

PRE-CHECK

1. DIAGNOSIS SYSTEM

(a) Description

- When troubleshooting OBD II vehicles, the only difference from the usual troubleshooting procedure is that you need to connect the vehicle to the OBD II scan tool complying with SAE J1978 or hand-held tester, and read off various data output from the vehicle's ECM.
- OBD II regulations require that the vehicle's on-board computer lights up the Malfunction Indicator Light (MIL) on the instrument panel when the computer detects a malfunction in the emission control system/components or in the powertrain control components which affect vehicle emissions, or a malfunction in the computer. In addition to the MIL lighting up when a malfunction is detected, the applicable Diagnostic Trouble Code (DTC) prescribed by SAE J2012 is recorded in the ECM memory (See page 05-168).

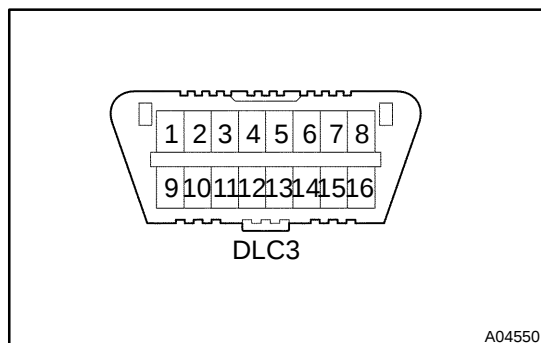
If the malfunction does not reoccur in 3 consecutive trips, the MIL goes off automatically but the DTCs remain in the ECM memory.

- To check the DTCs, connect the OBD II scan tool or hand-held tester to the Data Link Connector 3 (DLC3) on the vehicle. The OBD II scan tool or hand-held tester also enables you to erase the DTCs and check freeze frame data and various forms of engine data (For operating instructions, see the OBD II scan tool's instruction book.). DTCs include SAE controlled codes and manufacturer controlled codes. SAE controlled codes must be set as prescribed by the SAE, while manufacturer controlled codes can be set freely by the manufacturer within the prescribed limits (See DTC chart on page 05-168).
- The diagnosis system operates in the normal mode during the normal vehicle use. It also has a check mode for technicians to simulate malfunction symptoms and troubleshoot. Most DTCs use 2 trip detection logic* to prevent erroneous detection, which ensures the malfunction detection. By switching the ECM to the check mode when troubleshooting, the technician can cause the MIL to light up for a malfunction that is only detected once or momentarily (hand-held tester only) (See step 2).

- *2 trip detection logic:
When a malfunction is first detected, the malfunction is temporarily stored in the ECM memory (1st trip).

If the same malfunction is detected again during the second drive test, this second detection causes the MIL to light up (2nd trip). (however, the ignition switch must be turned OFF between the 1st 2 trip and 2nd 2 trip.).

- Freeze frame data:
Freeze frame data records the engine condition when a misfire (DTC P0300 – P0304) or fuel trim malfunction (DTC P0171 and P0172) or other malfunction (first malfunction only), is detected. Freeze frame data records the engine conditions (fuel system, calculated load, engine coolant temperature, fuel trim, engine speed, vehicle speed, etc.) 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.
- Priorities for troubleshooting:
If troubleshooting priorities for multiple DTCs are given in the applicable DTC chart, these should be followed. If no instructions are given, troubleshoot the DTCs according to the following priorities.
 - (1) DTCs other than fuel trim malfunction (DTCs P0171 and P0172) and misfire (DTCs P0300 – P0304).
 - (2) Fuel trim malfunction (DTCs P0171 and P0172).
 - (3) Misfire (DTCs P0300 – P0304).



- (b) Check the DLC3.
The vehicle's ECM uses ISO 9141-2 for communication. The terminal arrangement of DLC3 complies with SAE J1962 and matches the ISO 9141-2 format.

Terminal No	Connection/Voltage or Resistance	Condition
7	Bus + Line/Pulse generation	During transmission
4	Chassis Ground – Body Ground/1 Ω or less	Always
5	Signal Ground – Body Ground/1 Ω or less	Always
16	Battery Positive – Body Ground/9 – 14 V	Always

HINT:

If your display shows **UNABLE TO CONNECT TO VEHICLE** when you have connected the cable of the OBD II scan tool or hand-held tester to the DLC3, turned the ignition switch ON and operated the scan tool, there is a problem on the vehicle side or tool side.

- If the communication is normal when the tool is connected to another vehicle, inspect the DLC3 on the original vehicle.
- If the communication is still impossible when the tool is connected to another vehicle, the problem is probably in the tool itself, so consult the Service Department listed in the tool's instruction manual.

