

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 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 blink the MIL. For monitoring misfire, 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. 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 ECM illuminates the MIL.

DTC No.	DTC Detecting Condition	Trouble Area
P0300	Misfiring of random cylinders is detected	• Open or short in engine wire • Connector connection • Vacuum hose connection
P0301	Misfiring of each cylinder is detected	• Ignition system
P0302		• Injector
P0303		• Fuel pressure
P0304		• Mass air flow meter
P0305		• Engine coolant temperature sensor
P0306		• Compression pressure
P0307		• Valve clearance
P0308		• Valve timing
		• PCV piping
		• ECM

HINT:

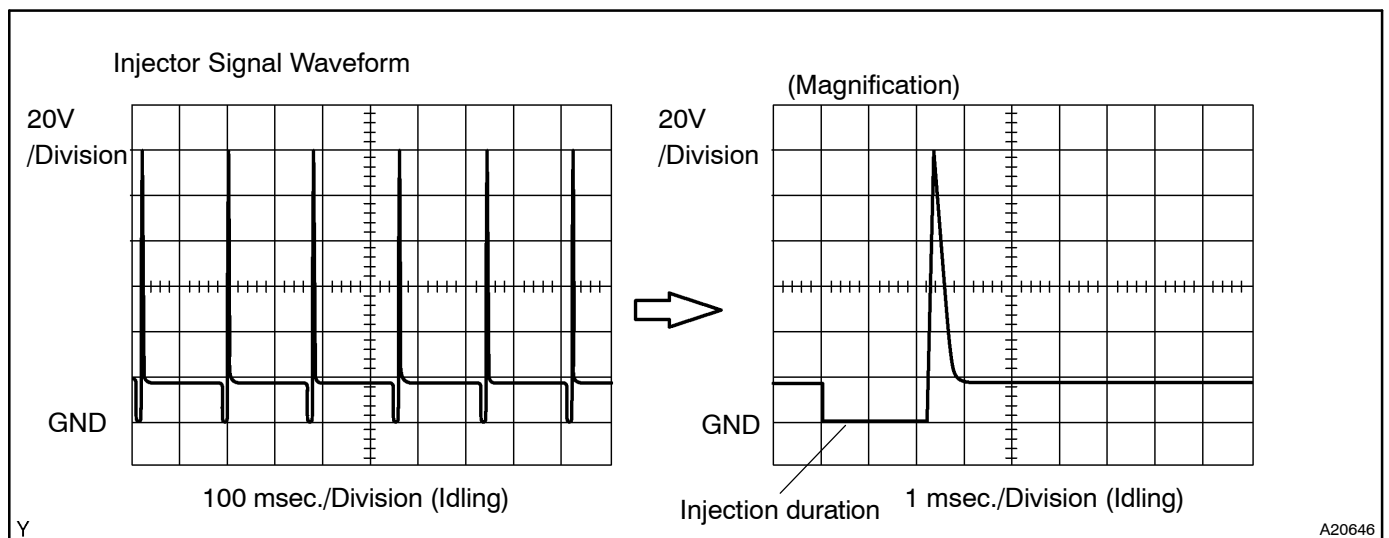
When several codes for a misfiring cylinder are recorded repeatedly but no random misfire code is recorded, it indicates that the misfires have been detected and recorded at different times.

Reference: Inspection using the oscilloscope.

