

PRE-CHECK

1. DIAGNOSIS SYSTEM

(a) Description

- When troubleshooting OBD II vehicles, the only difference from the usual troubleshooting procedure is that you 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 Lamp (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 Codes (DTCs) prescribed by SAE J2012 are recorded in the ECM memory (See page [05-18](#)).

If the malfunction does not reoccur in 3 consecutive trips, the MIL goes off automatize but the DTC remain recorded in the ECM memory.

- To check the DTC, 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 DTC and check frozen frame data and various forms of engine data (For operating instructions, see the OBD II scan tool's instruction book.). DTC 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 [05-18](#)).
- The diagnosis system operates in normal mode during normal vehicle use. It also has a check mode for technicians to simulate malfunction symptoms and troubleshoot. Most DTC use 2 trip detection logic* to prevent erroneous detection, and ensure thorough malfunction detection. By switching the ECM to 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) the 2 trip repeats the same mode a 2nd time (However, the ignition switch must be turned OFF between the 1st trip and 2nd trip.).

- Freeze frame data:
Freeze frame data records the engine condition when a misfire (DTCs P0300 - P0306) or fuel trim malfunction (DTCs P0171 and P0172) or other malfunction (first malfunction only), is detected. Because freeze frame data records the engine conditions (fuel system, calculated load, engine coolant temperature, fuel trim, engine speed, vehicle speed, etc.) when the 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.

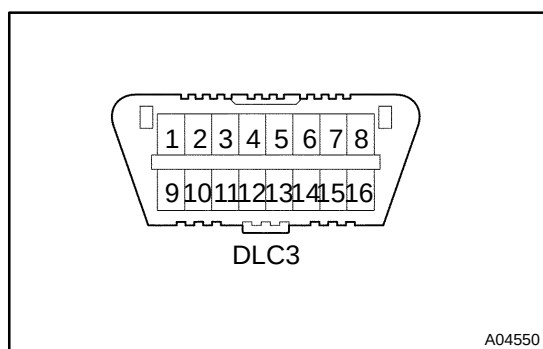
Priorities for troubleshooting:

If troubleshooting priorities for multiple DTCs are given in the applicable DTC chart, these should be followed.

If no instructions are given, troubleshoot DTCs according to the following priorities.

- (1) DTC other than fuel trim malfunction (DTCs P0171 and P0172), and misfire (DTCs P0300 - P0306).
 - (2) Fuel trim malfunction (DTCs P0171 and P0172).
 - (3) Misfire (DTCs P0300 - P0306).
- (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
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 TOYOTA 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 communication is normal when the tool is connected to another vehicle, inspect the DLC3 on the original vehicle.
- If communication is still not possible 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. INSPECT DIAGNOSIS (Normal Mode)**(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 [05-1040](#)).

- (2) When the engine started, the MIL should go off. If the lamp remains on, 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) or 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, it erases all DTC and freeze frame data recorded in the normal mode. So before switching modes, always check the DTC and freeze frame data, and note them down.

- (1) Prepare the OBD II scan tool (complying with SAE J 1978) or hand-held tester.
- (2) Connect the OBD II scan tool or hand-held tester to the DLC3 at the lower center of the instrument panel.
- (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 DTC 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 05-18 to confirm the details of the DTC.

NOTICE:

- When simulating symptoms with an OBD II scan tool (excluding hand-held tester) to check the DTC, 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 1st time. 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 DTCs and freeze frame data will be erased by either action.

- Operating the OBD II scan tool (complying with SAE J1978) or hand-held tester to erase the codes. (See the OBD II scan tool's instruction book for operating instructions.)
- Disconnecting the battery terminals or E.F.I. fuse and ETCS fuse more than 30 second.

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 OFF during the check mode, the DTCs and freeze frame data will be erased.

3. INSPECT DIAGNOSIS (Check Mode)**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 which are detected in the normal mode can also be detected in the check mode.

- (a) Check the DTC.