**2. Normal Mode:****INSPECT DIAGNOSIS****(a) Check the MIL.**

- (1) The MIL comes on when the ignition switch is turned ON and the engine is not running.

HINT:

If the MIL does not light up, troubleshoot the combination meter (See page [05-168](#)).

- (2) When the engine starts, the MIL should go off. If the lamp remains on, it means the diagnosis system has detected a malfunction or abnormality in the system.

(b) Check the DTC.**NOTICE:**

- If there is no DTC in the normal mode, check the 1st trip DTC using **Continuous Test Results function (Mode 7 for SAE J1979)** on the OBD II scan tool or hand-held tester.
- **Hand-held tester only:**

When the diagnosis system is switched from the normal mode to the check mode, all the DTCs and freeze frame data recorded in the normal mode will be erased. So before switching modes, always check the DTCs and freeze frame data, and note them down.

- (1) Prepare the OBD II scan tool (complying with SAE J1978) or hand-held tester.
- (2) Connect the OBD II scan tool or hand-held tester to the DLC3.
- (3) Turn the ignition switch ON, and push the OBD II scan tool or hand-held tester switch ON.

- (4) Use the OBD II scan tool or hand-held tester to check the DTCs and freeze frame data and note them down (For operating instructions, see the OBD II scan tool's instruction book).

If there is no DTC in the normal mode, check the 1st trip DTC using Continuous Test Results function (Mode 7 for SAE J1979) on the OBD II scan tool or hand-held tester.

- (5) See page 05-168 to confirm the details of the DTCs.

NOTICE:

- When simulating symptoms with an OBD II scan tool (excluding hand-held tester) to check the DTCs, use the normal mode. For code on the DTC chart subject to "2 trip detection logic", perform the following either action.
- Turn the ignition switch OFF after the symptom is simulated the once. Then repeat the simulation process again. When the problem has been simulated twice, the MIL lights up and the DTCs are recorded in the ECM.
- Check the 1st trip DTC using Mode 7 (Continuous Test Results) for SAE J1979.

- (c) Clear the DTC.

The DTC and freeze frame data will be erased by either action.

- (1) Operating the OBD II scan tool (complying with SAE J1978) or hand-held tester to erase the codes (For operating instructions, see the OBD II scan tool's instruction book).
- (2) Disconnecting the battery terminals or E.F.I.1 fuse.

NOTICE:

If the hand-held tester switches the ECM from the normal mode to the check mode or viseversa, or if the ignition switch is turned from ON to ACC or OFF during the check mode, the DTCs and freeze frame data will be erased.

3. Check Mode:

INSPECT DIAGNOSIS

HINT:

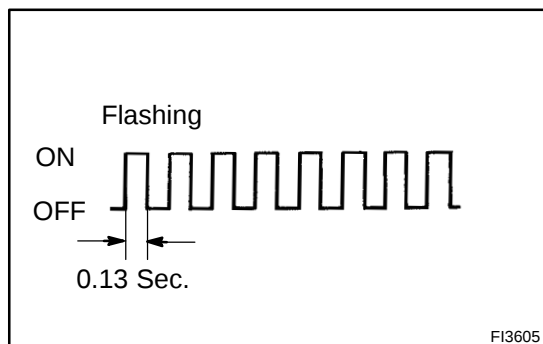
Hand-held tester only:

Compared to the normal mode, the check mode has an increased sensitivity to detect malfunctions. Furthermore, the same diagnostic items as ones detected in the normal mode can also be detected in the check mode.

- (a) Check the DTC.

- (1) Initial conditions
 - Battery positive voltage 11V or more
 - Throttle valve fully closed
 - Transmission in neutral position
 - A/C switched OFF
- (2) Turn the ignition switch OFF.

- (3) Prepare the hand-held tester.
- (4) Connect the hand-held tester to the DLC3.
- (5) Turn the ignition switch ON and push the hand-held tester switch ON.



- (6) Switch the hand-held tester from the normal mode to the check mode.
- (7) Check if the MIL blinks.

NOTICE:

If the hand-held tester switches the ECM from the normal mode to the check mode or vice-versa, or if the ignition switch is turned from ON to ACC or LOCK during the check mode, the DTCs and freeze frame data will be erased.

- (8) Start the engine (The MIL goes off after the engine starts).
- (9) Simulate the conditions of the malfunction described by the customer.

NOTICE:

Leave the ignition switch ON until you have checked the DTC, etc.

- (10) After simulating the malfunction conditions, use the hand-held tester diagnosis selector to check the DTCs and freeze frame data, etc.