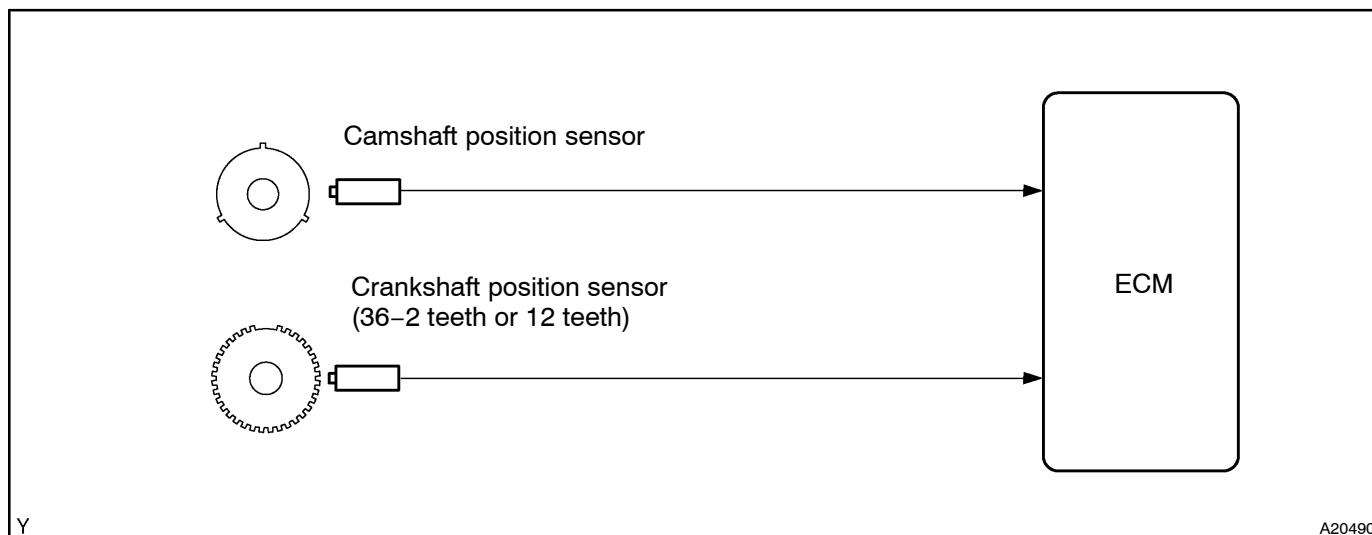
With the engine idling, check the waveform between terminals #1 to #8 and E01 of the ECM connectors.

HINT:

The correct waveform is as shown.



MONITOR DESCRIPTION



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

The ECM will illuminate the MIL when the percent misfire exceeds the specified limit per 1,000 engine revolutions. One occurrence of excessive misfire during engine start will set the MIL. Four occurrences are required to set the MIL 1,000 revolutions after engine start.

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

- Within 200 engine revolutions at a high rpm, the threshold for "percent of misfire causing catalyst damage" is reached 1 time.
- Within 200 engine revolutions at a normal rpm, the threshold for "percent of misfire causing catalyst damage" is reached 3 time.

MONITOR STRATEGY

Related DTCs	P0300	Random/Multiple cylinder misfire detected
	P0301	Cylinder 1 misfire detected
	P0302	Cylinder 2 misfire detected
	P0303	Cylinder 3 misfire detected
	P0304	Cylinder 4 misfire detected
	P0305	Cylinder 5 misfire detected
	P0306	Cylinder 6 misfire detected
	P0307	Cylinder 7 misfire detected
	P0308	Cylinder 8 misfire detected
Required sensors/components	Main sensors/components	Camshaft position sensor, Crankshaft position sensor
	Related sensors/components	Engine coolant temperature sensor, Intake air temperature sensor, Throttle position sensor
Frequency of operation	Continuous	
Duration	Every 1,000 revolutions (soon after engine is started: 1 time, other 4 times) (emission related misfire) Every 200 revolutions (1 or 3 times) (catalyst deteriorating misfire)	
MIL operation	2 driving cycles MIL ON Immediate MIL blinking (Catalyst deteriorating misfire)	
Sequence of operation	None	

