

## 2012 - Mazda6 - Engine

### ENGINE CONTROL SYSTEM OPERATION INSPECTION [MZI 3.7 V6]

#### Input Signal System Inspection Procedure

1. Find an irregular signal. (See [Finding irregular signals.](#))
2. Locate source. (See [Locating the source of unusual signals.](#))
3. Repair or replace the malfunctioning part.
4. Confirm that the irregular signal is no longer detected.

#### Finding irregular signals

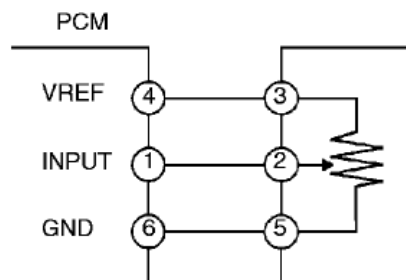
- While referring to [ON-BOARD DIAGNOSTIC TEST \[MZI 3.7 V6\]](#), use the PID/DATA monitor and record function to inspect the input signal system relating to the problem.
1. Start the engine and idle the vehicle. You can assume that any signals that are out of specification by a wide margin are irregular.
  2. When recreating the problem, any sudden change in monitor input signals that is not intentionally created by the driver can be determined as irregular.

#### Locating the source of unusual signals

#### CAUTION:

- Compare the M-MDS monitor voltage with the measurement voltage using the digital measurement system function. If you use another tester, misreading may occur.
- When measuring voltage, attach the tester GND to the GND of the PCM that is being tested, or to the engine itself. If this is not performed, the measured voltage and actual voltage may differ.
- After connecting the pin to a waterproof coupler, confirming continuity and measuring the voltage, inspect the waterproof connector for cracks. If there are any, use sealant to fix them. Failure to do this may result in deterioration of the wiring harness or terminal from water damage, leading to problems with the vehicle.

#### Variable resistance type (TP sensor)



#### Input signal system inspection for variable resistance type

1. When an irregular signal is detected, measure the #1 PCM terminal voltage.
  - If the #1 terminal voltage and the M-MDS monitor voltage are the same, proceed to the next step.
  - If there is a difference of **0.5 V or more**, inspect for the following points concerning the PCM connector:
    - Female terminal opening is loose.
    - Coupler (pin holder) damage

Pin discoloration (blackness)

- Harness/pin crimp is loose or disconnected.

2. Measure the #2 sensor terminal voltage.

- If there is a **0.5 V or more** difference between the sensor and the M-MDS voltages, inspect the wiring harness for open or short circuits.
- If the sensor and the M-MDS voltages are the same, inspect for the following points concerning the sensor connector:
  - Female terminal opening is loose.
  - Coupler (pin holder) damage
  - Pin discoloration (blackness)
- If there are no problems, proceed to next investigation below.

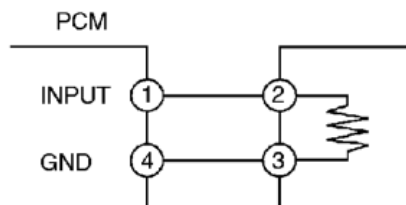
#### Standard power supply system inspection for variable resistance type

- Confirm that the #3 terminal is at **5 V**.
  - If the measured voltage on the #3 terminal is **5 V**, inspect the following points on the sensor connector.
    - Female terminal opening is loose.
    - Coupler (pin holder) damage
    - Pin discoloration (blackness)
  - If there is no problem, inspect for the following:
    - Female terminal opening is loose.
    - Coupler (pin holder) damage
    - Pin discoloration (blackness)
  - If the #3 terminal measures other than **5 V**, inspect for the following:
    - Open or short circuit in wiring harness
    - Harness/pin crimp is loose or disconnected.

#### GND system inspection for variable resistance type

- Confirm that terminal sensor #5 is at **0 V**.
  - If it is at **0 V**, inspect the sensor.
    - If necessary, replace the sensor.
  - If not, inspect for the following:
    - Open or short circuit in wiring harness
    - Female terminal opening is loose causing an open or short circuit in wiring harness.
    - Coupler (pin holder) damage
    - Pin discoloration (blackness)
    - Harness/pin crimp is loose or disconnected.

#### Thermistor type (IAT sensor and CHT sensor)



#### Input signal system inspection for thermistor type

1. When an irregular signal is detected, measure the #1 PCM terminal voltage.

- If the #1 terminal voltage and the M-MDS monitor voltage are the same, proceed to the next step.
- If there is a difference of **0.5 V or more**, inspect the following points concerning the PCM connector:
  - Female terminal opening loose
  - Coupler (pin holder) damage
  - Pin discoloration (blackness)
  - Harness/pin crimp is loose or disconnected.

2. Measure the #2 sensor terminal voltage.

- If there is a **0.5 V or more** difference between the sensor and the M-MDS voltages, inspect the wiring harness for open or short circuits.
- If the sensor and the M-MDS voltages are the same, inspect the following points concerning the sensor connector:
  - Female terminal opening is loose.
  - Coupler (pin holder) damage
  - Pin discoloration (blackness)
  - Harness/pin crimp is loose or disconnected.
- If there are no problems, proceed to next investigation below.

#### GND system inspection for thermistor type

- Confirm that terminal sensor #3 is at **0 V**.
  - If it is at **0 V**, inspect the sensor. If necessary, replace the sensor.
  - If not, inspect for the following:
    - Open circuit in wiring harness
    - Female terminal opening is loose.
    - Coupler (pin holder) damage
    - Pin discoloration (blackness)
    - Harness/pin crimp is loose or disconnected.

#### Main Relay Operation Inspection

1. Verify that the main relay clicks when the ignition is switched to ON and off.

- If there is no operation sound, inspect the following:
  - Main relay (See [RELAY INSPECTION](#).)
  - Harness and connector between battery and main relay terminal A
  - Harness and connector between PCM terminal 1AZ and main relay terminal D

#### Drive-by-Wire Control System Inspection

##### Engine coolant temperature compensation inspection

1. Connect the M-MDS to the DLC-2.

2. Access the following PCM PIDs:

- ECT
- IAT
- RPM

3. Verify that the engine is cold, then start the engine.

4. Verify that the engine speed decreases as the engine warms up.

- If the engine speed does not decrease or decreases slowly, inspect the following:
  - CHT sensor and related wiring harness (See [CYLINDER HEAD TEMPERATURE \(CHT\) SENSOR INSPECTION \[MZI 3.7 V6\] .](#))
  - Throttle body and related wiring harness (See [THROTTLE BODY INSPECTION \[MZI 3.7 V6\] .](#))

#### Load compensation inspection

1. Start the engine and idle it.
2. Connect the M-MDS to the DLC-2.
3. Verify that P0506:00, P0507:00 is not displayed.
  - If the P0506:00, P0507:00 are displayed, perform the DTC inspection. (See [DTC P0506:00 \[MZI 3.7 V6\] .](#)) (See [DTC P0507:00 \[MZI 3.7 V6\] .](#))
4. Access the PCM PID RPM.

#### NOTE:

- Excludes temporary idle speed drop just after the loads are turned on.
5. Verify that the engine speed is within the specification under each load condition.
    - If load condition is not as specified, inspect the following:
      - A/C switch and related wiring harness (See [CLIMATE CONTROL UNIT INSPECTION \[MANUAL AIR CONDITIONER\] .](#)) (See [CLIMATE CONTROL UNIT INSPECTION \[FULL-AUTO AIR CONDITIONER\] .](#))
      - Fan switch and related wiring harness (See [CLIMATE CONTROL UNIT INSPECTION \[MANUAL AIR CONDITIONER\] .](#)) (See [CLIMATE CONTROL UNIT INSPECTION \[FULL-AUTO AIR CONDITIONER\] .](#))

#### Throttle position (TP) sweep inspection

1. Connect the M-MDS to the DLC-2.
2. Switch the ignition to ON.
3. Verify that none of the following DTC are displayed:
  - P0122:00, P0123:00, P0222:00, P0223:00, P2101:00, P2107:00, P2111:00, P2112:00, P2122:00, P2123:00, P2127:00, P2128:00, P2135:00, P2138:00
    - If any one DTC is displayed, perform the DTC inspection. (See [DTC TABLE \[MZI 3.7 V6\] .](#))
4. Access the PCM PIDs TP1, TP2.
5. Verify that the PID reading is within the CTP value. (See [PCM INSPECTION \[MZI 3.7 V6\] .](#))
  - If the PID reading is out of range, perform the following:
    - Remove the air duct from the throttle body.
    - Verify that the throttle valve opens when the accelerator pedal is depressed.
      - If the throttle valve opens, inspect the TP sensor and related wiring harness. (See [THROTTLE POSITION \(TP\) SENSOR INSPECTION \[MZI 3.7 V6\] .](#))
      - If the throttle valve does not open, inspect the throttle valve actuator and related wiring harness.
6. Gradually depress the throttle pedal and verify that the PID reading increases accordingly.
  - If the PID reading drops momentarily, inspect the following:
    - TP sensor
7. Fully depress the throttle pedal and verify that the PID reading is within WOT value. (See [PCM INSPECTION \[MZI 3.7 V6\] .](#))
  - If the PID reading is out of range, perform the followings:
    - Remove the air duct from throttle body.
    - Verify that the throttle valve opens when throttle pedal is depressed.
      - If the throttle valve opens, inspect the TP sensor and related wiring harness. (See [THROTTLE POSITION \(TP\) SENSOR INSPECTION \[MZI 3.7 V6\] .](#))
      - If the throttle valve does not open, inspect the throttle valve actuator control motor and related wiring harness.