- (1) Initial conditions.

- Battery positive voltage 11 V or more
- Throttle valve fully closed
- Transmission in P or N position
- A/C switched OFF

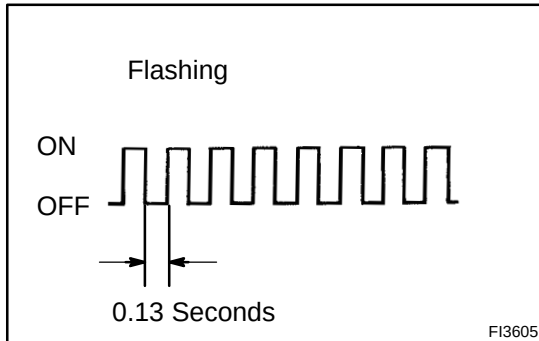
- (2) Turn the ignition switch OFF.

- (3) Prepare the hand-held tester.

- (4) Connect the hand-held tester to the DLC3 at the lower center of the instrument panel.

- (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 (Check that the MIL flashes.).

**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 OFF during the check mode, the DTC and freeze frame data will be erased.

- (7) Start the engine (The MIL goes out after the engine start.).
- (8) Simulate the conditions of the malfunction described by the customer.

NOTICE:

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

- (9) After simulating the malfunction conditions, use the hand-held tester diagnosis selector to check the DTC 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 DTC, etc. are erased.

- (10) After checking the DTC, inspect the applicable circuit.
- (b) Clear the DTC.
- The following actions will erase the DTCs and freeze frame data.
- Operating the hand-held tester to erase the codes. (See the hand-held tester's instruction book for operating instructions.)
 - Disconnecting the battery terminals or E.F.I. fuse and ETCS fuse more than 30 second.

NOTICE:

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

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 temp. is fixed at 20°C (68°F)	Returned to normal condition
P0115	Engine coolant temp. is fixed at 80°C (176°F)	Returned to normal condition
P0141 P1135 P1155	The heater circuit in which an abnormality is detected is turned off	Ignition switch OFF
P0325 P0330	Max. timing retardation	Ignition switch OFF
P1300 P1305 P1310 P1315 P1320 P1325	Fuel cut	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 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 2.)
- (3) Perform a simulation test (See page [01-21](#)).
- (4) Check the connector and terminal (See page [01-31](#)).
- (5) Handle the connector (See page [01-31](#)).

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.

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

Item	Measurement Item/Range (Display)	Normal Condition	Diagnostic Note
INJECTOR	Injection period/ Min.: 0 ms, Max.: 32.64 ms	Idling: 1.6 - 2.9 ms	
IGN ADVANCE	Ignition timing advance/ Min.: -64 deg., Max.: 63.5 deg.	Idling: BTDC 10 - 25 deg.	
CALC LOAD	Calculated load by engine ECM/ Min.: 0 %, Max.: 100 %	- Idling: 13.1 - 18.7 % - Racing without load(2500 rpm): 11.7 - 17.3 %	
MAF	Air flow rate from MAF sensor/ Min.: 0 gm/s, Max.: 655 gm/s	- Idling: 3.3 - 4.7 gm/sec. - Racing without load (2,500 rpm): 10.4 - 15.4 gm/sec.	
ENGINE SPD	Engine Speed/ Min.: 0 rpm, Max.: 16383 rpm	Idling: 650 - 750 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 - 20 % - Throttle fully open: 64 - 96 %	
VEHICLE SPD	Vehicle speed/ Min.: 0 km/h, Max.: 255 km/h	Vehicle stopped: 0 km/h (0 mph)	
O2S B1 S2	Oxygen sensor output voltage of the bank 1 sensor 2/ Min.: 0 V, Max.: 1.275 V	Driving: 0.05 - 0.95 V	
O2S B2 S2	Oxygen sensor output voltage of the bank 2 sensor 2/ Min.: 0 V, Max.: 1.275 V		
AFS B1 S1	A/F sensor output voltage of the bank 1 sensor 1/ Min.: 0 V, Max.: 7.999 V	Idling: 2.8 - 3.8 V	
AFS B2 S1	A/F sensor output voltage of the bank 2 sensor 1/ Min.: 0 V, Max.: 7.999 V		
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	
SHORT FT #2	Short term fuel trim of bank 2/ Min.: -100 %, Max.: 100 %	0 ± 20 %	