TYPICAL ENABLING CONDITIONS

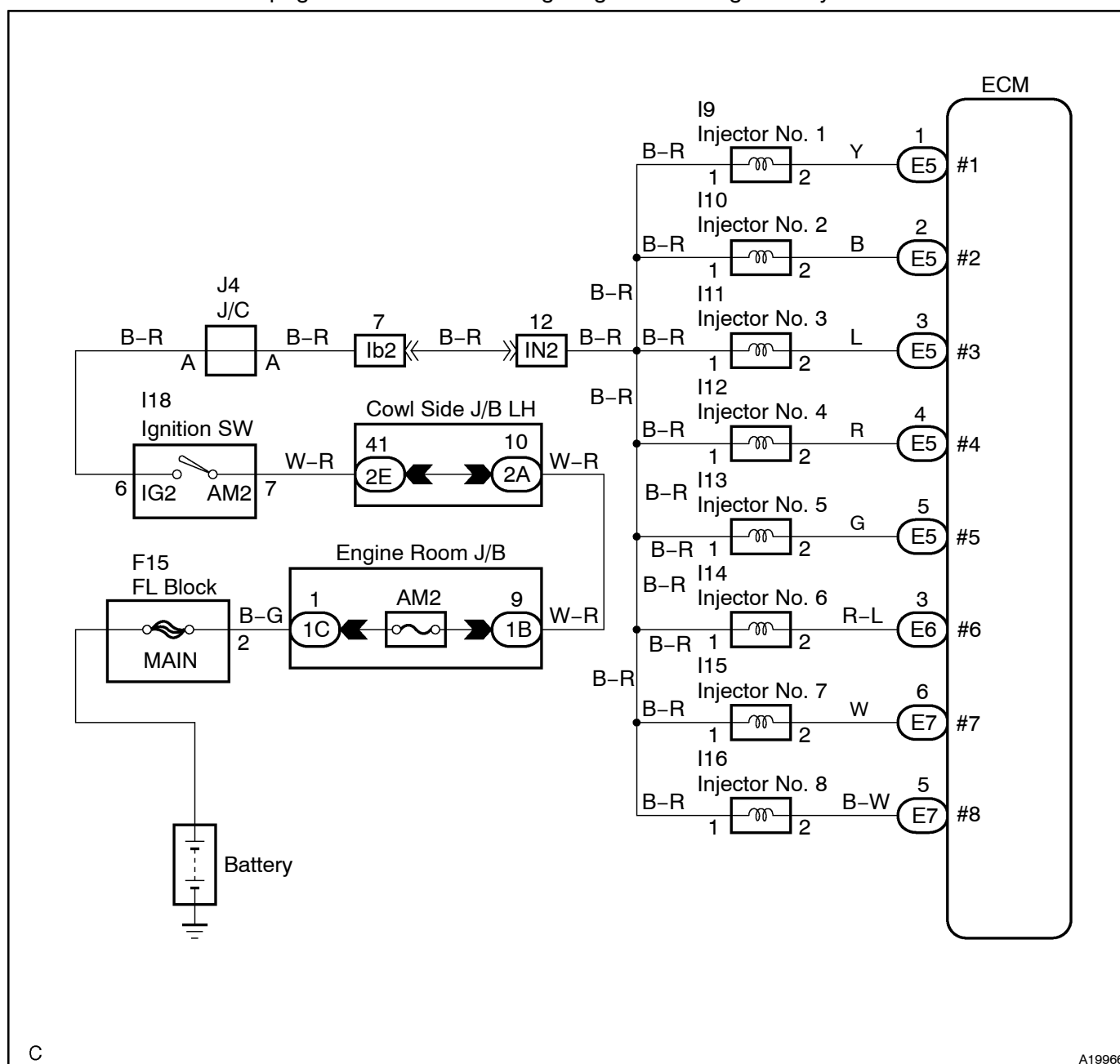
Item	Specification	
	Minimum	Maximum
The monitor will run whenever the following DTCs are not present	See "List of disable a monitor" (on page DI-3)	
Battery voltage	8 V	–
VVT	Normal operation (i. e. not under scan–tool control)	
EGR	Not checking	
Engine speed fluctuation	Engine speed should not have changed rapidly	
Engine speed (Two full revolutions (2 rev.) after engine has started)	400 rpm	5,300 rpm
All of the following conditions are met:	A, B and C	
A. Engine coolant temperature	–10°C (14°F)	–
B. Either of the following conditions is met:	(a) or (b)	
(a) Intake air temperature	–10°C (14°F)	–
(b) Engine coolant temperature	75°C (167°F)	–
C. Either of the following conditions is met:	(a) or (b)	
(a) Engine coolant temperature at engine started	–7°C (19°F)	–
(b) Engine coolant temperature	20°C (68°F)	–
Intake air amount per revolution (varies with engine speed)	0.4 g/rev.	–
Throttle position learning	Completed	
Throttle position	Rapid throttle opening or closing operation has not occurred	
	–	Changing value of throttle position Less than 3° per 0.008 sec.
Rough road counter	–	14 times/1,000 revolutions (Not running on rough road)
For paired cylinder misfire (6 or 8 cylinders):		
When ECT is between –10°C (14°F) and 75°C (167°F), the following conditions are met:	A and B	
A. Engine speed	–	3,000 rpm
B. Intake air amount per revolution at 1,800 rpm (varies with engine speed)	0.7 g/sec.	–
When ECT is over 75°C (167°F), the following conditions are met:	A or (B and C)	
A. NE signal plate tooth width learning was not completed		
B. Engine speed	–	3,000 rpm
C. Intake air amount per revolution at 1,800 rpm (varies with engine speed)	0.7 g/sec.	–