## Fuel Injector Operation Inspection

| STEP | INSPECTION                                                                                                                                                                                             | RESULTS | ACTION                                                                                                                                                                                                                                                                                                                   |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | <ul style="list-style-type: none"> <li>While cranking the engine, inspect for fuel injector operation sound at each cylinder using a soundscope.</li> <li>Is the operation sound heard?</li> </ul>     | Yes     | Fuel injector operation is normal.                                                                                                                                                                                                                                                                                       |
|      |                                                                                                                                                                                                        | No      | All cylinders not heard: <ul style="list-style-type: none"> <li>Go to the next step.</li> </ul> Some cylinders not heard: <ul style="list-style-type: none"> <li>Go to Step 3.</li> </ul>                                                                                                                                |
| 2    | <ul style="list-style-type: none"> <li>Perform the main relay operation inspection.<br/>(See <a href="#">Main Relay Operation Inspection</a>.)</li> <li>Is the main relay operation normal?</li> </ul> | Yes     | Inspect the following: <ul style="list-style-type: none"> <li>Fuel injector power system related wiring harness and connectors</li> <li>PCM connectors</li> <li>Fuel injector ground and related wiring harness and connectors</li> </ul> Repair or replace the malfunctioning part according to the inspection results. |
|      |                                                                                                                                                                                                        | No      | Repair or replace the malfunctioning part according to the inspection results.                                                                                                                                                                                                                                           |
| 3    | <ul style="list-style-type: none"> <li>Switch fuel injector connector of not operating fuel injector with operating fuel injector.</li> <li>Is the operation sound heard?</li> </ul>                   | Yes     | Go to the next step.                                                                                                                                                                                                                                                                                                     |
|      |                                                                                                                                                                                                        | No      | Replace the fuel injector.<br><br>(See <a href="#">FUEL INJECTOR REMOVAL/ INSTALLATION [MZI 3.7 V6]</a> .)                                                                                                                                                                                                               |
| 4    | <ul style="list-style-type: none"> <li>Are wiring harness and connectors of not operation fuel injector normal? (Open or short)</li> </ul>                                                             | Yes     | Inspect the PCM terminal voltage of fuel injector signal.<br><br>Repair or replace the malfunctioning part according to the inspection results.                                                                                                                                                                          |
|      |                                                                                                                                                                                                        | No      | Repair or replace the malfunctioning part according to the inspection results.                                                                                                                                                                                                                                           |

## Fuel Cut Control System Inspection

### NOTE:

- This inspection has to perform after the Fuel Injector Operation Inspection.

### If active command mode function of the M-MDS is used:

- Warm up the engine and idle it.
- Connect the M-MDS to the DLC-2.
- Select the PCM PIDs RPM and FUELSYS.
- Monitor the both PIDs while performing the following steps.
  - Depress the accelerator pedal and increase the RPM PID to **4,000 rpm**.
  - Quickly release the accelerator pedal (brake pedal is not depressed) and verify that the FUELSYS PID is OL, and CL when the RPM PID drops **below 1,200 rpm**.
    - If not as specified, inspect the following.
      - CHT sensor and related harness (See [CYLINDER HEAD TEMPERATURE \(CHT\) SENSOR INSPECTION](#))

If active command mode function of the M-MDS is not used:

1. Warm up the engine and idle it.
2. Measure the fuel injector control signal wave profile using the oscilloscope while performing the following steps.
  - a. Depress the accelerator pedal and increase the engine speed to **4,000 rpm**.
  - b. Quickly release the accelerator pedal (brake pedal is not depressed) and verify that the wave profile constant **B+**, and appears wave, when the engine speed drops **below 2,200 rpm**.
    - If not as specified, inspect the following.
      - CHT sensor and related harness (See **CYLINDER HEAD TEMPERATURE (CHT) SENSOR INSPECTION [MZI 3.7 V6].**)

## Fuel Pump Operation Inspection

1. Remove the fuel-filler cap.
2. Switch the ignition to ON.
3. Turn the fuel pump relay from off to on using the PCM PID FP and inspect if the fuel pump operation sound is heard.
  - If no operation sounds is heard, go to the next step.
4. Measure the voltage at fuel pump unit terminal B (wiring harness-side).

### Specification

- **B+** (Ignition switch at on)
  - If the voltage is as specified, inspect the following:
    - Fuel pump continuity
    - Fuel pump ground
  - If not as specified, inspect the following:
    - Fuel pump relay (See **RELAY INSPECTION.**)
    - Wiring harness connector (Battery positive terminal—Fuel pump relay—Fuel pump)
    - Wiring harness between fuel pump relay and PCM terminal 1BI

## Spark Test

1. Disconnect the fuel pump relay.
2. Verify that each ignition coil and connector is connected properly.
3. Inspect the ignition system in the following procedure.

### WARNING:

- High voltage in the ignition system can cause strong electrical shock which can result in serious injury. Avoid direct contact to the vehicle body during the following spark test.

| STEP | INSPECTION                                                                                                                                                                                                                                                                                                                                                                  | ACTION                                                                                                                          |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| 1    | <ul style="list-style-type: none"> <li>• Disconnect the ignition coil from the spark plugs.</li> <li>• Remove the spark plugs.<br/>(See <b>SPARK PLUG REMOVAL/ INSTALLATION [MZI 3.7 V6].</b>)               <ul style="list-style-type: none"> <li>▪ Ensure that the spark plugs don't have carbon deposits.</li> </ul> </li> <li>• Are the spark plugs normal?</li> </ul> | YesGo to the next step.                                                                                                         |
|      |                                                                                                                                                                                                                                                                                                                                                                             | No Perform 2 times of no-load racing at <b>4,000 rpm</b> for <b>2 min</b> to burn off the carbon deposits.<br>Repeat this step. |
| 2    | <ul style="list-style-type: none"> <li>• Inspect the spark plugs for damage, wear, and proper plug gap.</li> </ul>                                                                                                                                                                                                                                                          | YesGo to the next step.                                                                                                         |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |                                                                                                                                                                                                 |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | <ul style="list-style-type: none"> <li>Are the spark plugs normal?</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                | No  | Replace the spark plugs, then go to the next step.<br>(See <a href="#">SPARK PLUG REMOVAL/ INSTALLATION [MZI 3.7 V6]</a> .)                                                                     |
| 3 | <ul style="list-style-type: none"> <li>Reconnect the spark plugs to the ignition coil.</li> <li>Ground the spark plugs to the engine.</li> <li>Is a strong blue spark visible at each cylinder while cranking?</li> </ul>                                                                                                                                                                                                                                                                                                                    | Yes | Ignition system is normal.                                                                                                                                                                      |
|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | No  | Some cylinders do not spark: <ul style="list-style-type: none"> <li>Go to the next step.</li> </ul> All cylinders do not spark: <ul style="list-style-type: none"> <li>Go to Step 5.</li> </ul> |
| 4 | <ul style="list-style-type: none"> <li>Inspect the following wiring harnesses for open or short: <ul style="list-style-type: none"> <li>Ignition coil No.1 terminal C—PCM terminal 2BB</li> <li>Ignition coil No.2 terminal C—PCM terminal 2AT</li> <li>Ignition coil No.3 terminal C—PCM terminal 2B</li> <li>Ignition coil No.4 terminal C—PCM terminal 2AX</li> <li>Ignition coil No.5 terminal C—PCM terminal 2C</li> <li>Ignition coil No.6 terminal C—PCM terminal 2D</li> </ul> </li> <li>Are the wiring harnesses normal?</li> </ul> | Yes | Inspect the ignition coil.<br>(See <a href="#">IGNITION COIL INSPECTION [MZI 3.7 V6]</a> .)<br>Repair or replace the malfunctioning part according to the inspection results.                   |
|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | No  | Repair or replace suspect wiring harness and connector, then go to Step 1.                                                                                                                      |
| 5 | <ul style="list-style-type: none"> <li>Measure the voltage at terminal A in each ignition coils.</li> <li>Is the voltage <b>B+</b> ?</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                              | Yes | Go to the next step.                                                                                                                                                                            |
|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | No  | Inspect the power supply circuit of ignition coils.<br>Repair or replace suspect wiring harness and connector.                                                                                  |
| 6 | <ul style="list-style-type: none"> <li>Verify the continuity between each ignition coils terminal B and battery negative terminal.</li> <li>Is there continuity?</li> </ul>                                                                                                                                                                                                                                                                                                                                                                  | Yes | Go to the next step.                                                                                                                                                                            |
|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | No  | Inspect the ground circuit of ignition coils.<br>Repair or replace suspect wiring harness and connector.                                                                                        |
| 7 | <ul style="list-style-type: none"> <li>Does the PCM connector or ignition coil connectors have poor connection?</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                   | Yes | Repair or replace the connector, then go to Step 1.                                                                                                                                             |
|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | No  | Go to the next step.                                                                                                                                                                            |
| 8 | <ul style="list-style-type: none"> <li>Are the CKP sensor and crankshaft pulley normal?</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                           | Yes | Inspect for open or short circuit in wiring harness and connector of CKP sensor.<br>Repair or replace suspect wiring harness and connector.                                                     |
|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | No  | Repair or replace the malfunctioning part according to the inspection results, then go to Step 1.                                                                                               |

## Purge Control System Inspection

If active command mode function of the M-MDS is used:

- Start the engine.
- Disconnect the vacuum hose between the purge solenoid valve and the charcoal canister.
- Put the finger to the purge solenoid valve and verify that there is no vacuum applied when the engine is cold.
  - If there is a vacuum, inspect the following:

- Wiring harness and connectors (Purge solenoid valve terminal B—PCM terminal 2H)
  - Purge solenoid valve (stuck open) (See [PURGE SOLENOID VALVE INSPECTION \[MZI 3.7 V6\]](#).)
4. Connect the M-MDS to the DLC-2 and verify that the DTC P0443:00 is shown.
    - If the P0443:00 are displayed, perform the DTC inspection. (See [DTC P0443:00 \[MZI 3.7 V6\]](#).)
  5. Select the PCM PID EVAPCP.
  6. Increase the duty value of the purge solenoid valve to **50 %** and inspect if the operation sound of the valve is heard.
    - If the operation sound is heard, inspect for the loose or damaged vacuum hose. (Intake manifold—Purge solenoid valve—Charcoal canister)
    - If the operation sound is not heard, perform the purge solenoid valve inspection.  
(See [PURGE SOLENOID VALVE INSPECTION \[MZI 3.7 V6\]](#).)
  7. Warm up the engine to normal operating temperature.
  8. Monitor the EVAPCP PID using the M-MDS, and drive the vehicle **approx. 2,000 rpm for 30 s or more**.
    - If the EVAPCP PID is **0 %**, inspect the PCM PIDs MAF, APP1, APP2, TP REL and LOAD.

