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

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 sets a DTC.

DTC No.	DTC Detection Conditions	Trouble Areas
P0300	Simultaneous misfiring of several cylinders 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
P0301 P0302 P0303 P0304 P0305 P0306	Misfiring of specific cylinder detected (2 trip detection logic)	

HINT:

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.

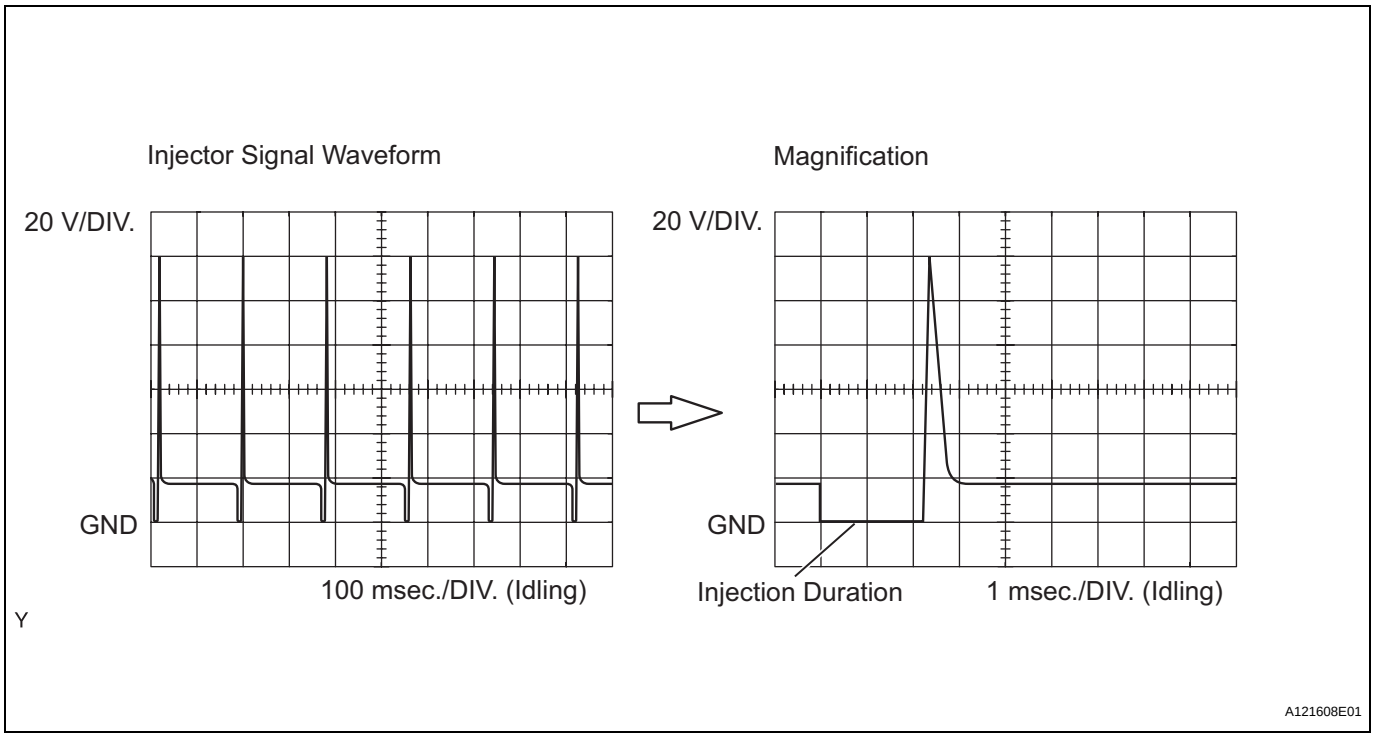
Reference: Inspection using an oscilloscope.

With the engine idling, check the waveform between terminals #10 to #60 and E1 of the ECM connectors.