HINT:

Take care not to turn the ignition switch OFF. Turning the ignition switch OFF switches the diagnosis system from the check mode to the normal mode. So all the DTCs, etc. will be erased.

- (11) After checking the DTC, inspect the applicable circuit.

4. FAIL-SAFE CHART

If any of the following codes is recorded, the ECM enters fail-safe mode.

DTC No.	Fail-safe Operation	Fail-safe Deactivation Conditions
P0100	Ignition timing fixed at 10° BTDC	Returned to normal condition
P0110	Intake air temperature is fixed at 20°C (68°F)	Returned to normal condition
P0115	Engine coolant temperature is fixed at 80° (176°F)	Returned to normal condition
P0120	VTA is fixed at 0°	The following condition must be repeated at least 2 times consecutively when closed throttle position switch is OFF: VTA $\geq$ 0.1 V and $\leq$ 0.95 V
P0135 P0141	The heater circuit in which an abnormality is detected is turned off	Ignition switch OFF
P0325	Max. timing retardation	Ignition switch OFF
P1300 P1305 P1310 P1315	Fuel cut	Returned to normal condition
P1656	It cut electrically the circuit in which an abnormality is detected.	Returned to normal condition

5. CHECK FOR INTERMITTENT PROBLEMS

Hand-held tester only:

By putting the vehicle's ECM in the check mode, 1 trip detection logic is possible instead of 2 trip detection logic and the sensitivity to detect open circuits is increased. This makes it easier to detect intermittent problems.

- (1) Clear the DTC (See step 2).
- (2) Set the check mode (See step 3).
- (3) Perform a simulation test (See page 01-24).
- (4) Check the connector and terminal (See page 01-34).
- (5) Handle the connector (See page 01-34).

6. DATA LIST

HINT:

According to the DATA LIST displayed by the OBD II scan tool or Hand-held tester, you can read the value of the switch, sensor, actuator and so on without parts removal. Reading the DATA LIST as a first step of troubleshooting is one of the method to shorten the labor time.

- (a) Warm up the engine.
- (b) Turn the ignition switch OFF.
- (c) Connect the OBD II scan tool or Hand-held tester to the DLC3.
- (d) Turn the ignition switch ON.
- (e) According to the display on tester, read the "DATA LIST".

Item	Measurement Item/Range (Display)	Normal Condition	Diagnostic Note
INJECTOR	Injection period of the No.1 cylinder/ Min.: 0 ms, Max.: 32.64 ms	Idling: 0.85 – 2.0 ms	
IGN ADVANCE	Ignition timing advance for No.1 cylinder/ Min.: –64 deg., Max.: 63.5 deg.	Idling: M/T BTDC 4 – 12 deg. A/T BTDC 10 – 18 deg.	
IAC DUTY RATIO	Duty ratio of the IAC valve/ Min.: 0 %, Max.: 99 %	• Idling: 25 – 45 % • Racing with out load(2500 rpm): 25 – 45 %	
CALC LOAD	Calculated load by engine ECM/ Min.: 0 %, Max.: 100 %	• Idling: 9.1 – 20.0 % • Racing without load(2500 rpm): 11.0 – 23.0 %	
MAF	Air flow rate from MAF sensor/ Min.: 0 gm/s, Max.: 655 gm/s	• Idling: M/T 1.5 – 5.0 gm/sec. A/T 1.5 – 5.0 gm/sec. • Racing without load (2,500 rpm): 5.0 – 15.0 gm/sec.	
ENGINE SPD	Engine Speed/ Min.: 0 rpm, Max.: 16383 rpm	Idling: M/T 750 – 850 rpm A/T 700 – 800 rpm	
COOLANT TEMP	Coolant temperature/ Min.: –40 °C, Max.: 140 °C	After warming up: 80 – 95 °C (176 – 203 °F)	If the value is "–40 °C" or "140 °C", sensor circuit is open or shorted.
INTAKE AIR	Intake air temperature/ Min.: –40 °C, Max.: 140 °C	Equivalent to Ambient Temp.	
THROTTLE POS	Absolute throttle position sensor/ Min.: 0 %, Max.: 100 %	• Throttle fully closed: 8 – 18 % • Throttle fully open: 64 – 98 %	
CTP SW	Closed throttle position switch/ ON or OFF	• Throttle fully closed: ON • Throttle open: OFF	
VEHICLE SPD	Vehicle speed/ Min.: 0 km/h, Max.: 255 km/h	Vehicle stopped: 0 km/h (0 mph)	