LONG FT #2	Long term fuel trim of bank 2/ Min.: -100 %, Max.: 100 %	0 ± 20 %	
TOTAL FT #2	Total fuel trim of bank 2/ Min.: 0.5, Max.: 1.496	Idling: 0.5 - 1.4	
AF FT B1 S1	Short term fuel trim associated with the bank 1, sensor 1/ Min.: 0, Max.: 1.999	• Lean: 0 < 1 • Stoichiometric Air-Fuel Ratio = 1 • Rich: 1 < 1.999	
AF FT B2 S1	Short term fuel trim associated with the bank2, sensor 1/ Min.: 0, Max.: 1.999		
CTP SW	Closed throttle position switch/ ON or OFF	• Throttle fully closed: ON • Throttle open: OFF	
FUEL SYS #1	Fuel system status (Bank1) / 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 enrichment) • 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.
FUEL SYS #2	Fuel system status (Bank2) / OL or CL or OL DRIVE or OL FAULT or CL FAULT		
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	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	
INTAKE CTL VSV1	VSV status for intake control (Bank1) / ON or OFF	VSV operating: ON	
INTAKE CTL VSV2	VSV status for intake control (Bank1) / ON or OFF	VSV operating: ON	
FUEL PUMP / SPD	Fuel pump / speed status / ON/H or OFF/M,L	Idling: ON	

DIAGNOSTICS - SFI SYSTEM (1MZ-FE)

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 B2	VVT control status (Bank 2) / ON or OFF	VVT system operation: ON	
VVT CTRL B1	VVT control status (Bank 2) / ON or OFF	VVT system operation: ON	
SHIFT	Actual Gear Position/ 1st, 2nd, 3rd 4th	Shift Lever Position is; • L: 1st • 2: 1st or 2nd • D(O/D OFF): 1st, 2nd or 3rd • D(O/D ON): 1st, 2nd, 3rd or 4th	
LOCK UP SOL	Lock Up Solenoid Status/ ON or OFF	• Lock Up: ON • Except Lock Up: OFF	
OVERDRV CUT SW1	O/D SW Status/ ON or OFF	• O/D SW Push: ON • O/D SW Release: OFF	
REVERSE	PNP SW Status/ ON or OFF	Shift lever position is; R: ON Except R: OFF	The shift lever position and these values are different, there are failures of the PNP switch or shift cable adjustment.
4TH/DRIVE	PNP SW Status/ ON or OFF	Shift lever position is; D: ON Except D: OFF	The shift lever position and these values are different, there are failures of the PNP switch or shift cable adjustment.
2ND	PNP SW Status/ ON or OFF	Shift lever position is; 2: ON Except 2: OFF	The shift lever position and these values are different, there are failures of the PNP switch or shift cable adjustment.
LOW	PNP SW Status/ ON or OFF	Shift lever position is; L: ON Except L: OFF	The shift lever position and these values are different, there are failures of the PNP switch or shift cable adjustment.
SOLENOID (SLT)	Shift Solenoid SLT Status/ ON or OFF	IG SW ON: ON	
SPD (NC)	Counter Gear Speed display: 50 r/min	D Range is warmed up, 4th; Same as input shaft speed	
IGNITION	Ignition counter/ Min.: 0, Max.: 600	0 - 600	
CYL #1, #2, #3, #4, #5, #6	Misfire ratio of the cylinder 1/ Min.: 0 %, Max.: 50 %	0 %	
AT FLUID TEMP	ATF Temp. Sensor Value/ min.: -40 °C (-40 °F) max.: 225 °C (437 °F)	80 °C (176 °F) (After Stall Test)	If the value is "-40 °C (-40 °F)" or "225 °C (437 °F)", ATF temp. sensor circuit is opened or shorted.
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)	
THROTTLE POS #2	Throttle position sensor No.2 output voltage/ Min.: 0 V, Max.: 5 V	• Throttle fully closed: 2.0 - 2.9 V • Throttle fully open: 4.6 - 5.0 V	
ACCEL POS #1	Accelerator pedal position sensor No.1 output voltage/ Min.: 0 V, Max.: 5 V	• Accelerator released: 0.5 - 1.1 V • Accelerator depressed: 3.0 - 4.6 V	