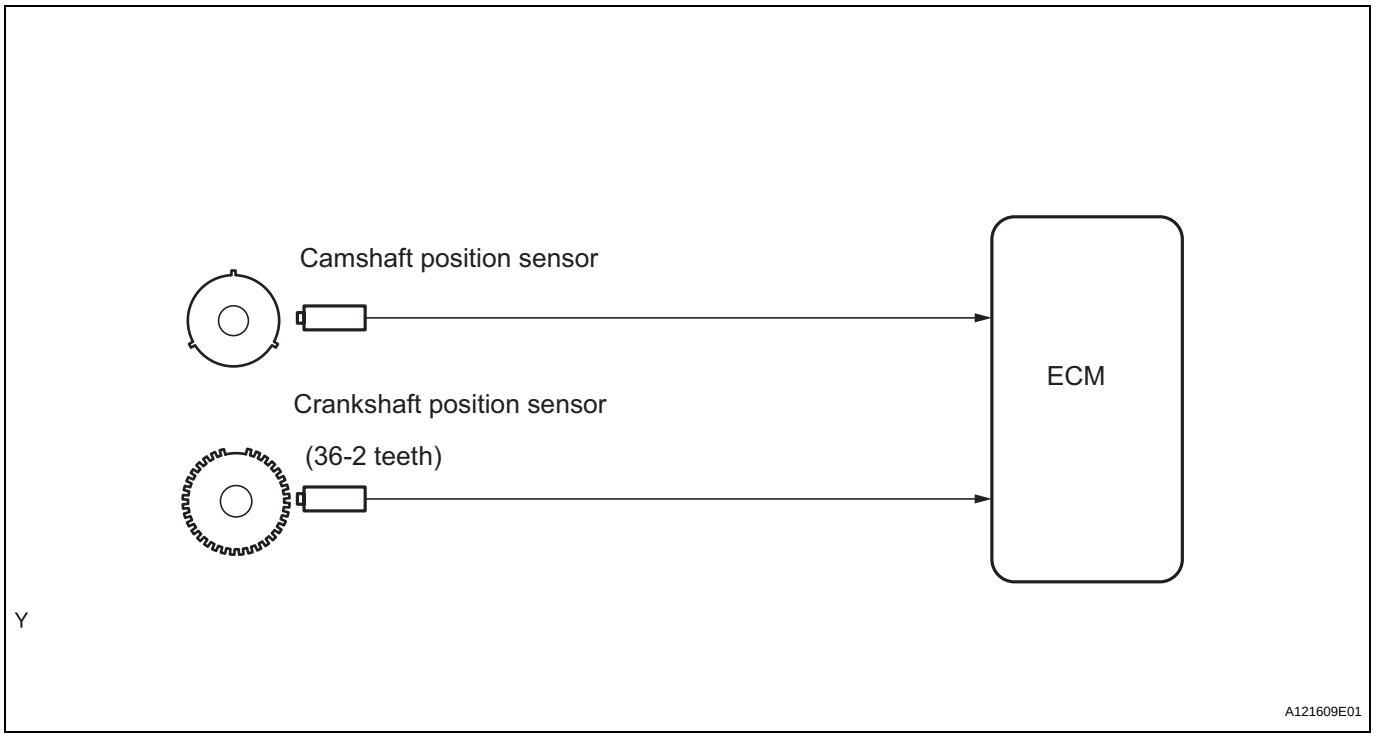
Items	Contents
Terminals	#10 to #60 - E01
Equipment Settings	20 V/Division, 100 or 1 ms/Division

Items	Contents
Conditions	Idling

HINT:
The correct waveform is as shown.



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 50 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

TYPICAL ENABLING CONDITIONS

Misfire:

Monitor runs whenever following DTCs not present	P0100 - P0103 (MAF meter) P0110 - P0113 (IAT sensor) P0115 - P0118 (ECT sensor) P0120 - P0223, P2135 (TP sensor) P0125 (Insufficient ECT for closed loop) P0327 - P0333 (knock sensor) P0335 (CKP sensor) P0340 (CMP sensor) P0500 (VSS)
Battery voltage	8 V or more
Throttle position learning	Completed
VVT system	Not operated by scan tool
Engine RPM	Manual Transmission: 450 to 5,400 rpm Automatic Transmission: 400 to 5,400 rpm
Both of following conditions 1 and 2 met	-
1. Engine Coolant Temperature (ECT)	-10°C (14°F) or more
2. Either of following conditions (a) or (b) met	-
(a) ECT at engine start	More than -7°C (19°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

1. Driving cycles	1st
2. Check mode	OFF
3. Engine RPM	Less than 2,800 rpm
Except above	Crankshaft 200 revolutions x 3

TYPICAL MALFUNCTION THRESHOLDS

Monitor period of emission-related-misfire:

Misfire rate	2.9 % or more (Manual transmission) 2 % or more (Automatic transmission)
Either of following conditions (a) or (b) met	-
(a) First 1,000 revolutions after engine start or check mode	Crankshaft 1,000 revolutions
(b) Except above	Crankshaft 1,000 revolutions x 4

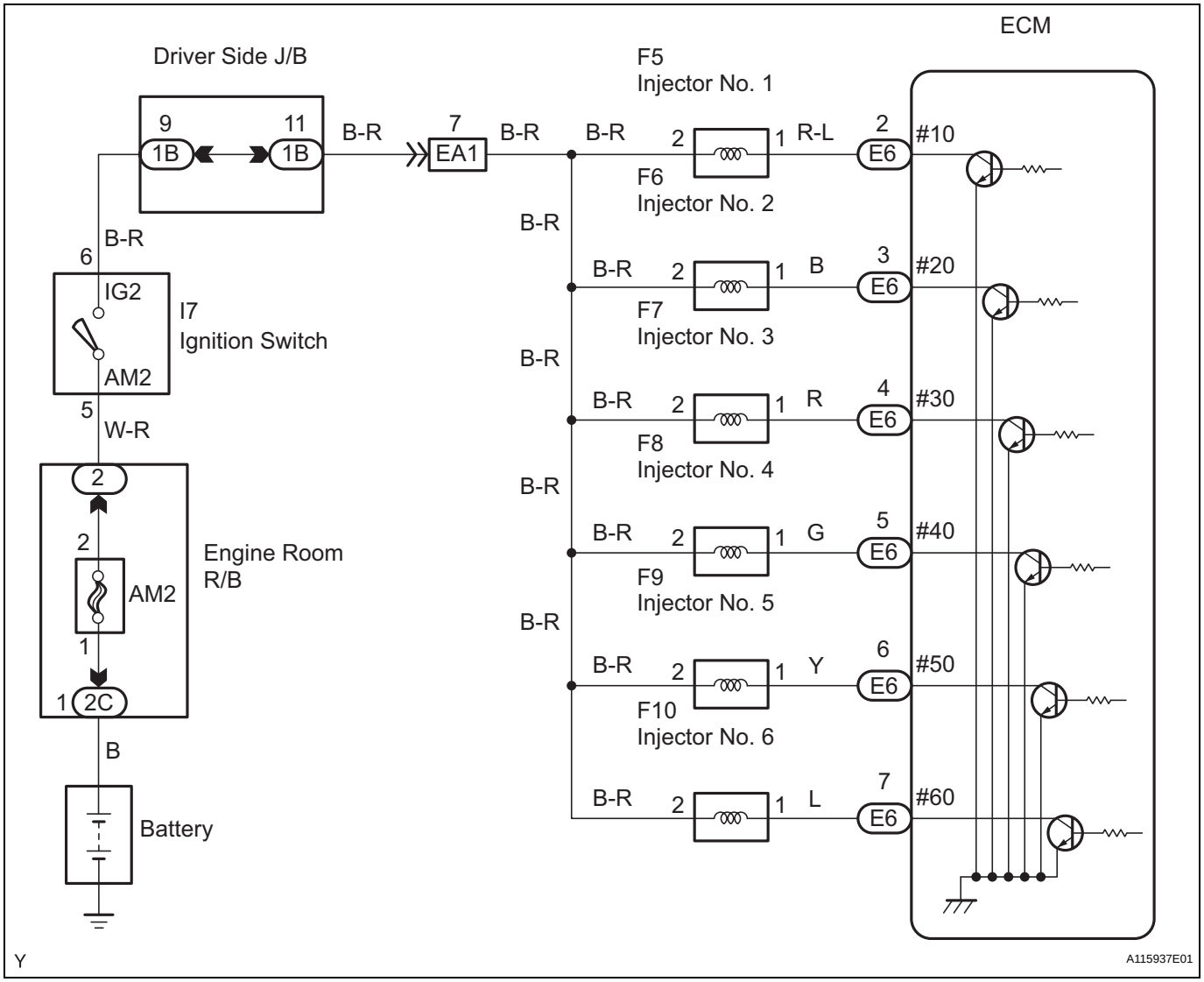
Monitor period of catalyst-damage-misfire (MIL blinks):

Number of misfires per 200 revolutions	77 or more (varies with intake air amount and RPM)
Either of following conditions (a) or (b) met	-
(a) All of following conditions A, B and C met	Crankshaft 200 revolutions x 3
A. Driving cycles	1st
B. Check mode	OFF
C. Engine RPM	Below 2,800 rpm
(b) Except above	Crankshaft 200 revolutions

MONITOR RESULT

Detailed information on Checking Monitor Status (See page ES-19).