**If active command mode function of the M-MDS is not used:**

1. Start the engine.
2. Disconnect the vacuum hose between the purge solenoid valve and the charcoal canister.
3. Put the finger to the purge solenoid valve and verify that there is no vacuum applied when the engine is cold.
  - If there is a vacuum, inspect the following:
    - Wiring harness and connectors (Purge solenoid valve—PCM terminal 2H)
    - Purge solenoid valve (stuck open) (See [PURGE SOLENOID VALVE INSPECTION \[MZI 3.7 V6\]](#).)
4. Connect the M-MDS to the DLC-2 and verify that the DTC P0443:00 is shown.
  - If the P0443:00 are displayed, perform the DTC inspection. (See [DTC P0443:00 \[MZI 3.7 V6\]](#).)
5. Access the PCM PIDs EVAPCP and ECT.
6. Verify that the ECT PID is **more than 78 °C { 172 °F }**.
  - If the ECT PID reading indicates **less than 78 °C { 172 °F }**, perform the CHT sensor inspection. (See [CYLINDER HEAD TEMPERATURE \(CHT\) SENSOR INSPECTION \[MZI 3.7 V6\]](#).)
7. Set the vehicle on the dynamometer or chassis roller.

#### **WARNING:**

- When the dynamometer or chassis roller is operating, there is a possibility that the operator may come into contact with or be caught up in the rotating parts, leading to serious injuries or death. When performing work while the dynamometer or chassis roller is operating, be careful not to come into contact with or caught up in any of the rotating parts.
8. Drive the vehicle **approx. 2,000 rpm for 30 s or more**.
    - If there is no vacuum, inspect the following:
      - Wiring harness and connector (Main relay—Purge solenoid valve—PCM terminal 2H)
      - Purge solenoid valve (See [PURGE SOLENOID VALVE INSPECTION \[MZI 3.7 V6\]](#).)
      - MAF, APP1, APP2, TP REL and LOAD PIDs
    - If there is vacuum, inspect the following:
      - Vacuum hose (Purge solenoid valve—Charcoal canister)

#### **A/ C Cut-off Control System Inspection**

1. Start the engine.
2. Turn the A/C switch and the fan switch on.
3. Verify that the magnetic clutch actuates.
  - If it does not actuate, go to symptom troubleshooting "NO.23 A/C DOES NOT WORK SUFFICIENTLY". (See [NO.23 A/ C DOES NOT WORK SUFFICIENTLY \[MZI 3.7 V6\]](#).)
4. Fully open the throttle valve and verify that the magnetic clutch does not actuate for **2—5 s**.



- If it actuates, inspect as follows:
  - A/C relay (See [RELAY INSPECTION](#).)
  - Open or short to ground circuit in wiring harness and connectors (Ignition switch (without advanced keyless entry and push button start system)/IG2 relay (with advanced keyless entry and push button start system)—A/C relay—PCM terminal 1W)
  - A/C related parts
  - APP1, APP2 PIDs

## Cooling Fan Control System Inspection

1. Connect the M-MDS to the DLC-2.
2. Start the engine and warm it up to normal operating temperature.
3. Perform the KOER self test. (See [KOE0/ KOER SELF TEST \[MZI 3.7 V6\]](#).)
4. Verify the cooling fan operates during KOER self test.

### Cooling fans do not operate

- Inspect for followings:
  - Open circuit between fan control module relay and battery positive terminal
  - Open circuit between fan control module relay and PCM terminal 1BI
  - Open circuit between fan control module relay and fan control module terminal 1C
  - Open circuit between fan control module terminal 1A and ground
  - Poor connection of the fan control module connector
  - Fan control module relay malfunction (See [RELAY INSPECTION](#).)
  - Open or short circuit between fan control module terminal 1B and PCM terminal 1AY
  - Open or short circuit between ignition switch (IG1)<sup>\*1</sup>/IG1 relay<sup>\*2</sup> and fan control module relay
    - If there is malfunction, repair or replace malfunctioning part.
    - If there is no malfunction, replace the fan control module. (See [COOLING FAN MOTOR REMOVAL/ INSTALLATION \[MZI 3.7 V6\]](#).)

\*1

**Vehicles without advanced keyless entry and push button start system**

\*2

**Vehicles with advanced keyless entry and push button start system**

### Cooling fan motor No.1 does not operate

- Inspect for followings:
  - Open or short to ground circuit between fan control module and cooling fan motor No.1
  - Poor connection of the fan control module connector or cooling fan motor No.1 connector
  - Cooling fan motor No.1 malfunction (See [COOLING FAN MOTOR INSPECTION \[MZI 3.7 V6\]](#).)
    - If there is malfunction, repair or replace malfunctioning part.
    - If there is no malfunction, replace the fan control module. (See [COOLING FAN MOTOR REMOVAL/ INSTALLATION \[MZI 3.7 V6\]](#).)

### Cooling fan motor No.2 does not operate

- Inspect for followings:
  - Open or short to ground circuit between fan control module and the cooling fan motor No.2
  - Poor connection of the fan control module connector or the cooling fan motor No.2 connector
  - Cooling fan motor No.2 malfunction (See [COOLING FAN MOTOR INSPECTION \[MZI 3.7 V6\]](#).)
    - If there is malfunction, repair or replace malfunctioning part.

- If there is no malfunction, replace the fan control module. (See [COOLING FAN MOTOR REMOVAL/ INSTALLATION \[MZI 3.7 V6\] .](#))

## Variable Valve Timing Control System Operation Inspection

**When idling cannot be continued**

### NOTE:

- Inspect for each bank.
1. Remove the OCV and verify that the spool valve is at maximum retard position. (See [OIL CONTROL VALVE \(OCV\) REMOVAL/ INSTALLATION \[MZI 3.7 V6\] .](#))
    - If the spool valve is stuck in advance direction, replace the OCV. (See [OIL CONTROL VALVE \(OCV\) REMOVAL/ INSTALLATION \[MZI 3.7 V6\] .](#))
  2. Connect the OCV connector.
  3. Switch the ignition to ON.
  4. Verify that the spool valve is at max. retard position.
    - If the spool valve is stuck in advance direction, inspect the following:
      - Short circuit in harnesses or connectors between OCV and PCM.
  5. Inspect the variable valve timing actuator.

**When idling can be continued**

### For right bank

1. Disconnect OCV (RH) connector.
2. Warm up the engine and it at idle.
3. Apply the battery voltage to the OCV and verify that the engine idles roughly or stalls.
  - If the engine idles roughly or stalls, inspect the timing belt component (valve timing deviation).
  - If the engine does not idle roughly or stall, go to the next step.
4. Remove the OCV (RH) and perform the spool valve operation inspection. (See [OIL CONTROL VALVE \(OCV\) REMOVAL/ INSTALLATION \[MZI 3.7 V6\] .](#))
  - If not as specified, inspect the following:
    - OCV (RH) (See [OIL CONTROL VALVE \(OCV\) INSPECTION \[MZI 3.7 V6\] .](#))
    - Harnesses and connectors between OCV (RH) and PCM have an open or short circuit.
  - If as specified, inspect the following right bank hydraulic passages for clogging or leakage, or both.
    - Oil pressure switch—OCV
    - OCV—Camshaft
    - Camshaft internal passage
5. If they are normal, replace the right bank camshaft pulley (with built-in variable valve timing actuator).

**When idling can be continued**

### For left bank

1. Disconnect OCV (LH) connector.
2. Warm up the engine to idle.
3. Apply the battery voltage to the OCV and verify that the engine idles roughly or stalls.
  - If the engine idles roughly or stalls, inspect the timing belt component (valve timing deviation).
  - If the engine does not idle roughly or stall, go to the next step.
4. Remove the OCV (LH) and perform spool valve operation inspection. (See [OIL CONTROL VALVE \(OCV\) REMOVAL/ INSTALLATION \[MZI 3.7](#)

V6].)

- If not as specified, inspect the following:
  - OCV (LH) (See **OIL CONTROL VALVE (OCV) INSPECTION [MZI 3.7 V6].**)
  - Harnesses and connectors between OCV (LH) and PCM have an open or short circuit.
- If as specified, inspect the following left bank hydraulic passages for clogging or leakage or both.
  - Oil pressure switch— OCV
  - OCV—Camshaft
  - Camshaft internal passage

5. If they are normal, replace the left bank camshaft pulley (with built-in variable valve timing actuator).

### Evaporative Emission (EVAP) System Leak Inspection

- To verify that the problem has been fixed properly after repairs, the run drive cycle or EVAP system leak inspection must be performed.

#### EVAP system leak inspection using the M-MDS

#### NOTE:

- Use the IDS (laptop PC) because the PDS (Pocket PC) does not support the EVAP system test.

#### EVAP system test out line

- The EVAP system test, which can substituted for the run drive cycle as an EVAP control system repair confirmation method, can detect the small / large leak or blockage without run-drive cycle.

#### NOTE:

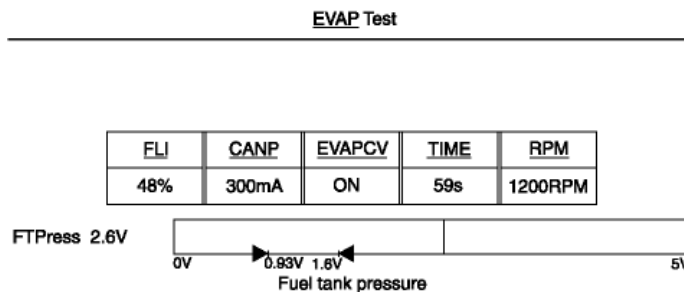
- M-MDS can not detect "VERY SMALL LEAK". To identify the leak point, please use the leak tester or ultrasonic leak detector.