ACCEL POS #2	Accelerator pedal position sensor No.2 output voltage/ Min.: 0 V, Max.: 5 V	• Accelerator released: 2.0 - 2.9 V • Accelerator depressed: 4.6 - 5.0 V	
THROTTLE TARGT	Target position of throttle valve/ Min.: 0 V, Max.: 5 V	Idling: 0.4 - 1.0 V	
THROTTLE OPN DUTY	Throttle motor opening duty ratio/ Min.: 0 %, Max.: 100 %	Throttle fully closed: 0 %	When accelerator pedal is depressed, duty ratio is increased.
THROTTLE CLS DUTY	Throttle motor closed duty ratio/ Min.: 0 %, Max.: 100 %	Throttle fully closed: 0 %	When accelerator pedal is quick released, duty ratio is increased.
THROTTLE MOT	Whether or not throttle motor control is permitted/ ON or OFF	Idling: ON	
+BM	Whether or not electric throttle control system power is inputted/ ON or OFF	Idling: ON	

7. ACTIVE TEST

HINT:

Performing the ACTIVE TEST using the OBD II scan tool or 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.
INTAKE CTL VSV1	[Test Details] Activate the VSV for intake control. ON or OFF	
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.
TC/TE1	[Test Details] Connect the TC and TE1 ON or OFF	
FC IDL PROHBT	[Test Details] Control the EGR system. 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

NG

CHARGE OR REPLACE BATTERY

OK

2 CHECK IF ENGINE IS CRANKED

NG

PROCEED TO PROBLEM SYMPTOMS TABLE ON PAGE 05-30

OK

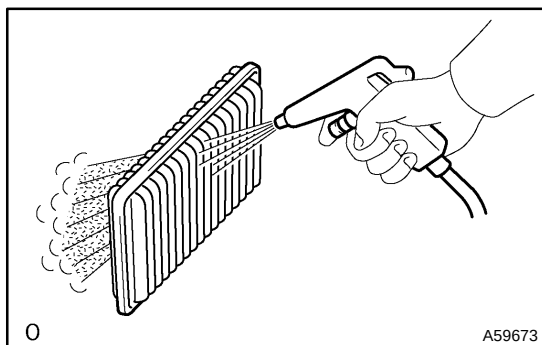
3 CHECK IF ENGINE STARTS

NG

GO TO STEP 7

OK

4 CHECK AIR FILTER



- (a) 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 14-1)**NG****PROCEED TO PROBLEM SYMPTOMS TABLE
ON PAGE 05-30****OK****6 CHECK IGNITION TIMING (See page 18-1)****NG****PROCEED TO PAGE 18-1 AND CONTINUE TO
TROUBLESHOOT****OK****PROCEED TO PROBLEM SYMPTOMS TABLE
ON PAGE 05-30****7 CHECK FUEL PRESSURE (See page 11-4)****NG****PROCEED TO PAGE 11-4 AND CONTINUE TO
TROUBLESHOOT****OK****8 CHECK FOR SPARK(See page 18-1)****NG****PROCEED TO PAGE 18-1 AND CONTINUE TO
TROUBLESHOOT****OK****PROCEED TO PROBLEM SYMPTOMS TABLE ON PAGE 05-30**