #6, #7 or #8)

(a) Clear the DTCs.
(b) Select the Engine Speed, Calculated Load, CYL#1, #2, #3, #4, #5, #6, #7 and #8 of the Data List.
(c) Allow the engine to idle.
(d) Read the misfire count of the cylinders #1 to #8.

If no misfire counts in all the cylinders, move the shift lever into the D position and repeat steps (b) to (d).
If misfire counts still do not occur, perform steps (e) and (f).

(e) Drive the vehicle with the MISFIRE RPM and the MISFIRE LOAD.
(f) Read the misfire count of the cylinders #1 to #8, or DTCs.

Result:

Misfire count in each cylinder	Proceed to
1 or 2 cylinders have some misfire counts	A
3 cylinders or more have some misfire counts	B

HINT:

- If it is difficult to reproduce misfires for each cylinder, check the DATA LIST item called MISFIRE MARGIN. Try to find vehicle driving conditions that lower the MISFIRE MARGIN value. Values above 30% are considered normal.
- If the freeze frame data's record of the Engine Coolant Temperature (ECT) is below 75°C (167°F), the misfire may be detected only when the engine is cold.
- If the freeze frame data's record of the ENGINE RUN TIME is below 120 seconds, the misfire may be detected right after the engine is started.

* Misfire margin indicates possibility that misfires do not occur. The misfires are counted when the misfire margin is 0 % or less. There is little possibility of misfires if the misfire margin is less than 30 %. Misfire margin is calculated with the following arithmetic expression.

$$\text{Misfire margin (\%)} = \frac{\text{Fluctuation of engine revolution to interpret as misfire} - \text{Fluctuation of actual engine revolution}}{\text{Fluctuation of engine revolution to interpret as misfire}} \times 100$$

B → **Go to step 14**

A

5 PERFORM ACTIVE TEST (FUEL CUT #1 – #8)

(a) Allow the engine to idle.
(b) Enter the following menus: Enter/ Diagnosis/ OBD·MOBD/ Power train/ Engine and ECT/ Active Test/ FUEL CUT#1 (to #8).
(c) If a cylinder has a high misfire count, cut fuel to the cylinder. Compare the misfire count of the cylinder before fuel cut and after fuel cut.
Result:

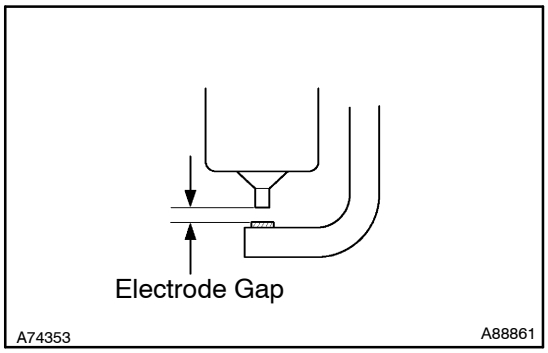
Misfire Count in Each Cylinder	Proceed to
The misfire count of the cylinder before fuel cut and after fuel cut are roughly the same.	A
The misfire count of the cylinder before fuel cut is lower than after fuel cut.	B

HINT:
”The misfire count of the cylinder before fuel cut and after fuel cut are roughly the same” means the cylinder is misfiring.
”The misfire count of the cylinder before fuel cut is lower than after fuel cut” means the cylinder misfires sometimes.
NOTICE:
This Active Test cannot be performed while the vehicle is being driven.

B → **Go to step 12**

A

6 CHECK SPARK PLUG



(a) Remove the engine cover.
(b) Remove the ignition coil and the spark plug of the misfire cylinder.
(c) Measure the spark plug’s electrode gap.
Standard:
Electrode gap: 1.0 to 1.3 mm (0.039 to 0.051 in.)
(d) Check the electrode for carbon deposits.
Recommended spark plug:

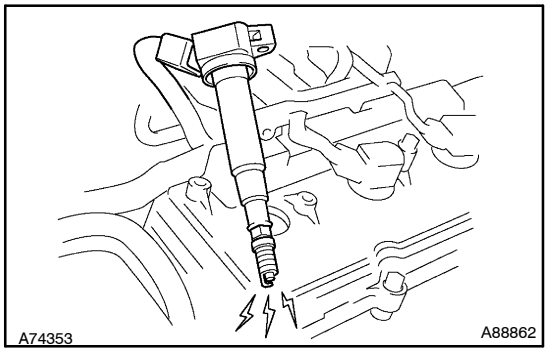
DENSO	SK20R11
NGK	IFR6A11

NOTICE:
If the electrode gap is larger than the standard, replace the spark plug. Do not adjust the electrode gap.