TYPICAL MALFUNCTION THRESHOLDS

Detection Criteria	Threshold
Emission related misfire rate: 1. During the first 1,000 revolutions after engine start (MIL is set when misfire is detected 1 time) 2. After the first 1,000 revolutions have occurred (MIL is set when misfire is detected 4 times)	3 %/1,000 revolutions
Catalyst damage misfire count: 1. Low engine rpm area (ex. less than 3,000 rpm): 200 revolutions (MIL is set when misfire is detected 3 times) 2. High engine rpm area: Every 200 revolutions	96 count/200 revolutions (Threshold varies with engine speed and intake air amount per revolution)

WIRING DIAGRAM

Refer to DTC P0351 on page [DI-208](#) 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 or OBD II scan tool.
- Start the engine and drive the confirmation pattern.
- 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 $\pm 20\%$, 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?
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PREPARATION:

- Connect the hand-held tester or the OBD II scan tool to the DLC3.
- Turn the ignition switch ON and push the hand-held tester or OBD II scan tool main switch ON.
- When using hand-held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / DTC INFO / CURRENT CODES.

CHECK:

Read the DTC using hand-held tester or the OBD II scan tool.

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-43](#)).

A

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

- Check the connection conditions of the wire harness and connector.
- 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.
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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 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) When using hand-held tester, enter the following menus: DIAGNOSIS / ENHANCED OBD II / DATA LIST / ALL / CYL#1 to CYL#8.

CHECK:

Read the number of misfire on the hand-held tester or the OBD II scan tool.

HINT:

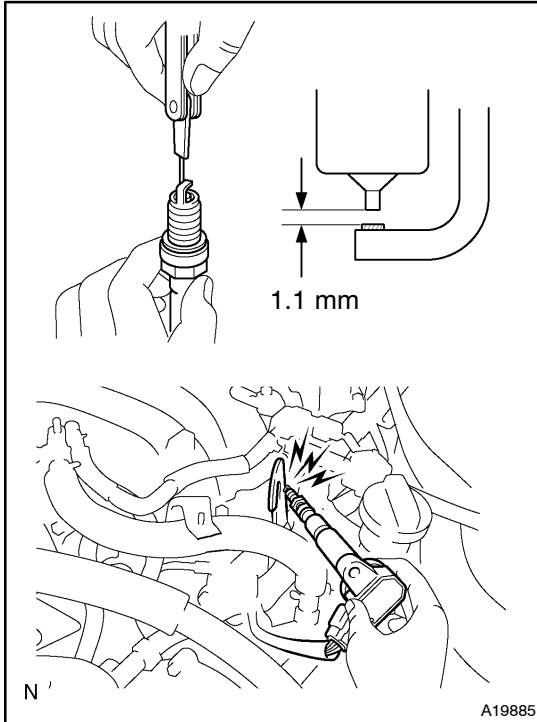
When a misfire is not reproduced, be sure to branch below based on the stored DTC.

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.



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 (See page [IG-1](#)).
- (c) Check electrode gap.

OK:

No large carbon deposit present.

Not wet with gasoline or oil.

Electrode gap: 1.0 to 1.3 mm (0.039 to 0.051 in.)

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 cranked.

CAUTION:

Always disconnect each injector connector.

NOTICE:

Do not crank the engine for more than 2 seconds.