#### EVAP system test description

- The EVAP system test finds gas leaks or blockage of EVAP system using the changes of the fuel tank pressure.
  - This test starts after sending an on-demand test signal from the M-MDS to the PCM.
  - This test consists of three stages, and each stage is performed automatically as follows:

##### Stage 1 test (Test for large leak or blockage)

- M-MDS send the stage 1 test start signal to the PCM.



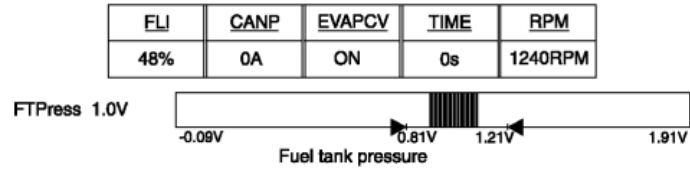
#### Pulling Target Vacuum

- PCM controls the CV solenoid valve and purge solenoid valve to control the tank pressure to the targeted value.
- M-MDS detect the large leak or the purge line blockage if the tank pressure does not arrive at the target vacuum in specified period.

##### Stage 2 test (Test for small leak)

- When fuel tank pressure arrived at the targeted pressure at stage 1 test, M-MDS send the stage 2 test signal to the PCM to turn off the purge solenoid to keep the tank pressure.

#### EVAP Test



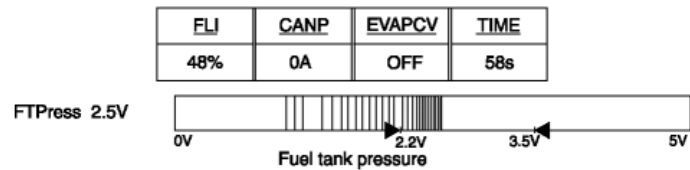
The vacuum bleed down and bleed up rate is in range

- M-MDS detect the small leak if the tank pressure can not keep within the target in specified period.

#### Stage 3 test (Test for blockage)

- M-MDS send the stage 3 test signal to the PCM to turn off the CV solenoid for check the blockage of EVAP system.

#### EVAP Test



The FTP value is in range.

- M-MDS detect blockage of the CV solenoid valve or air filter if the tank pressure does not arrive at the target (atmosphere).

#### EVAP system malfunction judgment

- M-MDS detect the small / large leak or blockage based on fuel tank pressure at the end of EVAP Test.

**The EVAP Test could not obtain the target vacuum. A large leak or blockage is suspect.**

- This judgment means tank pressure could not arrive at target pressure at stage 1 test.
- Check for the large leakage or inspect the purge solenoid valve operation and related hoses.
- Repair or replace any malfunctioning parts.

**The EVAP Test could not maintain the target vacuum. A small leak is suspect.**

- This judgment means tank pressure could not stay in target pressure at stage 2 test.
- Run the EVAP Test again after Re-tighten the fuel filler cap.
- If small leak is suspected again, use the leak tester or ultrasonic leak detector for identify the leak point.
- Repair or replace any malfunctioning parts.

**Blockage in EVAP system.**

- This judgment means tank pressure could not return to atmosphere at stage 3 test.
- Inspect the CV solenoid, Air filter, Charcoal canister and related hoses for blockage.

**No large leaks or blockage have been detected in the EVAP system at this time.**

- M-MDS can not detect "VERY SMALL LEAK".
- To identify the leak point, please use the leak tester or ultrasonic leak detector.

**Evaporative system test procedure**

- Verify that all PIDs within the following specifications.

**Specification**

| PID  | PID Range                              |
|------|----------------------------------------|
| BARO | 74.9 kPa {562 mmHg, 22.1 inHg} or more |
| FLI  | 15—85 %                                |
| ECT  | ECT minus IAT -10—25 °C {14—77 °F}     |
| IAT  |                                        |

**NOTE:**

- To successfully perform this procedure, all PIDs must be within the specifications before proceeding to the next step.
- Select the following items from the initialization screen of the M-MDS.
  - Select the "Powertrain".
  - Select the "Fuel".
  - Select the "EVAP Test".
    - Verify that ECT and IAT are within the specifications at the confirmation screen. To successfully perform this procedure, ECT and IAT must be within the spec before proceeding to the next step.
    - Fuel Level must be maintained within 15 % —85 % . PCM will cancel the EVAP Test If the Fuel Level

is **lower than 15 %** or **higher than 85 %** .

- Verify the test results described on the M-MDS and follow the instructions.

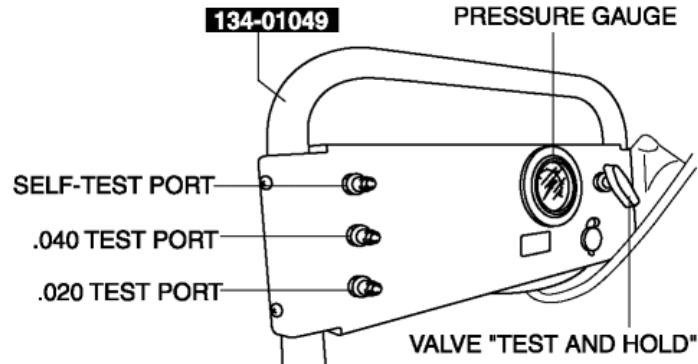
#### EVAP system leak inspection using leak tester

1. Perform the following **SST** (EVAP System Tester 134-01049) self-test:

##### NOTE:

- If the tester does not work correctly during the self-test, refer to the tester operators manual for a more detailed self-test procedure.

- a. Verify that the control valve on the panel is in the HOLD position then open the nitrogen bottle valve.



- b. Connect the vehicle interface hose (part of the **SST**) to the SELF-TEST port located on the control panel. Hand tighten the fitting. (Do not overtighten.)

- c. Turn the control valve to the TEST position.

- d. The gauge should read **331—381 mm { 13.1—15.0 in }** of water.

- If the gauge is not reading in this range, adjust the pressure by turning the black knob on the low pressure regulator at the nitrogen bottle.

- e. Turn the control valve to the HOLD position.

- f. Verify that the gauge holds pressure and that the flow meter reads no flow.

1. If there is no drop in pressure and no flow, the tester passes the self-test.

2. If the gauge leaks down, refer to the tester operators manual.

2. Connect the **SST** to the vehicle.

- a. Verify that the control valve on the panel is in the HOLD position then open the nitrogen bottle valve.

- b. Remove the fuel-filler cap from the vehicle.

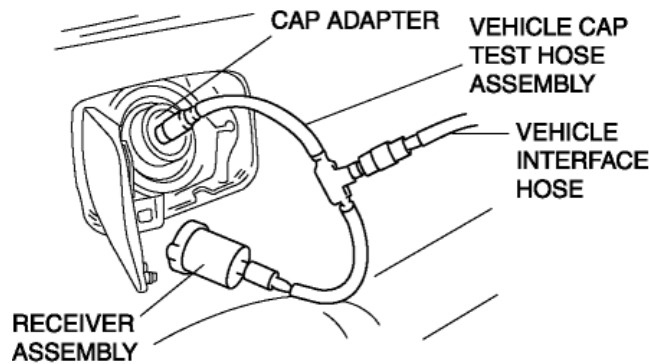
- If the fuel-filler cap is not a MAZDA part or equivalent, replace it.

##### NOTE:

- INSPECT FUEL FILLER CAP AND FILLER NECK

- Visually inspect for damage, insufficient sealing, rust, cracks or warps for filler cap and filler neck.
- Repair or replace if necessary.

- c. Connect the receiver assembly (**SST**: 134-01059) to the vehicle cap test hose assembly (part of the **SST**) and the fuel-filler cap from the vehicle.



d. Connect the cap adaptor (**SST**: 134-01058) to the vehicle cap test hose assembly (part of the **SST**) and to the fuel-filler neck.

e. Connect the vehicle interface hose (part of the **SST**) to the center fitting of the vehicle cap test hose assembly (part of the **SST**).

3. Connect the M-MDS to the DLC-2.

4. Switch the ignition to ON (Engine off).

5. Request the PCM on-board device control (Mode 08) using the M-MDS to close the canister vent value.

**NOTE:**

- The canister vent value is closed for **10 min** unless the following any actions are done:
  - Engine is started.
  - Ignition is switched to off.

6. Make sure the control valve on the 134-01049 is in the HOLD position and that the valve on the cylinder of nitrogen gas is open.

7. Turn the control valve to the open position and let the system fill. You should note a drop in the gauge pressure along with the flow meter being pegged at maximum flow for several minutes depending on how full or empty the fuel tank is, and how long it takes to completely fill and pressurize the EVAP system hoses.

8. If the gauge and the flow meter do not settle to a measurable level after **2—3 min { 0.08—0.11 in }**, then refer to the Mazda Workshop Manual to verify that the canister vent valve is properly closed. If canister vent valve is properly closed. The EVAP system has large leakage. Check for leakage and repair as necessary.

9. Verify the pressure gauge and flow meter reading to determine if there is an EVAP leak:

**NO EVAPORATIVE LEAK:**

- The flow meter registers "zero flow" and the pressure gauge returns to the pre-set pressure of **356 mm { 14.0 in }** of water (H<sub>2</sub>O).

**EVAPORATIVE LEAK:**

- The pressure does not return to the preset level of **356 mm { 14.0 in }** of water (H<sub>2</sub>O) when measuring the flow. See "SETTING LEAK STANDARD FOR TESTING" (.020 to .040 inch H<sub>2</sub>O) of the Evaporative Emissions Tester operators manual (134-01067).