WIRING DIAGRAM



CONFIRMATION DRIVING PATTERN

(a) Connect an intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the tester ON.
(d) Record the DTC(s) and freeze frame data.
(e) Using the tester, switch the ECM from normal mode to check mode (See page ES-41).
(f) Read the misfire counts of each cylinder (CYL #1 to #6) with the engine in an idling condition. If any misfire count is displayed, skip the following confirmation driving pattern.
(g) Drive the vehicle several times with the conditions, such as engine rpm and engine load, shown in MISFIRE RPM and MISFIRE LOAD in the DATA LIST.
HINT:
In order to store misfire DTCs, it is necessary to drive the vehicle for the period of time shown in the table below, with the MISFIRE RPM and MISFIRE LOAD in the DATA LIST.

Engine RPM	Duration
Idling	3.5 minutes or more
1,000	3 minutes or more
2,000	1.5 minutes or more
3,000	1 minute or more

(h) Check whether misfires have occurred by checking DTCs and freeze frame data.
HINT:
Do not turn the ignition switch OFF until the stored DTC(s) and freeze frame data have been recorded. When the ECM returns to normal mode (default), the stored DTC(s), freeze frame data and other data will be erased.
(i) Record the DTC(s), freeze frame data and misfire counts.
(j) Turn the ignition switch OFF and wait for at least 5 seconds.

HINT:
- If any DTCs other than the misfire DTCs are output, troubleshoot those DTCs first.
- Read freeze frame data using an intelligent tester. Freeze frame data record the engine conditions when malfunctions are detected. When troubleshooting, freeze frame data can help determine if the vehicle was moving or stationary, 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 recur when the vehicle is brought to the workshop, reproduce the conditions stored in the freeze frame data.
- The misfire still cannot be reproduced even though the conditions stored in the freeze frame data have been duplicated, one of the following factors is considered to be a possible cause of the problem:
  (1) The fuel tank is low full.
  (2) Improper fuel is used.
  (3) The spark plugs have been contaminated.
  (4) The problem is complex.
- After finishing repairs, check the misfire counts of the cylinders (CYL #1, #2, #3, #4, #5 and #6).
- Be sure to confirm that no misfiring cylinder DTCs are set again by conducting the confirmation driving pattern, after repairs.
- For 6 and 8 cylinder engines, the ECM intentionally does not set the specific misfiring cylinder DTCs at high engine RPM. If misfires occur only in high engine RPM areas, only DTC P0300 is set.
  In the event of DTC P0300 being present, perform the following operations:
  (1) Clear DTCs (See page ES-38).
  (2) Start the engine and conduct the confirmation driving pattern.
  (3) Read the misfiring rates of each cylinder or DTC(s) using the tester.
  (4) Repair the cylinder(s) that has a high misfiring rate or is indicated by the DTC.
  (5) After finishing repairs, conduct the confirmation driving pattern again, in order to verify that DTC P0300 is not set.
- When one of SHORT FT #1, LONG FT #1, SHORT FT #2 or LONG FT #2 in the freeze frame data is outside the range of +-20 %, the air-fuel ratio may be rich (-20 % or less) or lean (+20 % or more).
- When the COOLANT TEMP in the freeze frame data is less than 75°C (167°F), the misfires have occurred only while warming up the engine.

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

(a) Connect an intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the tester ON.
(d) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.
(e) Read DTCs.

Result

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

HINT:
If any DTCs other than P0300, P0301, P0302, P0303, P0304, P0305 and P0306 are output, troubleshoot those DTCs first.