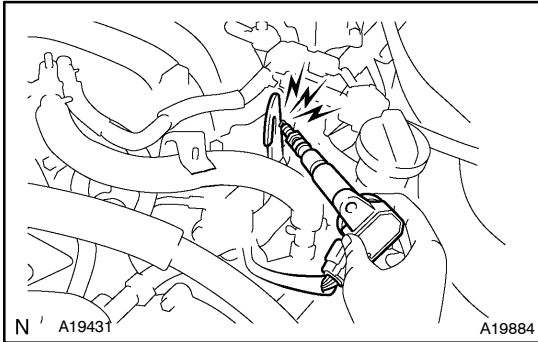
OK:

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:

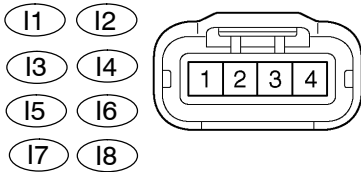
Spark jumps across electrode gap.

OK**Replace spark plug.****NG**

7

Check for open and short in harness and connector between ignition coil and ECM.**Wire Harness Side:**

Ignition Coil Connector



Y

A21025

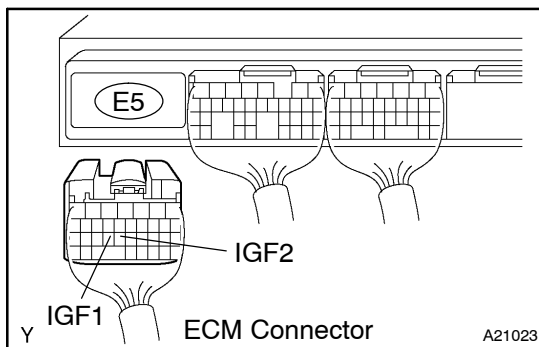
Check the harness and connector between the ignition coil and the ECM (IGF terminal) connectors:

PREPARATION:

- Disconnect the I1, I2, I3, I4, I5, I6, I7 or I8 ignition coil connector.
- Disconnect the E5 ECM connector.

CHECK:

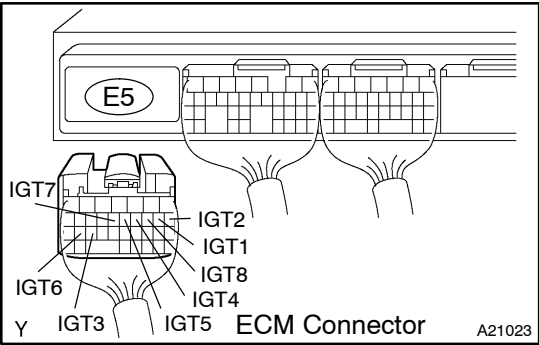
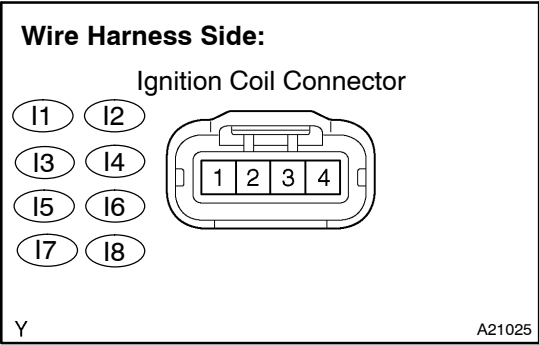
Check the resistance between the wire harness side connectors.

OK:

Y

A21023

Tester Connection	Specified Condition
Ignition coil (I1-2) – IGF1 (E5-24)	Below 1 Ω
Ignition coil (I2-2) – IGF2 (E5-23)	Below 1 Ω
Ignition coil (I3-2) – IGF1 (E5-24)	Below 1 Ω
Ignition coil (I4-2) – IGF2 (E5-23)	Below 1 Ω
Ignition coil (I5-2) – IGF1 (E5-24)	Below 1 Ω
Ignition coil (I6-2) – IGF2 (E5-23)	Below 1 Ω
Ignition coil (I7-2) – IGF1 (E5-24)	Below 1 Ω
Ignition coil (I8-2) – IGF2 (E5-23)	Below 1 Ω
Ignition coil (I1-2) or IGF1 (E5-24) – Body ground	10 k Ω or higher
Ignition coil (I2-2) or IGF2 (E5-23) – Body ground	10 k Ω or higher
Ignition coil (I3-2) or IGF1 (E5-24) – Body ground	10 k Ω or higher
Ignition coil (I4-2) or IGF2 (E5-23) – Body ground	10 k Ω or higher
Ignition coil (I5-2) or IGF1 (E5-24) – Body ground	10 k Ω or higher
Ignition coil (I6-2) or IGF2 (E5-23) – Body ground	10 k Ω or higher
Ignition coil (I7-2) or IGF1 (E5-24) – Body ground	10 k Ω or higher
Ignition coil (I8-2) or IGF2 (E5-23) – Body ground	10 k Ω or higher