**NOTE:**

1. Turn the control valve to the HOLD position then disconnect the **SST**.

## 2012 - Mazda6 - Engine

### ENGINE CONTROL SYSTEM OPERATION INSPECTION [MZI 3.7 V6]

#### Input Signal System Inspection Procedure

1. Find an irregular signal. (See [Finding irregular signals.](#))
2. Locate source. (See [Locating the source of unusual signals.](#))
3. Repair or replace the malfunctioning part.
4. Confirm that the irregular signal is no longer detected.

#### Finding irregular signals

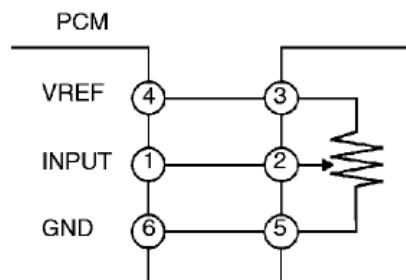
- While referring to [ON-BOARD DIAGNOSTIC TEST \[MZI 3.7 V6\]](#), use the PID/DATA monitor and record function to inspect the input signal system relating to the problem.
1. Start the engine and idle the vehicle. You can assume that any signals that are out of specification by a wide margin are irregular.
  2. When recreating the problem, any sudden change in monitor input signals that is not intentionally created by the driver can be determined as irregular.

#### Locating the source of unusual signals

#### CAUTION:

- Compare the M-MDS monitor voltage with the measurement voltage using the digital measurement system function. If you use another tester, misreading may occur.
- When measuring voltage, attach the tester GND to the GND of the PCM that is being tested, or to the engine itself. If this is not performed, the measured voltage and actual voltage may differ.
- After connecting the pin to a waterproof coupler, confirming continuity and measuring the voltage, inspect the waterproof connector for cracks. If there are any, use sealant to fix them. Failure to do this may result in deterioration of the wiring harness or terminal from water damage, leading to problems with the vehicle.

#### Variable resistance type (TP sensor)



#### Input signal system inspection for variable resistance type

1. When an irregular signal is detected, measure the #1 PCM terminal voltage.
  - If the #1 terminal voltage and the M-MDS monitor voltage are the same, proceed to the next step.
  - If there is a difference of **0.5 V or more**, inspect for the following points concerning the PCM connector:
    - Female terminal opening is loose.
    - Coupler (pin holder) damage



Pin discoloration (blackness)

- Harness/pin crimp is loose or disconnected.

2. Measure the #2 sensor terminal voltage.

- If there is a **0.5 V or more** difference between the sensor and the M-MDS voltages, inspect the wiring harness for open or short circuits.
- If the sensor and the M-MDS voltages are the same, inspect for the following points concerning the sensor connector:
  - Female terminal opening is loose.
  - Coupler (pin holder) damage
  - Pin discoloration (blackness)
- If there are no problems, proceed to next investigation below.

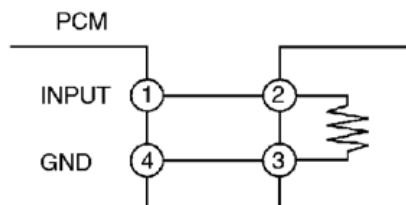
#### Standard power supply system inspection for variable resistance type

- Confirm that the #3 terminal is at **5 V**.
  - If the measured voltage on the #3 terminal is **5 V**, inspect the following points on the sensor connector.
    - Female terminal opening is loose.
    - Coupler (pin holder) damage
    - Pin discoloration (blackness)
  - If there is no problem, inspect for the following:
    - Female terminal opening is loose.
    - Coupler (pin holder) damage
    - Pin discoloration (blackness)
  - If the #3 terminal measures other than **5 V**, inspect for the following:
    - Open or short circuit in wiring harness
    - Harness/pin crimp is loose or disconnected.

#### GND system inspection for variable resistance type

- Confirm that terminal sensor #5 is at **0 V**.
  - If it is at **0 V**, inspect the sensor.
    - If necessary, replace the sensor.
  - If not, inspect for the following:
    - Open or short circuit in wiring harness
    - Female terminal opening is loose causing an open or short circuit in wiring harness.
    - Coupler (pin holder) damage
    - Pin discoloration (blackness)
    - Harness/pin crimp is loose or disconnected.

#### Thermistor type (IAT sensor and CHT sensor)



#### Input signal system inspection for thermistor type

1. When an irregular signal is detected, measure the #1 PCM terminal voltage.

- If the #1 terminal voltage and the M-MDS monitor voltage are the same, proceed to the next step.
- If there is a difference of **0.5 V or more**, inspect the following points concerning the PCM connector:
  - Female terminal opening loose
  - Coupler (pin holder) damage
  - Pin discoloration (blackness)
  - Harness/pin crimp is loose or disconnected.

2. Measure the #2 sensor terminal voltage.

- If there is a **0.5 V or more** difference between the sensor and the M-MDS voltages, inspect the wiring harness for open or short circuits.
- If the sensor and the M-MDS voltages are the same, inspect the following points concerning the sensor connector:
  - Female terminal opening is loose.
  - Coupler (pin holder) damage
  - Pin discoloration (blackness)
  - Harness/pin crimp is loose or disconnected.
- If there are no problems, proceed to next investigation below.

#### GND system inspection for thermistor type

- Confirm that terminal sensor #3 is at **0 V**.
  - If it is at **0 V**, inspect the sensor. If necessary, replace the sensor.
  - If not, inspect for the following:
    - Open circuit in wiring harness
    - Female terminal opening is loose.
    - Coupler (pin holder) damage
    - Pin discoloration (blackness)
    - Harness/pin crimp is loose or disconnected.

#### Main Relay Operation Inspection

1. Verify that the main relay clicks when the ignition is switched to ON and off.

- If there is no operation sound, inspect the following:
  - Main relay (See [RELAY INSPECTION](#).)
  - Harness and connector between battery and main relay terminal A
  - Harness and connector between PCM terminal 1AZ and main relay terminal D

#### Drive-by-Wire Control System Inspection

##### Engine coolant temperature compensation inspection

1. Connect the M-MDS to the DLC-2.

2. Access the following PCM PIDs:

- ECT
- IAT
- RPM

3. Verify that the engine is cold, then start the engine.

4. Verify that the engine speed decreases as the engine warms up.

- If the engine speed does not decrease or decreases slowly, inspect the following:
  - CHT sensor and related wiring harness (See [CYLINDER HEAD TEMPERATURE \(CHT\) SENSOR INSPECTION \[MZI 3.7 V6\]](#).)
  - Throttle body and related wiring harness (See [THROTTLE BODY INSPECTION \[MZI 3.7 V6\]](#).)

#### Load compensation inspection

1. Start the engine and idle it.
2. Connect the M-MDS to the DLC-2.
3. Verify that P0506:00, P0507:00 is not displayed.
  - If the P0506:00, P0507:00 are displayed, perform the DTC inspection. (See [DTC P0506:00 \[MZI 3.7 V6\]](#).) (See [DTC P0507:00 \[MZI 3.7 V6\]](#).)
4. Access the PCM PID RPM.

#### NOTE:

- Excludes temporary idle speed drop just after the loads are turned on.
5. Verify that the engine speed is within the specification under each load condition.
    - If load condition is not as specified, inspect the following:
      - A/C switch and related wiring harness (See [CLIMATE CONTROL UNIT INSPECTION \[MANUAL AIR CONDITIONER\]](#).) (See [CLIMATE CONTROL UNIT INSPECTION \[FULL-AUTO AIR CONDITIONER\]](#).)
      - Fan switch and related wiring harness (See [CLIMATE CONTROL UNIT INSPECTION \[MANUAL AIR CONDITIONER\]](#).) (See [CLIMATE CONTROL UNIT INSPECTION \[FULL-AUTO AIR CONDITIONER\]](#).)

#### Throttle position (TP) sweep inspection

1. Connect the M-MDS to the DLC-2.
2. Switch the ignition to ON.
3. Verify that none of the following DTC are displayed:
  - P0122:00, P0123:00, P0222:00, P0223:00, P2101:00, P2107:00, P2111:00, P2112:00, P2122:00, P2123:00, P2127:00, P2128:00, P2135:00, P2138:00
    - If any one DTC is displayed, perform the DTC inspection. (See [DTC TABLE \[MZI 3.7 V6\]](#).)
4. Access the PCM PIDs TP1, TP2.
5. Verify that the PID reading is within the CTP value. (See [PCM INSPECTION \[MZI 3.7 V6\]](#).)
  - If the PID reading is out of range, perform the following:
    - Remove the air duct from the throttle body.
    - Verify that the throttle valve opens when the accelerator pedal is depressed.
      - If the throttle valve opens, inspect the TP sensor and related wiring harness. (See [THROTTLE POSITION \(TP\) SENSOR INSPECTION \[MZI 3.7 V6\]](#).)
      - If the throttle valve does not open, inspect the throttle valve actuator and related wiring harness.
6. Gradually depress the throttle pedal and verify that the PID reading increases accordingly.
  - If the PID reading drops momentarily, inspect the following:
    - TP sensor
7. Fully depress the throttle pedal and verify that the PID reading is within WOT value. (See [PCM INSPECTION \[MZI 3.7 V6\]](#).)
  - If the PID reading is out of range, perform the followings:
    - Remove the air duct from throttle body.
    - Verify that the throttle valve opens when throttle pedal is depressed.
      - If the throttle valve opens, inspect the TP sensor and related wiring harness. (See [THROTTLE POSITION \(TP\) SENSOR INSPECTION \[MZI 3.7 V6\]](#).)
      - If the throttle valve does not open, inspect the throttle valve actuator control motor and related wiring harness.