DIAGNOSTICS – SFI SYSTEM (2ZZ-GE)

OS2 B1 S1	Oxygen sensor output voltage of the bank 1 sensor 1/ Min.: 0 V, Max.: 1.275 V	Idling: 0.1 – 0.9 V	
O2S B1 S2	Oxygen sensor output voltage of the bank 1 sensor 2/ Min.: 0 V, Max.: 1.275 V	Idling: 0.1 – 0.9 V	
VAPOR PRESS	Vapor pressure/ Min.: – 4.12 kPa, Max.: 2.125 kPa		
SHORT FT #1	Short term fuel trim of bank 1/ Min.: –100 %, Max.: 100%	0 ± 20 %	
LONG FT #1	Long term fuel trim of bank 1/ Min.: –100 %, Max.: 100 %	0 ± 20 %	
TOTAL FT #1	Total fuel trim of bank 1/ Min.: 0.5, Max.: 1.496	Idling: 0.5 – 1.4	
TOTAL FT #2	Total fuel trim of bank 2/ Min.: 0.5, Max.: 1.496	Idling: 0.5 – 1.4	
O2FT B1 S1	Short term fuel trim associated with the bank1, sensor1/ Min.: 100 %, Max.: 100 %		
O2FT B1 S2	Short term fuel trim associated with the bank1, sensor2/ Min.: –100 %, Max.: 100 %		
O2LR B1 S1	Response time of the O2 sensor, lean to rich (bank1, sensor1)/ Min.: 0 ms, Max.: 16711 ms		
O2LR B2 S1	Response time of the O2 sensor, lean to rich (bank2, sensor1)/ Min.: 0 ms, Max.: 16711 ms		
O2RL B1 S1	Response time of the O2 sensor, lean to rich/ (bank1, sensor1) Min.: 0 ms, Max.: 16711 ms		
O2RL B2 S1	Response time of the O2 sensor, lean to rich/ (bank2, sensor1) Min.: 0 ms, Max.: 16711 ms		
FUEL SYS #1, #2	Fuel system status (Bank1, 2) / OL or CL or OLDRIVE or OLFAULT or CLFAULT	Idling after warming up: CL	• OL: Open Loop–has not yet satisfied conditions to go closed loop. • CL: Closed Loop–using oxygen sensor(s) as feed back for fuel control. • OL DRIVE: Open loop due to driving conditions. (power enrichment, deceleration enleanment) • OL FAULT: Open loop due to detected system fault. • CL FAULT: Closed loop, but fault with at least one oxygen sensor may be using single oxygen sensor for fuel control.
FC IDL	Idle fuel cut / ON or OFF	Fuel cut operation: ON	
MIL	MIL status / ON or OFF	MIL ON: ON	

STARTER SIG	Starter signal / ON or OFF	Cranking: ON	
A/C SIG	A/C signal / ON or OFF	A/C ON: ON	
PNP SW [NSW]	Neutral position switch signal / ON or OFF	P or N position: ON	
ELECT LOAD SIG	Electrical load signal / ON or OFF	Defogger switch ON: ON	
STOP LIGHT SW *1	Stop light switch / ON or OFF	• Brake pedal depressed: ON • Brake pedal released: OFF	
PS OIL PRESS SW	Power steering signal / ON or OFF	Steering position is; center: OFF Except center: ON	
PS SIGNAL	Power steering signal/ ON or OFF	• After engine start: OFF • After steer the steering: ON	
FUEL PUMP / SPD	Fuel pump / speed status / ON/H or OFF/M,L	Idling: ON	
A/C MAG CLUTCH	A/C magnet clutch status / ON or OFF	A/C magnet clutch ON: ON	
EVAP VSV	VSV status for EVAP control / ON or OFF	VSV operating: ON	
VVT CTRL B1	VVT control status (Bank 1) / ON or OFF	VVT system operation: ON	
INT AIR CTL VSV *1	VSV status for intake air control/ ON or OFF		
IGNITION	Ignition counter/ Min.: 0, Max.: 400	0 – 400	
CYL #1, #2, #3, #4	Misfire ratio of the cylinder 1, 2, 3, 4/ Min.: 0 %, Max.: 50 %	0 %	
MIL ON RUN DIST	This parameter indicates the distance travelled while MIL/ Min.: 0 km, Max.: 65535 km	When there is no DTC: 0 km/h (0 mph)	

*1: Only for A/T models.

7. ACTIVE TEST

HINT:

Performing the ACTIVE TEST using the Hand-held tester allows the relay, VSV, actuator and so on to operate without parts removal. Performing the ACTIVE TEST as a first step of troubleshooting is one of the method to shorten the labor time.