B → GO TO DTC CHART

A

2 READ VALUE OF INTELLIGENT TESTER (MISFIRE RPM AND MISFIRE LOAD)

(a) Connect an intelligent tester to the DLC3.
(b) Turn the ignition switch ON and turn the tester ON.
(c) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DATA LIST / MISFIRE / MISFIRE RPM and MISFIRE LOAD.
(d) Read and note the MISFIRE RPM and MISFIRE LOAD (engine load) values.
HINT:
The MISFIRE RPM and MISFIRE LOAD indicate the vehicle conditions under which the misfire occurred.

NEXT

3 CHECK PCV HOSE CONNECTIONS

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

NG → REPAIR OR REPLACE PCV HOSE

OK

4 CHECK MISFIRE COUNT (CYL #1, #2, #3, #4, #5 AND #6)

(a) Connect an intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the tester ON.
(d) Clear DTCs (See page ES-38).
(e) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DATA LIST / MISFIRE / CYL #1, #2, #3, #4, #5 and #6.
(f) Allow the engine to idle.
(g) Read each value of CYL #1 to #6 displayed on the tester.
If no misfire counts occur in any cylinders, perform the following operations:
  (1) Shift the gear selector lever to the D position.
  (2) Repeat steps (e) to (g) above.
  (3) Check the CYL #1 to #6.
  (4) If misfire counts are still not displayed, perform steps (h) and (i) and then check the misfire counts again.
(h) Drive the vehicle with the MISFIRE RPM and MISFIRE LOAD noted in step 2.

ES

(i) Read the CYL #1 to #6 or DTCs displayed on the tester.

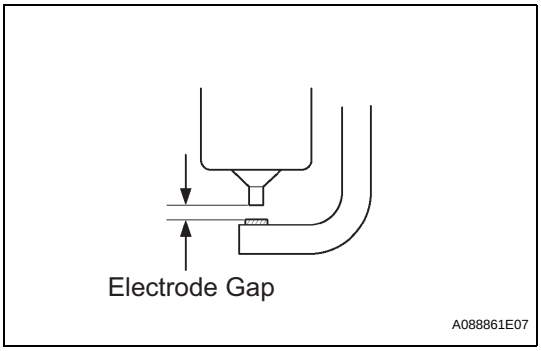
Result

Misfire count	Proceed To
One or two cylinders have misfire counts	A
Three cylinders or more have misfire counts	B

B → **Go to step 13**

A

5 CHECK SPARK PLUG



(a) Remove the ignition coil and the spark plug of the misfiring cylinder.
(b) Measure the spark plug electrode gap.
Standard:
Between 1.0 mm and 1.1 mm (0.039 in. and 0.043 in.)
(c) Check the electrode for carbon deposits.
Recommended spark plug

Manufactures	Products
DENSO	K20HR-U11
NGK	LFR6C-11

NOTICE:
If the electrode gap is larger than standard, replace the spark plug. Do not adjust the electrode gap.
(d) Reinstall the ignition coil and the spark plug.

NG → **REPLACE SPARK PLUG**

OK

6 CHECK SPARKS AND IGNITION

(a) Disconnect the injector connectors, in order to prevent the engine from starting.
(b) Install the spark plug to the ignition coil.
(c) Attach the spark plug assembly to the cylinder head cover.
(d) Crank the engine for less than 2 seconds and check the spark.
OK:
Sparks jump across electrode gap
(e) Reconnect the injector connectors.

NG → **Go to step 8**

OK

7	CHECK CYLINDER COMPRESSION PRESSURE OF MISFIRING CYLINDER

(a) Measure the cylinder compression pressure of the misfiring cylinder.

OK → **Go to step 9**

NG

REPAIR OR REPLACE MALFUNCTION PARTS

ES

8	CHANGE NORMAL SPARK PLUG AND CHECK SPARK OF MISFIRING CYLINDER

(a) Change the installed spark plug to a spark plug that functions normally.

(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 sparks occur while the engine is being cranked.