## Fuel Injector Operation Inspection

| STEP | INSPECTION                                                                                                                                                                                             | RESULTS | ACTION                                                                                                                                                                                                                                                                                                                   |
|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | <ul style="list-style-type: none"> <li>While cranking the engine, inspect for fuel injector operation sound at each cylinder using a soundscope.</li> <li>Is the operation sound heard?</li> </ul>     | Yes     | Fuel injector operation is normal.                                                                                                                                                                                                                                                                                       |
|      |                                                                                                                                                                                                        | No      | All cylinders not heard: <ul style="list-style-type: none"> <li>Go to the next step.</li> </ul> Some cylinders not heard: <ul style="list-style-type: none"> <li>Go to Step 3.</li> </ul>                                                                                                                                |
| 2    | <ul style="list-style-type: none"> <li>Perform the main relay operation inspection.<br/>(See <a href="#">Main Relay Operation Inspection</a>.)</li> <li>Is the main relay operation normal?</li> </ul> | Yes     | Inspect the following: <ul style="list-style-type: none"> <li>Fuel injector power system related wiring harness and connectors</li> <li>PCM connectors</li> <li>Fuel injector ground and related wiring harness and connectors</li> </ul> Repair or replace the malfunctioning part according to the inspection results. |
|      |                                                                                                                                                                                                        | No      | Repair or replace the malfunctioning part according to the inspection results.                                                                                                                                                                                                                                           |
| 3    | <ul style="list-style-type: none"> <li>Switch fuel injector connector of not operating fuel injector with operating fuel injector.</li> <li>Is the operation sound heard?</li> </ul>                   | Yes     | Go to the next step.                                                                                                                                                                                                                                                                                                     |
|      |                                                                                                                                                                                                        | No      | Replace the fuel injector.<br><br>(See <a href="#">FUEL INJECTOR REMOVAL/ INSTALLATION [MZI 3.7 V6]</a> .)                                                                                                                                                                                                               |
| 4    | <ul style="list-style-type: none"> <li>Are wiring harness and connectors of not operation fuel injector normal? (Open or short)</li> </ul>                                                             | Yes     | Inspect the PCM terminal voltage of fuel injector signal.<br><br>Repair or replace the malfunctioning part according to the inspection results.                                                                                                                                                                          |
|      |                                                                                                                                                                                                        | No      | Repair or replace the malfunctioning part according to the inspection results.                                                                                                                                                                                                                                           |

## Fuel Cut Control System Inspection

### NOTE:

- This inspection has to perform after the Fuel Injector Operation Inspection.

### If active command mode function of the M-MDS is used:

- Warm up the engine and idle it.
- Connect the M-MDS to the DLC-2.
- Select the PCM PIDs RPM and FUELSYS.
- Monitor the both PIDs while performing the following steps.
  - Depress the accelerator pedal and increase the RPM PID to **4,000 rpm**.
  - Quickly release the accelerator pedal (brake pedal is not depressed) and verify that the FUELSYS PID is OL, and CL when the RPM PID drops **below 1,200 rpm**.
    - If not as specified, inspect the following.
      - CHT sensor and related harness (See [CYLINDER HEAD TEMPERATURE \(CHT\) SENSOR INSPECTION](#))

If active command mode function of the M-MDS is not used:

1. Warm up the engine and idle it.
2. Measure the fuel injector control signal wave profile using the oscilloscope while performing the following steps.
  - a. Depress the accelerator pedal and increase the engine speed to **4,000 rpm**.
  - b. Quickly release the accelerator pedal (brake pedal is not depressed) and verify that the wave profile constant **B+**, and appears wave, when the engine speed drops **below 2,200 rpm**.
    - If not as specified, inspect the following.
      - CHT sensor and related harness (See **CYLINDER HEAD TEMPERATURE (CHT) SENSOR INSPECTION [MZI 3.7 V6].**)

## Fuel Pump Operation Inspection

1. Remove the fuel-filler cap.
2. Switch the ignition to ON.
3. Turn the fuel pump relay from off to on using the PCM PID FP and inspect if the fuel pump operation sound is heard.
  - If no operation sounds is heard, go to the next step.
4. Measure the voltage at fuel pump unit terminal B (wiring harness-side).

### Specification

- **B+** (Ignition switch at on)
  - If the voltage is as specified, inspect the following:
    - Fuel pump continuity
    - Fuel pump ground
  - If not as specified, inspect the following:
    - Fuel pump relay (See **RELAY INSPECTION.**)
    - Wiring harness connector (Battery positive terminal—Fuel pump relay—Fuel pump)
    - Wiring harness between fuel pump relay and PCM terminal 1BI

## Spark Test

1. Disconnect the fuel pump relay.
2. Verify that each ignition coil and connector is connected properly.
3. Inspect the ignition system in the following procedure.

### WARNING:

- High voltage in the ignition system can cause strong electrical shock which can result in serious injury. Avoid direct contact to the vehicle body during the following spark test.

| STEP | INSPECTION                                                                                                                                                                                                                                                                                                                                                                  | ACTION                                                                                                                          |
|------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
| 1    | <ul style="list-style-type: none"> <li>• Disconnect the ignition coil from the spark plugs.</li> <li>• Remove the spark plugs.<br/>(See <b>SPARK PLUG REMOVAL/ INSTALLATION [MZI 3.7 V6].</b>)               <ul style="list-style-type: none"> <li>▪ Ensure that the spark plugs don't have carbon deposits.</li> </ul> </li> <li>• Are the spark plugs normal?</li> </ul> | YesGo to the next step.                                                                                                         |
|      |                                                                                                                                                                                                                                                                                                                                                                             | No Perform 2 times of no-load racing at <b>4,000 rpm</b> for <b>2 min</b> to burn off the carbon deposits.<br>Repeat this step. |
| 2    | <ul style="list-style-type: none"> <li>• Inspect the spark plugs for damage, wear, and proper plug gap.</li> </ul>                                                                                                                                                                                                                                                          | YesGo to the next step.                                                                                                         |

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |                                                                                                                                                                                                 |
|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | <ul style="list-style-type: none"> <li>Are the spark plugs normal?</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                | No  | Replace the spark plugs, then go to the next step.<br>(See <a href="#">SPARK PLUG REMOVAL/ INSTALLATION [MZI 3.7 V6]</a> .)                                                                     |
| 3 | <ul style="list-style-type: none"> <li>Reconnect the spark plugs to the ignition coil.</li> <li>Ground the spark plugs to the engine.</li> <li>Is a strong blue spark visible at each cylinder while cranking?</li> </ul>                                                                                                                                                                                                                                                                                                                    | Yes | Ignition system is normal.                                                                                                                                                                      |
|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | No  | Some cylinders do not spark: <ul style="list-style-type: none"> <li>Go to the next step.</li> </ul> All cylinders do not spark: <ul style="list-style-type: none"> <li>Go to Step 5.</li> </ul> |
| 4 | <ul style="list-style-type: none"> <li>Inspect the following wiring harnesses for open or short: <ul style="list-style-type: none"> <li>Ignition coil No.1 terminal C—PCM terminal 2BB</li> <li>Ignition coil No.2 terminal C—PCM terminal 2AT</li> <li>Ignition coil No.3 terminal C—PCM terminal 2B</li> <li>Ignition coil No.4 terminal C—PCM terminal 2AX</li> <li>Ignition coil No.5 terminal C—PCM terminal 2C</li> <li>Ignition coil No.6 terminal C—PCM terminal 2D</li> </ul> </li> <li>Are the wiring harnesses normal?</li> </ul> | Yes | Inspect the ignition coil.<br>(See <a href="#">IGNITION COIL INSPECTION [MZI 3.7 V6]</a> .)<br>Repair or replace the malfunctioning part according to the inspection results.                   |
|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | No  | Repair or replace suspect wiring harness and connector, then go to Step 1.                                                                                                                      |
| 5 | <ul style="list-style-type: none"> <li>Measure the voltage at terminal A in each ignition coils.</li> <li>Is the voltage <b>B+</b> ?</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                              | Yes | Go to the next step.                                                                                                                                                                            |
|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | No  | Inspect the power supply circuit of ignition coils.<br>Repair or replace suspect wiring harness and connector.                                                                                  |
| 6 | <ul style="list-style-type: none"> <li>Verify the continuity between each ignition coils terminal B and battery negative terminal.</li> <li>Is there continuity?</li> </ul>                                                                                                                                                                                                                                                                                                                                                                  | Yes | Go to the next step.                                                                                                                                                                            |
|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | No  | Inspect the ground circuit of ignition coils.<br>Repair or replace suspect wiring harness and connector.                                                                                        |
| 7 | <ul style="list-style-type: none"> <li>Does the PCM connector or ignition coil connectors have poor connection?</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                   | Yes | Repair or replace the connector, then go to Step 1.                                                                                                                                             |
|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | No  | Go to the next step.                                                                                                                                                                            |
| 8 | <ul style="list-style-type: none"> <li>Are the CKP sensor and crankshaft pulley normal?</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                           | Yes | Inspect for open or short circuit in wiring harness and connector of CKP sensor.<br>Repair or replace suspect wiring harness and connector.                                                     |
|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | No  | Repair or replace the malfunctioning part according to the inspection results, then go to Step 1.                                                                                               |

## Purge Control System Inspection

If active command mode function of the M-MDS is used:

- Start the engine.
- Disconnect the vacuum hose between the purge solenoid valve and the charcoal canister.
- Put the finger to the purge solenoid valve and verify that there is no vacuum applied when the engine is cold.
  - If there is a vacuum, inspect the following:

- Wiring harness and connectors (Purge solenoid valve terminal B—PCM terminal 2H)
  - Purge solenoid valve (stuck open) (See [PURGE SOLENOID VALVE INSPECTION \[MZI 3.7 V6\]](#).)
4. Connect the M-MDS to the DLC-2 and verify that the DTC P0443:00 is shown.
    - If the P0443:00 are displayed, perform the DTC inspection. (See [DTC P0443:00 \[MZI 3.7 V6\]](#).)
  5. Select the PCM PID EVAPCP.
  6. Increase the duty value of the purge solenoid valve to **50 %** and inspect if the operation sound of the valve is heard.
    - If the operation sound is heard, inspect for the loose or damaged vacuum hose. (Intake manifold—Purge solenoid valve—Charcoal canister)
    - If the operation sound is not heard, perform the purge solenoid valve inspection.  
(See [PURGE SOLENOID VALVE INSPECTION \[MZI 3.7 V6\]](#).)
  7. Warm up the engine to normal operating temperature.
  8. Monitor the EVAPCP PID using the M-MDS, and drive the vehicle **approx. 2,000 rpm for 30 s or more**.
    - If the EVAPCP PID is **0 %**, inspect the PCM PIDs MAF, APP1, APP2, TP REL and LOAD.