It is possible to display the DATA LIST during the ACTIVE TEST.

- (a) Warm up the engine.
- (b) Turn the ignition switch OFF.
- (c) Connect the OBD II scan tool or Hand-held tester to the DLC3.
- (d) Turn the ignition switch ON.
- (e) According to the display on tester, perform the "ACTIVE TEST".

Item	Test Details	Diagnostic Note
INJ VOL	[Test Details] Control the injection volume Min.: -12.5 %, Max.: 24.8 % [Vehicle Condition] Engine speed: 3000rpm or less.	
IAC DUTY RATIO	[Test Details] Control the IAC duty ratio Min.: 0 %, Max.: 90 % [Vehicle Condition] Vehicle speed: 0 km/h. Engine speed: Idling Battery voltage: 8.5V or more.	When Engine speed does not change, IAC system has some failure.
CAN CTRL VSV	[Test Details] Activate the VSV for canister control. ON or OFF	
TANK BYPASS VSV	[Test Details] Activate the VSV for tank bypass. ON or OFF	
EVAP VSV (ALONE)	[Test Details] Activate the VSV for EVAP control. ON or OFF	
A/C MAG CLUTCH	[Test Details] Control the A/C magnet clutch. ON or OFF	
FUEL PUMP / SPD	[Test Details] Control the fuel pump speed. ON or OFF	
VVT CTRL B1	[Test Details] Activate the VVT system (Bank 1). ON or OFF	• ON: Rough idle or engine stall. • OFF: Normal engine speed.
VVTL CTRL B1	[Test Details] Control the VVTL system (Bank 1). ON or OFF	
INT AIR CTL VSV	[Test Details] Activate the VSV for intake air control. ON or OFF	
TC/TE1	[Test Details] Connect the TC and TE1 ON or OFF	
FC IDL PROHBT	[Test Details] Control the idle fuel cut prohibit. ON or OFF	

BASIC INSPECTION

When the malfunction code is not confirmed in the DTC check, troubleshooting should be carried out in the order for all possible circuits to be considered as the causes of the problems. In many cases, by carrying out the basic engine check shown in the following flow chart, the location causing the problem can be found quickly and efficiently. Therefore, using of this check is essential in engine troubleshooting.

1 CHECK BATTERY VOLTAGE

NOTICE:

Carry out this check under the engine stoppage condition.

	OK	NG
Voltage	11V or more	Less than 11V

NO

CHARGE OR REPLACE BATTERY

OK

2 CHECK IF ENGINE IS CRANKED

NG

**PROCEED TO PROBLEM TABLE ON PAGE
05-175**

OK

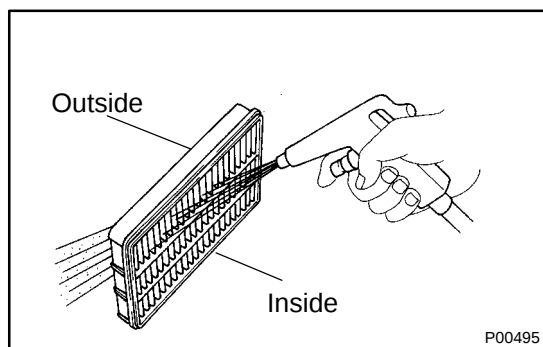
3 CHECK IF ENGINE STARTS

NG

GO TO STEP 7

OK

4 CHECK AIR FILER



- (a) Visually check that the air filter is not excessively dirty or oily.

HINT:

Visually check that the air filter is not excessively dirty or oily.

NOTICE:

If necessary, clean the filter with compressed air. First blow from inside thoroughly, then blow from outside of filter.

NG

REPAIR OR REPLACE

OK

5 CHECK IDLE SPEED (See page 14-174)**NG****PROCEED TO PROBLEM SYMPTOM TABLE ON PAGE 05-175****OK****6 CHECK IGNITION TIMING (See page 14-174)****NG****PROCEED TO PAGE 05-175 AND CONTINUE TO TROUBLESHOOT****OK****PROCEED TO PROBLEM SYMPTOM TABLE ON PAGE 05-175****7 CHECK FUEL PRESSURE (See page 11-5)****NG****PROCEED TO PAGE 05-175 AND CONTINUE TO TROUBLESHOOT****OK****8 CHECK FOR SPARK (See page 18-4)****NG****PROCEED TO PAGE 05-175 AND CONTINUE TO TROUBLESHOOT****OK****PROCEED TO PROBLEM SYMPTOMS TABLE ON PAGE 05-175**