Check the harness and connector between the ignition coil and the ECM (IGT terminal) connectors:

PREPARATION:

- (a) Disconnect the I1, I2, I3, I4, I5, I6, I7 or I8 ignition coil connector.
- (b) Disconnect the E5 ECM connector.

CHECK:

Check the resistance between the wire harness side connectors.

OK:

Tester Connection	Specified Condition
Ignition coil (I1-3) – IGT1 (E5-9)	Below 1 Ω
Ignition coil (I2-3) – IGT2 (E5-8)	Below 1 Ω
Ignition coil (I3-3) – IGT3 (E5-25)	Below 1 Ω
Ignition coil (I4-3) – IGT4 (E5-11)	Below 1 Ω
Ignition coil (I5-3) – IGT5 (E5-12)	Below 1 Ω
Ignition coil (I6-3) – IGT6 (E5-26)	Below 1 Ω
Ignition coil (I7-3) – IGT7 (E5-13)	Below 1 Ω
Ignition coil (I8-3) – IGT8 (E5-10)	Below 1 Ω
Ignition coil (I1-3) or IGT1 (E5-9) – Body ground	10 kΩ or higher
Ignition coil (I2-3) or IGT2 (E5-8) – Body ground	10 kΩ or higher
Ignition coil (I3-3) or IGT3 (E5-25) – Body ground	10 kΩ or higher
Ignition coil (I4-3) or IGT4 (E5-11) – Body ground	10 kΩ or higher
Ignition coil (I5-3) or IGT5 (E5-12) – Body ground	10 kΩ or higher
Ignition coil (I6-3) or IGT6 (E5-26) – Body ground	10 kΩ or higher
Ignition coil (I7-3) or IGT7 (E5-13) – Body ground	10 kΩ or higher
Ignition coil (I8-3) or IGT8 (E5-10) – Body ground	10 kΩ or higher

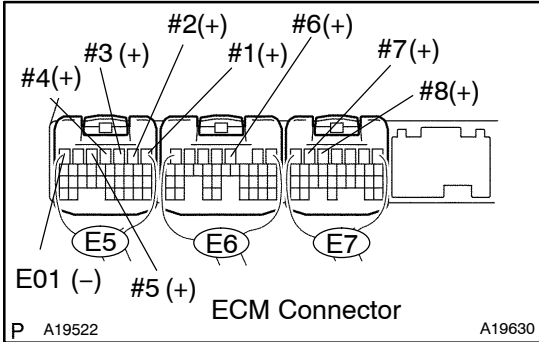
OK

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

NG

Repair or replace harness or connector.

8 Check ECM terminal of misfiring cylinder.



PREPARATION:

Turn the ignition switch ON.

CHECK:

Measure the voltage between the terminals of the E5, E6 and E7 ECM connectors.

OK:

Tester Connection	Specified Condition
#1 (E5-1) - E01 (E5-7)	9 to 14 V
#2 (E5-2) - E01 (E5-7)	9 to 14 V
#3 (E5-3) - E01 (E5-7)	9 to 14 V
#4 (E5-4) - E01 (E5-7)	9 to 14 V
#5 (E5-5) - E01 (E5-7)	9 to 14 V
#6 (E6-3) - E01 (E5-7)	9 to 14 V
#7 (E7-6) - E01 (E5-7)	9 to 14 V
#8 (E7-5) - E01 (E5-7)	9 to 14 V

OK

Go to step 11.