**If active command mode function of the M-MDS is not used:**

1. Start the engine.
2. Disconnect the vacuum hose between the purge solenoid valve and the charcoal canister.
3. Put the finger to the purge solenoid valve and verify that there is no vacuum applied when the engine is cold.
  - If there is a vacuum, inspect the following:
    - Wiring harness and connectors (Purge solenoid valve—PCM terminal 2H)
    - Purge solenoid valve (stuck open) (See [PURGE SOLENOID VALVE INSPECTION \[MZI 3.7 V6\]](#).)
4. Connect the M-MDS to the DLC-2 and verify that the DTC P0443:00 is shown.
  - If the P0443:00 are displayed, perform the DTC inspection. (See [DTC P0443:00 \[MZI 3.7 V6\]](#).)
5. Access the PCM PIDs EVAPCP and ECT.
6. Verify that the ECT PID is **more than 78 °C { 172 °F }**.
  - If the ECT PID reading indicates **less than 78 °C { 172 °F }**, perform the CHT sensor inspection. (See [CYLINDER HEAD TEMPERATURE \(CHT\) SENSOR INSPECTION \[MZI 3.7 V6\]](#).)
7. Set the vehicle on the dynamometer or chassis roller.

#### **WARNING:**

- When the dynamometer or chassis roller is operating, there is a possibility that the operator may come into contact with or be caught up in the rotating parts, leading to serious injuries or death. When performing work while the dynamometer or chassis roller is operating, be careful not to come into contact with or caught up in any of the rotating parts.
8. Drive the vehicle **approx. 2,000 rpm for 30 s or more**.
    - If there is no vacuum, inspect the following:
      - Wiring harness and connector (Main relay—Purge solenoid valve—PCM terminal 2H)
      - Purge solenoid valve (See [PURGE SOLENOID VALVE INSPECTION \[MZI 3.7 V6\]](#).)
      - MAF, APP1, APP2, TP REL and LOAD PIDs
    - If there is vacuum, inspect the following:
      - Vacuum hose (Purge solenoid valve—Charcoal canister)

#### **A/ C Cut-off Control System Inspection**

1. Start the engine.
2. Turn the A/C switch and the fan switch on.
3. Verify that the magnetic clutch actuates.
  - If it does not actuate, go to symptom troubleshooting "NO.23 A/C DOES NOT WORK SUFFICIENTLY". (See [NO.23 A/ C DOES NOT WORK SUFFICIENTLY \[MZI 3.7 V6\]](#).)
4. Fully open the throttle valve and verify that the magnetic clutch does not actuate for **2—5 s**.

- If it actuates, inspect as follows:
  - A/C relay (See [RELAY INSPECTION](#).)
  - Open or short to ground circuit in wiring harness and connectors (Ignition switch (without advanced keyless entry and push button start system)/IG2 relay (with advanced keyless entry and push button start system)—A/C relay—PCM terminal 1W)
  - A/C related parts
  - APP1, APP2 PIDs

## Cooling Fan Control System Inspection

1. Connect the M-MDS to the DLC-2.
2. Start the engine and warm it up to normal operating temperature.
3. Perform the KOER self test. (See [KOE0/ KOER SELF TEST \[MZI 3.7 V6\]](#).)
4. Verify the cooling fan operates during KOER self test.

### Cooling fans do not operate

- Inspect for followings:
  - Open circuit between fan control module relay and battery positive terminal
  - Open circuit between fan control module relay and PCM terminal 1BI
  - Open circuit between fan control module relay and fan control module terminal 1C
  - Open circuit between fan control module terminal 1A and ground
  - Poor connection of the fan control module connector
  - Fan control module relay malfunction (See [RELAY INSPECTION](#).)
  - Open or short circuit between fan control module terminal 1B and PCM terminal 1AY
  - Open or short circuit between ignition switch (IG1)<sup>\*1</sup>/IG1 relay<sup>\*2</sup> and fan control module relay
    - If there is malfunction, repair or replace malfunctioning part.
    - If there is no malfunction, replace the fan control module. (See [COOLING FAN MOTOR REMOVAL/ INSTALLATION \[MZI 3.7 V6\]](#).)

\*1

**Vehicles without advanced keyless entry and push button start system**

\*2

**Vehicles with advanced keyless entry and push button start system**

### Cooling fan motor No.1 does not operate

- Inspect for followings:
  - Open or short to ground circuit between fan control module and cooling fan motor No.1
  - Poor connection of the fan control module connector or cooling fan motor No.1 connector
  - Cooling fan motor No.1 malfunction (See [COOLING FAN MOTOR INSPECTION \[MZI 3.7 V6\]](#).)
    - If there is malfunction, repair or replace malfunctioning part.
    - If there is no malfunction, replace the fan control module. (See [COOLING FAN MOTOR REMOVAL/ INSTALLATION \[MZI 3.7 V6\]](#).)

### Cooling fan motor No.2 does not operate

- Inspect for followings:
  - Open or short to ground circuit between fan control module and the cooling fan motor No.2
  - Poor connection of the fan control module connector or the cooling fan motor No.2 connector
  - Cooling fan motor No.2 malfunction (See [COOLING FAN MOTOR INSPECTION \[MZI 3.7 V6\]](#).)
    - If there is malfunction, repair or replace malfunctioning part.



- If there is no malfunction, replace the fan control module. (See [COOLING FAN MOTOR REMOVAL/ INSTALLATION \[MZI 3.7 V6\] .](#))

## Variable Valve Timing Control System Operation Inspection

**When idling cannot be continued**

### NOTE:

- Inspect for each bank.
1. Remove the OCV and verify that the spool valve is at maximum retard position. (See [OIL CONTROL VALVE \(OCV\) REMOVAL/ INSTALLATION \[MZI 3.7 V6\] .](#))
    - If the spool valve is stuck in advance direction, replace the OCV. (See [OIL CONTROL VALVE \(OCV\) REMOVAL/ INSTALLATION \[MZI 3.7 V6\] .](#))
  2. Connect the OCV connector.
  3. Switch the ignition to ON.
  4. Verify that the spool valve is at max. retard position.
    - If the spool valve is stuck in advance direction, inspect the following:
      - Short circuit in harnesses or connectors between OCV and PCM.
  5. Inspect the variable valve timing actuator.

**When idling can be continued**

### For right bank

1. Disconnect OCV (RH) connector.
2. Warm up the engine and it at idle.
3. Apply the battery voltage to the OCV and verify that the engine idles roughly or stalls.
  - If the engine idles roughly or stalls, inspect the timing belt component (valve timing deviation).
  - If the engine does not idle roughly or stall, go to the next step.
4. Remove the OCV (RH) and perform the spool valve operation inspection. (See [OIL CONTROL VALVE \(OCV\) REMOVAL/ INSTALLATION \[MZI 3.7 V6\] .](#))
  - If not as specified, inspect the following:
    - OCV (RH) (See [OIL CONTROL VALVE \(OCV\) INSPECTION \[MZI 3.7 V6\] .](#))
    - Harnesses and connectors between OCV (RH) and PCM have an open or short circuit.
  - If as specified, inspect the following right bank hydraulic passages for clogging or leakage, or both.
    - Oil pressure switch—OCV
    - OCV—Camshaft
    - Camshaft internal passage
5. If they are normal, replace the right bank camshaft pulley (with built-in variable valve timing actuator).

**When idling can be continued**

### For left bank

1. Disconnect OCV (LH) connector.
2. Warm up the engine to idle.
3. Apply the battery voltage to the OCV and verify that the engine idles roughly or stalls.
  - If the engine idles roughly or stalls, inspect the timing belt component (valve timing deviation).
  - If the engine does not idle roughly or stall, go to the next step.
4. Remove the OCV (LH) and perform spool valve operation inspection. (See [OIL CONTROL VALVE \(OCV\) REMOVAL/ INSTALLATION \[MZI 3.7](#)

V6].)

- If not as specified, inspect the following:
  - OCV (LH) (See **OIL CONTROL VALVE (OCV) INSPECTION [MZI 3.7 V6].**)
  - Harnesses and connectors between OCV (LH) and PCM have an open or short circuit.
- If as specified, inspect the following left bank hydraulic passages for clogging or leakage or both.
  - Oil pressure switch— OCV
  - OCV—Camshaft
  - Camshaft internal passage

5. If they are normal, replace the left bank camshaft pulley (with built-in variable valve timing actuator).

### Evaporative Emission (EVAP) System Leak Inspection

- To verify that the problem has been fixed properly after repairs, the run drive cycle or EVAP system leak inspection must be performed.

#### EVAP system leak inspection using the M-MDS

#### NOTE:

- Use the IDS (laptop PC) because the PDS (Pocket PC) does not support the EVAP system test.

#### EVAP system test out line

- The EVAP system test, which can substituted for the run drive cycle as an EVAP control system repair confirmation method, can detect the small / large leak or blockage without run-drive cycle.

#### NOTE:

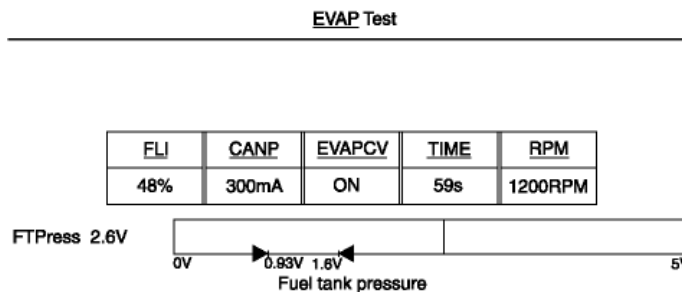
- M-MDS can not detect "VERY SMALL LEAK". To identify the leak point, please use the leak tester or ultrasonic leak detector.