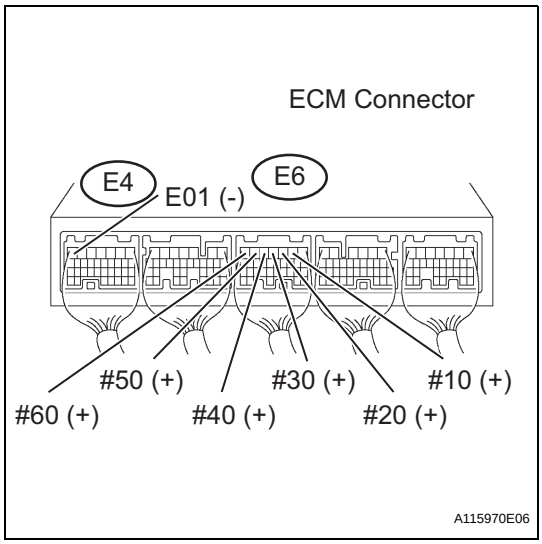
OK:
Sparks jump across electrode gap.

NG → **REPLACE IGNITION COIL ASSEMBLY THEN CONFIRM THAT THERE IS NO MISFIRE**

OK

REPLACE SPARK PLUG

9	INSPECT ECM TERMINAL OF MISFIRING CYLINDER (#10,#20,#30,#40.#50 AND/OR #60 VOLTAGE)



(a) Turn the ignition switch ON.
(b) Measure the voltage between the terminals of the E6 and E4 ECM connectors.

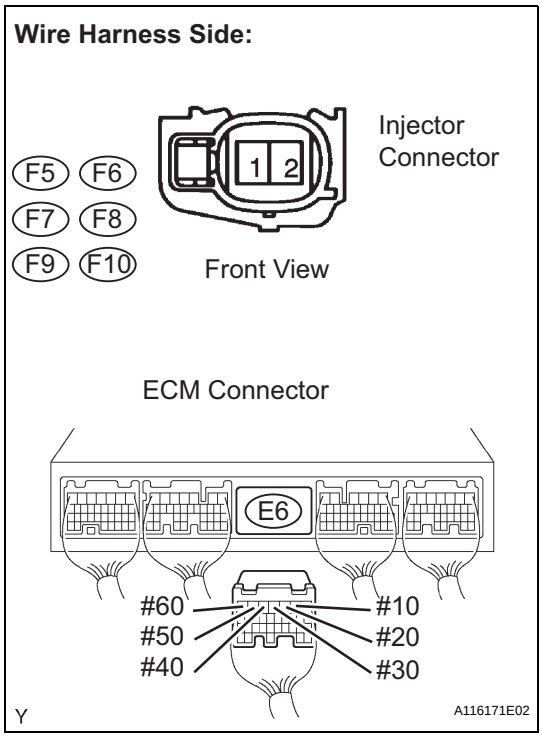
Standard Voltage

Tester Connections	Specified Conditions
#10 (E6-2) - E01 (E4-7)	9 to 14 V
#20 (E6-3) - E01 (E4-7)	
#30 (E6-4) - E01 (E4-7)	
#40 (E6-5) - E01 (E4-7)	
#50 (E6-6) - E01 (E4-7)	
#60 (E6-7) - E01 (E4-7)	

OK → Go to step 11

NG

10	CHECK HARNESS AND CONNECTOR (INJECTOR - ECM)



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

Standard (Cylinder No. 1)

Tester Connections	Specified Conditions
F5-2 - Ground	11 to 14 V
F5-1 - Ground	10 kΩ or higher
F5-1 - #10 (E6-2)	Below 1 Ω

Standard (Cylinder No. 2)

Tester Connections	Specified Conditions
F6-2 - Ground	11 to 14 V
F6-1 - Ground	10 kΩ or higher
F6-1 - #20 (E6-3)	Below 1 Ω

Standard (Cylinder No. 3)

Tester Connections	Specified Conditions
F7-2 - Ground	11 to 14 V
F7-1 - Ground	10 kΩ or higher
F7-1 - #30 (E6-4)	Below 1 Ω

Standard (Cylinder No. 4)

Tester Connections	Specified Conditions
F8-2 - Ground	11 to 14 V
F8-1 - Ground	10 kΩ or higher

Tester Connections	Specified Conditions
F8-1 - #40 (E6-5)	Below 1 Ω

Standard (Cylinder No. 5)

Tester Connections	Specified Conditions
F9-2 - Ground	11 to 14 V
F9-1 - Ground	10 kΩ or higher
F9-1 - #50 (E6-6)	Below 1 Ω

Standard (Cylinder No. 6)

Tester Connections	Specified Conditions
F10-2 - Ground	11 to 14 V
F10-1 - Ground	10 kΩ or higher
F10-1 - #60 (E6-7)	Below 1 Ω

(e) Reconnect the injector connector.
(f) Reconnect the ECM connector.