NG

9 Check injector resistance of misfiring cylinder (See page [SF-19](#)).

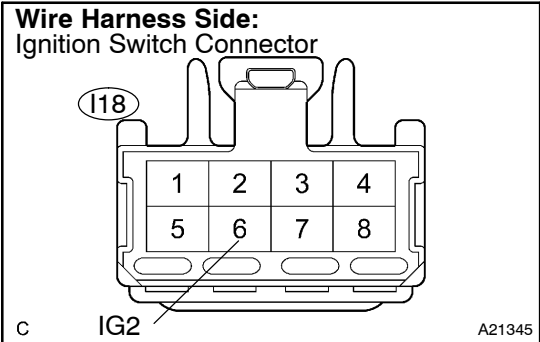
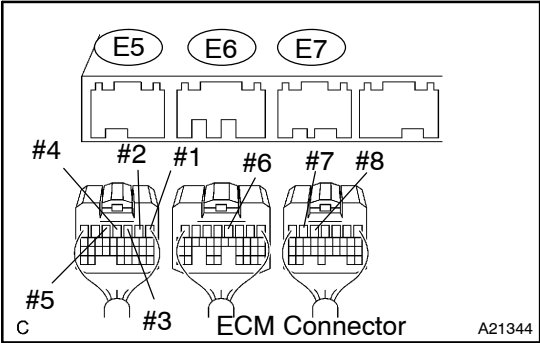
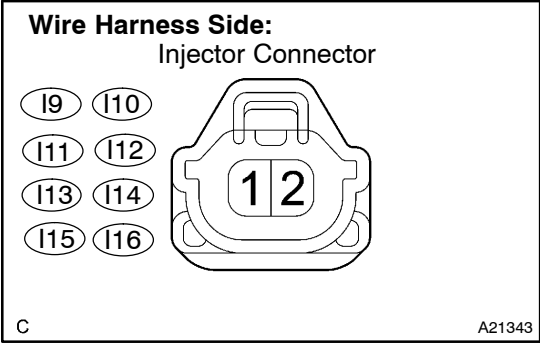
NG

Replace injector.

OK

10

Check for open and short in harness and connector between ignition SW and injector, injector and ECM of misfiring cylinder.



Check the harness and the connector between the injector connector and the ECM connector:

PREPARATION:

- (a) Disconnect the I9, I10, I11, I12, I13, I14, I15 or I16 injector connector.
- (b) Disconnect the E5, E6 or E7 ECM connector.

CHECK:

Measure the resistance between the wire harness side connectors.

OK:

Tester Connection	Specified Condition
Injector (I9-2) - #1 (E5-1)	Below 1 Ω
Injector (I10-2) - #2 (E5-2)	Below 1 Ω
Injector (I11-2) - #3 (E5-3)	Below 1 Ω
Injector (I12-2) - #4 (E5-4)	Below 1 Ω
Injector (I13-2) - #5 (E5-5)	Below 1 Ω
Injector (I14-2) - #6 (E6-3)	Below 1 Ω
Injector (I15-2) - #7 (E7-6)	Below 1 Ω
Injector (I16-2) - #8 (E7-5)	Below 1 Ω
Injector (I9-2) or #1 (E5-1) - Body ground	10 kΩ or higher
Injector (I10-2) or #2 (E5-2) - Body ground	10 kΩ or higher
Injector (I11-2) or #3 (E5-3) - Body ground	10 kΩ or higher
Injector (I12-2) or #4 (E5-4) - Body ground	10 kΩ or higher
Injector (I13-2) or #5 (E5-5) - Body ground	10 kΩ or higher
Injector (I14-2) or #6 (E6-3) - Body ground	10 kΩ or higher
Injector (I15-2) or #7 (E7-6) - Body ground	10 kΩ or higher
Injector (I16-2) or #8 (E7-5) - Body ground	10 kΩ or higher

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

PREPARATION:

- (a) Disconnect the I9, I10, I11, I12, I13, I14, I15 or I16 injector connector.
- (b) Disconnect the I18 ignition switch connector.

CHECK:

Measure the resistance between the wire harness side connectors.