#### EVAP system test description

- The EVAP system test finds gas leaks or blockage of EVAP system using the changes of the fuel tank pressure.
  - This test starts after sending an on-demand test signal from the M-MDS to the PCM.
  - This test consists of three stages, and each stage is performed automatically as follows:

##### Stage 1 test (Test for large leak or blockage)

- M-MDS send the stage 1 test start signal to the PCM.



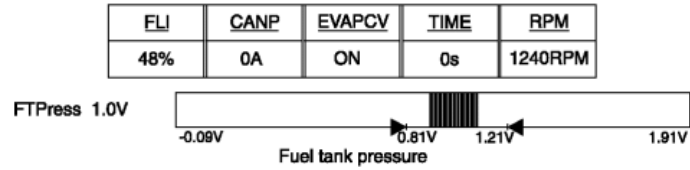
#### Pulling Target Vacuum

- PCM controls the CV solenoid valve and purge solenoid valve to control the tank pressure to the targeted value.
- M-MDS detect the large leak or the purge line blockage if the tank pressure does not arrive at the target vacuum in specified period.

##### Stage 2 test (Test for small leak)

- When fuel tank pressure arrived at the targeted pressure at stage 1 test, M-MDS send the stage 2 test signal to the PCM to turn off the purge solenoid to keep the tank pressure.

#### EVAP Test



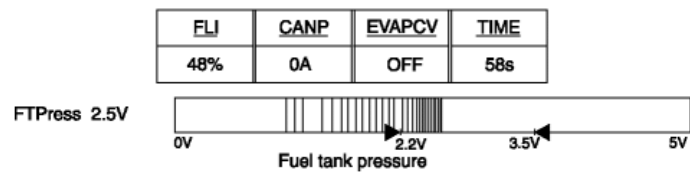
The vacuum bleed down and bleed up rate is in range

- M-MDS detect the small leak if the tank pressure can not keep within the target in specified period.

#### Stage 3 test (Test for blockage)

- M-MDS send the stage 3 test signal to the PCM to turn off the CV solenoid for check the blockage of EVAP system.

#### EVAP Test



The FTP value is in range.

- M-MDS detect blockage of the CV solenoid valve or air filter if the tank pressure does not arrive at the target (atmosphere).

#### EVAP system malfunction judgment

- M-MDS detect the small / large leak or blockage based on fuel tank pressure at the end of EVAP Test.

**The EVAP Test could not obtain the target vacuum. A large leak or blockage is suspect.**

- This judgment means tank pressure could not arrive at target pressure at stage 1 test.
- Check for the large leakage or inspect the purge solenoid valve operation and related hoses.
- Repair or replace any malfunctioning parts.

**The EVAP Test could not maintain the target vacuum. A small leak is suspect.**

- This judgment means tank pressure could not stay in target pressure at stage 2 test.
- Run the EVAP Test again after Re-tighten the fuel filler cap.
- If small leak is suspected again, use the leak tester or ultrasonic leak detector for identify the leak point.
- Repair or replace any malfunctioning parts.

**Blockage in EVAP system.**

- This judgment means tank pressure could not return to atmosphere at stage 3 test.
- Inspect the CV solenoid, Air filter, Charcoal canister and related hoses for blockage.

**No large leaks or blockage have been detected in the EVAP system at this time.**

- M-MDS can not detect "VERY SMALL LEAK".
- To identify the leak point, please use the leak tester or ultrasonic leak detector.

**Evaporative system test procedure**

- Verify that all PIDs within the following specifications.

**Specification**

| PID  | PID Range                              |
|------|----------------------------------------|
| BARO | 74.9 kPa {562 mmHg, 22.1 inHg} or more |
| FLI  | 15—85 %                                |
| ECT  | ECT minus IAT -10—25 °C {14—77 °F}     |
| IAT  |                                        |

**NOTE:**

- To successfully perform this procedure, all PIDs must be within the specifications before proceeding to the next step.
- Select the following items from the initialization screen of the M-MDS.
  - Select the "Powertrain".
  - Select the "Fuel".
  - Select the "EVAP Test".
    - Verify that ECT and IAT are within the specifications at the confirmation screen. To successfully perform this procedure, ECT and IAT must be within the spec before proceeding to the next step.
    - Fuel Level must be maintained within 15 % —85 % . PCM will cancel the EVAP Test If the Fuel Level

is **lower than 15 %** or **higher than 85 %** .

- Verify the test results described on the M-MDS and follow the instructions.

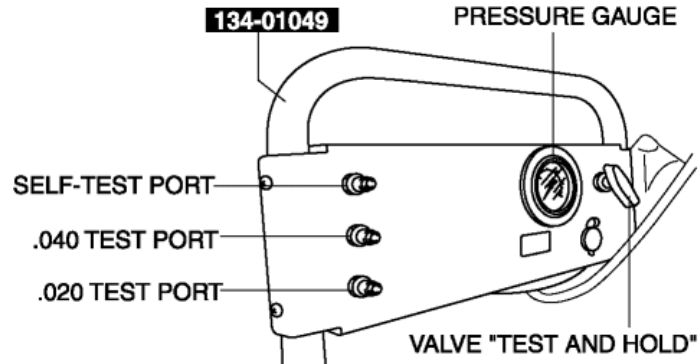
#### EVAP system leak inspection using leak tester

1. Perform the following **SST** (EVAP System Tester 134-01049) self-test:

##### NOTE:

- If the tester does not work correctly during the self-test, refer to the tester operators manual for a more detailed self-test procedure.

- a. Verify that the control valve on the panel is in the HOLD position then open the nitrogen bottle valve.



- b. Connect the vehicle interface hose (part of the **SST**) to the SELF-TEST port located on the control panel. Hand tighten the fitting. (Do not overtighten.)

- c. Turn the control valve to the TEST position.

- d. The gauge should read **331—381 mm { 13.1—15.0 in }** of water.

- If the gauge is not reading in this range, adjust the pressure by turning the black knob on the low pressure regulator at the nitrogen bottle.

- e. Turn the control valve to the HOLD position.

- f. Verify that the gauge holds pressure and that the flow meter reads no flow.

1. If there is no drop in pressure and no flow, the tester passes the self-test.

2. If the gauge leaks down, refer to the tester operators manual.

2. Connect the **SST** to the vehicle.

- a. Verify that the control valve on the panel is in the HOLD position then open the nitrogen bottle valve.

- b. Remove the fuel-filler cap from the vehicle.

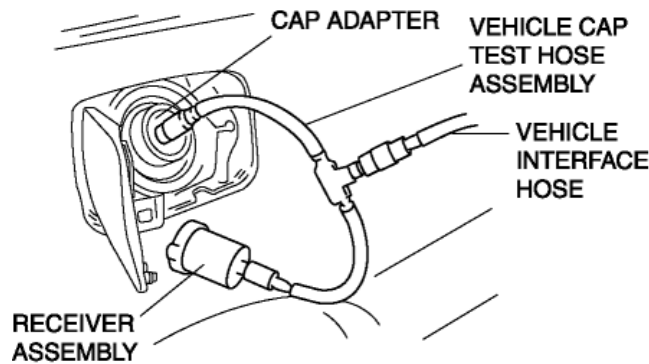
- If the fuel-filler cap is not a MAZDA part or equivalent, replace it.

##### NOTE:

- INSPECT FUEL FILLER CAP AND FILLER NECK

- Visually inspect for damage, insufficient sealing, rust, cracks or warps for filler cap and filler neck.
- Repair or replace if necessary.

- c. Connect the receiver assembly (**SST**: 134-01059) to the vehicle cap test hose assembly (part of the **SST**) and the fuel-filler cap from the vehicle.



d. Connect the cap adaptor (**SST**: 134-01058) to the vehicle cap test hose assembly (part of the **SST**) and to the fuel-filler neck.

e. Connect the vehicle interface hose (part of the **SST**) to the center fitting of the vehicle cap test hose assembly (part of the **SST**).

3. Connect the M-MDS to the DLC-2.

4. Switch the ignition to ON (Engine off).

5. Request the PCM on-board device control (Mode 08) using the M-MDS to close the canister vent value.

**NOTE:**

- The canister vent value is closed for **10 min** unless the following any actions are done:
  - Engine is started.
  - Ignition is switched to off.

6. Make sure the control valve on the 134-01049 is in the HOLD position and that the valve on the cylinder of nitrogen gas is open.

7. Turn the control valve to the open position and let the system fill. You should note a drop in the gauge pressure along with the flow meter being pegged at maximum flow for several minutes depending on how full or empty the fuel tank is, and how long it takes to completely fill and pressurize the EVAP system hoses.

8. If the gauge and the flow meter do not settle to a measurable level after **2—3 min { 0.08—0.11 in }**, then refer to the Mazda Workshop Manual to verify that the canister vent valve is properly closed. If canister vent valve is properly closed. The EVAP system has large leakage. Check for leakage and repair as necessary.

9. Verify the pressure gauge and flow meter reading to determine if there is an EVAP leak:

**NO EVAPORATIVE LEAK:**

- The flow meter registers "zero flow" and the pressure gauge returns to the pre-set pressure of **356 mm { 14.0 in }** of water (H<sub>2</sub>O).

**EVAPORATIVE LEAK:**

- The pressure does not return to the preset level of **356 mm { 14.0 in }** of water (H<sub>2</sub>O) when measuring the flow. See "SETTING LEAK STANDARD FOR TESTING" (.020 to .040 inch H<sub>2</sub>O) of the Evaporative Emissions Tester operators manual (134-01067).

**NOTE:**

1. Turn the control valve to the HOLD position then disconnect the **SST**.