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

OK

11 CHECK FUEL INJECTOR OF MISFIRING CYLINDER

(a) Check the injector injection (whether fuel volume is high or low, and whether injection pattern is poor).

NG → **REPLACE FUEL INJECTOR ASSEMBLY**

OK

12 CHECK VALVE CLEARANCE OF MISFIRING CYLINDER

NG → **ADJUST VALVE CLEARANCE**

OK

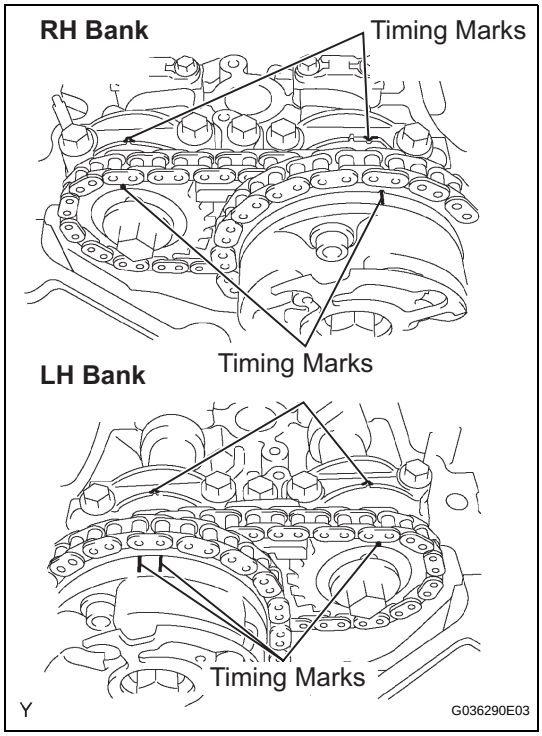
13 CHECK AIR INDUCTION SYSTEM

(a) Check the air induction system for vacuum leakage.
OK:
No leakage from air induction system.

NG → **REPAIR OR REPLACE AIR INDUCTION SYSTEM**

OK

14	CHECK VALVE TIMING



(a) Remove the cylinder head cover.
(b) Turn the crankshaft pulley, and align its groove with the timing mark "0" of the timing chain cover.
(c) Check that the timing marks of the camshaft timing gears are aligned with the timing marks of the bearing cap as shown in the illustration.
If not, turn the crankshaft 1 revolution (360°) and align the marks as above.
OK:
Timing marks on camshaft timing gears are aligned as shown in illustration.
(d) Reinstall the cylinder head cover.

NG → **ADJUST VALVE TIMING**

OK

15	CHECK FUEL PRESSURE

(a) Check the fuel pressure (See page FU-6).

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

OK

16	READ VALUE OF INTELLIGENT TESTER (COOLANT TEMP)

(a) Connect an intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the tester ON.
(d) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / COOLANT TEMP.
(e) Read the COOLANT TEMP twice, when the engine is both cold and warmed up.
Standard:
With cold engine: Same as ambient air temperature.
With warm engine: Between 80°C and 100°C (176°F and 212°F).

NG → REPLACE ENGINE COOLANT TEMPERATURE SENSOR

OK

17	READ VALUE OF INTELLIGENT TESTER (MAF)

(a) Connect an intelligent tester to the DLC3.
(b) Turn the ignition switch ON.
(c) Turn the tester ON.
(d) Select the following menu items: DIAGNOSIS / ENHANCED OBD II / DATA LIST / PRIMARY / MAF and COOLANT TEMP.
(e) Allow the engine to idle until the COOLANT TEMP reaches 75°C (167°F) or more.
(f) Read the MAF with the engine in an idling condition and at an engine speed of 2,500 rpm.
Standard:
MAF while engine idling: Between 3.2 g/sec and 4.7 g/sec (shift position: N, A/C: OFF).
MAF at engine speed of 2,500 rpm: Between 13.1 g/sec and 18.9 g/sec (shift position: N, A/C: OFF).

NG → REPLACE MASS AIR FLOW METER

OK

CHECK FOR INTERMITTENT PROBLEMS