NG → **REPLACE SPARK PLUG**

OK

7	CHECK SPARK AND IGNITION



(a) Disconnect the injector connectors to prevent the engine starting.
(b) Install the spark plug to the ignition coil.
(c) Attach the spark plug to the cylinder head cover.
(d) Crank the engine within 2 seconds and check the spark.
OK: Spark occurs

NG → **Go to step 9**

OK

8	CHECK CYLINDER COMPRESSION PRESSURE ON MISFIRING CYLINDER (See page 14–1)

Measure the cylinder compression pressure of the misfiring cylinder.

NG → **REPAIR OR REPLACE**

OK

Go to step 10

9	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.

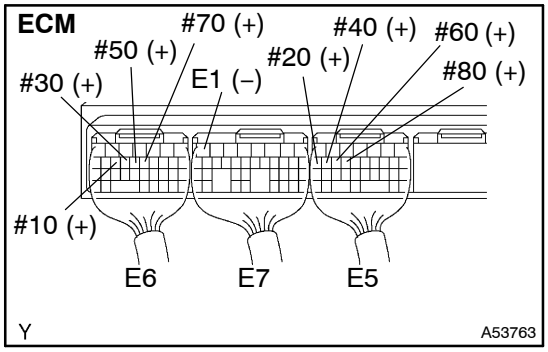
(1) Install the spark plug to the ignition coil and connect the ignition coil connector.
(2) Disconnect the injector connector.
(3) Ground the spark plug.
(4) Check if a spark occurs while the engine is being cranked.
OK: Spark jumps across electrode gap.

OK → **REPLACE SPARK PLUG**

NG

REPLACE IGNITION COIL ASSY (See page 18–10)
(THEN CONFIRM THAT THERE IS NO MISFIRE)

10	INSPECT ECM TERMINAL OF MISFIRING CYLINDER (#10, #20, #30, #40, #50, #60, #70 OR #80 VOLTAGE)



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

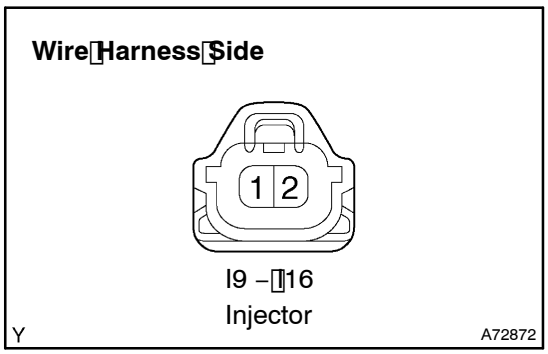
Standard:

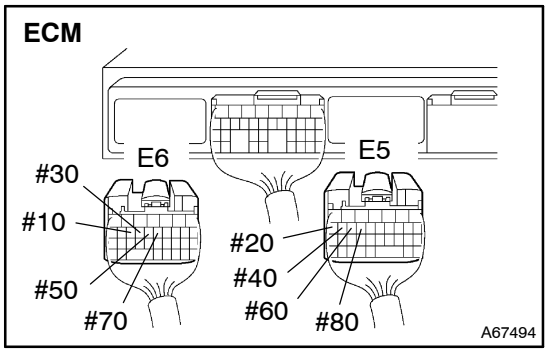
Tester Connection	Specified Condition
E6–15 (#10) – E7–7 (E1)	9 to 14 V
E5–17 (#20) – E7–7 (E1)	9 to 14 V
E6–14 (#30) – E7–7 (E1)	9 to 14 V
E5–16 (#40) – E7–7 (E1)	9 to 14 V
E6–13 (#50) – E7–7 (E1)	9 to 14 V
E5–15 (#60) – E7–7 (E1)	9 to 14 V
E6–12 (#70) – E7–7 (E1)	9 to 14 V
E5–14 (#80) – E7–7 (E1)	9 to 14 V

OK → **Go to step 12**

NG

11 CHECK WIRE HARNESS (INJECTOR – ECM)





(a) Disconnect the injector connector (of the misfire cylinder) and the E5 and E6 ECM connectors.
(b) Turn the ignition switch ON.
(c) Measure the resistance and voltage between the injector and the ECM connector terminals.