OK:

Tester Connection	Specified Condition
Injector (I9-1) – IG2 (I18-6)	Below 1 Ω
Injector (I10-1) – IG2 (I18-6)	Below 1 Ω
Injector (I11-1) – IG2 (I18-6)	Below 1 Ω
Injector (I12-1) – IG2 (I18-6)	Below 1 Ω
Injector (I13-1) – IG2 (I18-6)	Below 1 Ω
Injector (I14-1) – IG2 (I18-6)	Below 1 Ω
Injector (I15-1) – IG2 (I18-6)	Below 1 Ω
Injector (I16-1) – IG2 (I18-6)	Below 1 Ω
Injector (I9-1) or IG2 (I18-6) – Body ground	10 k Ω or higher
Injector (I10-1) or IG2 (I18-6) – Body ground	10 k Ω or higher
Injector (I11-1) or IG2 (I18-6) – Body ground	10 k Ω or higher
Injector (I12-1) or IG2 (I18-6) – Body ground	10 k Ω or higher
Injector (I13-1) or IG2 (I18-6) – Body ground	10 k Ω or higher
Injector (I14-1) or IG2 (I18-6) – Body ground	10 k Ω or higher
Injector (I15-1) or IG2 (I18-6) – Body ground	10 k Ω or higher
Injector (I16-1) or IG2 (I18-6) – Body ground	10 k Ω or higher

NG

Repair or replace harness or connector.

OK

11 Check injector injection of misfiring cylinder (See page [SF-24](#)).

NG

Replace injector.

OK

12 Check compression pressure of misfiring cylinder (See page [EM-3](#)).

NG

Repair or replace.

OK

13 Check valve clearance of misfiring cylinder (See page [EM-4](#)).

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 page EM-22).
----	---

NG	Adjust valve timing (Repair or replace timing belt).
----	--

OK

16	Check fuel pressure (See page SF-7).
----	---

NG	Check and repair fuel pump, pressure regulator, fuel pipe line and filter (See page SF-1).
----	---

OK

17	Check intake air temperature and mass air flow rate.
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PREPARATION:

- (a) Connect the hand-held tester or the OBD II scan tool to the DLC3.
- (b) Turn the ignition switch ON.

CHECK:

Check the intake air temperature.

- (1) Select the item "DIAGNOSIS/ENHANCED OBD II/DATA LIST/ALL/INTAKE AIR".
- (2) Read its value displayed on the hand-held tester or the OBD II scan tool.

OK:

Equivalent to ambient temperature

CHECK:

Check the air flow rate.

- (1) Select the item "DIAGNOSIS/ENHANCED OBD II/DATA LIST/ALL/MAF".
- (2) Read its value displayed on the hand-held tester or the OBD II scan tool.

OK:

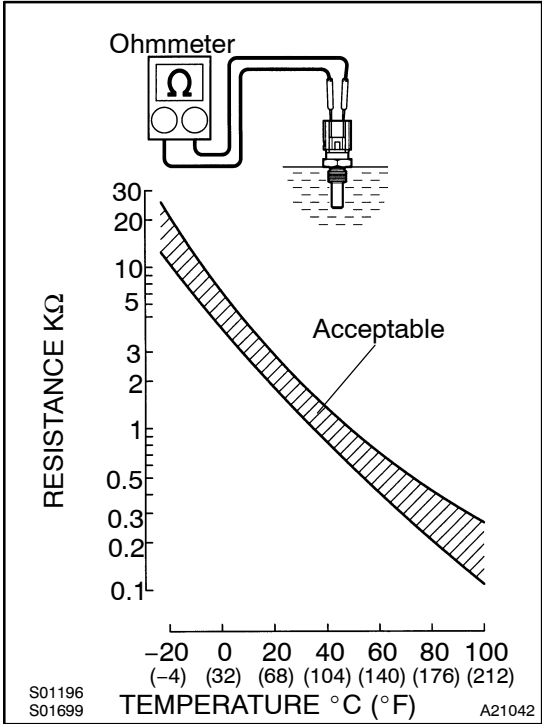
Condition	Air Flow Rate (gm/s)
Ignition switch ON (do not start engine)	0
Idling	4 to 6
Running without load (2,500 rpm)	13 to 20
Idling to quickly accelerating	Air flow rate fluctuates

NG

Replace mass 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](#)).**