Standard:

Cylinder	Connector Terminals	Specified Condition
No. 1	I9–1 – Ground	11 to 14 V
No. 1	I9–2 – Ground	10 kΩ or higher
No. 1	I9–2 – E6–15 (#10)	Below 1 Ω
No. 2	I10–1 – Ground	11 to 14 V
No. 2	I10–2 – Ground	10 kΩ or higher
No. 2	I10–2 – E5–17 (#20)	Below 1 Ω
No. 3	I11–1 – Ground	11 to 14 V
No. 3	I11–2 – Ground	10 kΩ or higher
No. 3	I11–2 – E6–14 (#30)	Below 1 Ω
No. 4	I12–1 – Ground	11 to 14 V
No. 4	I12–2 – Ground	10 kΩ or higher
No. 4	I12–2 – E5–16 (#40)	Below 1 Ω
No. 5	I13–1 – Ground	11 to 14 V
No. 5	I13–2 – Ground	10 kΩ or higher
No. 5	I13–2 – E6–13 (#50)	Below 1 Ω
No. 6	I14–1 – Ground	11 to 14 V
No. 6	I14–2 – Ground	10 kΩ or higher
No. 6	I14–2 – E5–15 (#60)	Below 1 Ω
No. 7	I15–1 – Ground	11 to 14 V
No. 7	I15–2 – Ground	10 kΩ or higher
No. 7	I15–2 – E6–12 (#70)	Below 1 Ω
No. 8	I16–1 – Ground	11 to 14 V
No. 8	I16–2 – Ground	10 kΩ or higher
No. 8	I16–2 – E5–14 (#80)	Below 1 Ω

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

OK

12 CHECK FUEL INJECTOR OF MISFIRING CYLINDER (See page 11–11)

NG → **REPLACE FUEL INJECTOR ASSY (See page 11–15)**

OK

13	CHECK VALVE CLEARANCE OF MISFIRING CYLINDER (See page 14–1)

NG → ADJUST VALVE CLEARANCE (See page14–7)

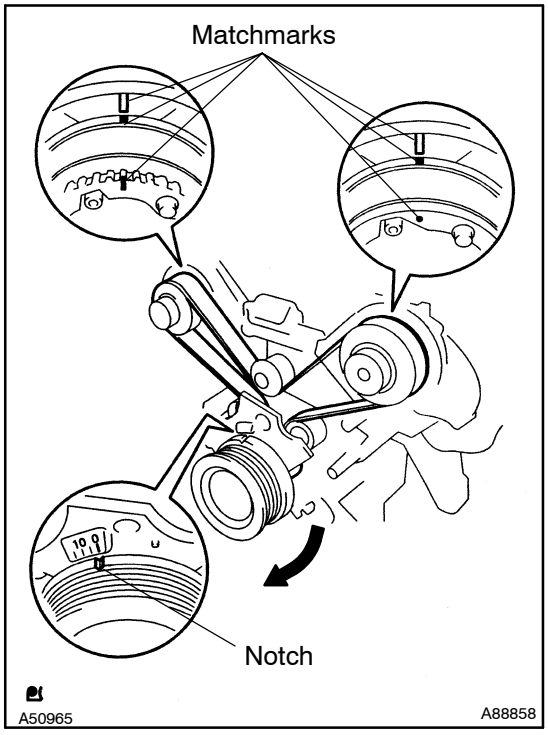
OK

14	CHECK AIR INDUCTION SYSTEM

NG → REPAIR OR REPLACE AIR INDUCTION SYSTEM

OK

15	CHECK VALVE TIMING



(a) Remove the engine cover.
(b) Remove the drive belt.
(c) Remove the timing belt cover LH and RH.
(d) Turn the crankshaft to align the matchmarks of the crankshaft.
(e) Align the notch of the crankshaft pulley to the "0" position.
(f) Confirm whether the camshaft pulley's matchmark and the matchmark of the cylinder head cover face each other.
(g) Turn the crankshaft clockwise by 360° if these do not face each other. Confirm whether or not these face each other once again.

OK:

The matchmarks of the camshaft pulley and the cylinder head cover face each other when the notch of the crankshaft pulley is in the "0" position.

NG → ADJUST VALVE TIMING

OK

16	CHECK FUEL PRESSURE (See page 11–9)

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

OK

17	READ VALUE OF INTELLIGENT TESTER II (IAT AND MAF)

(a) Check the IAT.
Enter the following menus: Data List/ All Data/ Intake Air. Read the values.
Standard: After cold soak, IAT is nearly equal to ambient temperature.

(b) Check the MAF.
Enter the following menus: Data List/ All Data/ MAF. Read the values.
Standard:

Condition	MAF (gm/s)
Ignition switch ON (do not start engine)	0
Idling	4 to 6 g/sec
Running without load (2,500 rpm)	13 to 20 g/sec
Idling to quickly accelerating	Fluctuates

NG → **Refer to P0100 (see page 05–62) and P0110 (see page 05–69)**

OK

18	READ VALUE OF INTELLIGENT TESTER II (ECT)

(a) Check the ECT.
Enter the following menus: Data List/ All Data/ Coolant Temp. Read the values.
OK:
After cold soak, ECT is nearly equal to ambient temperature.
When the engine is warmed–up, ECT is more than 75°C (167°F).

NG → **Refer to P0115 and P0116 (See page 05–74, 05–79)**

OK

CHECK FOR INTERMITTENT PROBLEMS (See page 05–11)