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2002 MAZDA MX-5 / Miata OEM Service and Repair Workshop Manual

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NO.20 FUEL ODOR (IN ENGINE COMPARTMENT) [SKYACTIV-G 2.5T]

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20	FUEL ODOR (IN ENGINE COMPARTMENT)
DESCRIPTION	• Gasoline fuel smell or visible leakage.
POSSIBLE CAUSE	• Missing or loose fuel filler cap • Fuel filler cap malfunction (seal malfunction) • Fuel leakage from fuel system • Charcoal canister damage • Vacuum hose (disconnection, damage) between charcoal canister and purge solenoid valve • Vacuum hose (disconnection, damage) between purge solenoid valve and check valve • Vacuum hose (disconnection, damage) between check valve and intake manifold • Vacuum hose (disconnection, damage) between check valve and ejector • Vacuum hose (disconnection, damage) between ejector and intake manifold • Evaporative hose (disconnection, damage) between fuel tank, charcoal canister, purge solenoid valve, and intake manifold • Fuel leakage at the fuel injector • Purge solenoid valve malfunction (stuck, operation malfunction due to open circuit) • Ejector (clogged) • Check valve (stuck) Warning • The following troubleshooting flow chart contains the fuel system diagnosis and repair procedures. Read the following warnings before performing the fuel system services: — Fuel vapor is hazardous. It can easily ignite, causing serious injury and damage. Always keep sparks and flames away from fuel. — Highly pressurized fuel may spray out if the fuel line is cut. Due to the following dangers occurring with a fuel spray, always complete the “Fuel Line Safety Procedure” to prevent the fuel from spraying. (See BEFORE SERVICE PRECAUTION [SKYACTIV-G 2.5T].) • Fuel may cause irritation if it comes in contact with skin and eyes. • If fuel ignites and causes a fire, it may lead to serious injury or death, and damage to property and facilities. — Fuel is highly flammable and dangerous. Fuel line spills and leakage can cause serious injury or death, and damage to equipment. Always refer to the “Quick Release Connector Removal/Installation (fuel system)” before performing the fuel hose installation, and execute the “Fuel Leakage Inspection” after installation. (See QUICK RELEASE CONNECTOR (FUEL SYSTEM) REMOVAL/INSTALLATION [SKYACTIV-G 2.5T].) (See AFTER SERVICE PRECAUTION [SKYACTIV-G 2.5T].) Caution • Disconnecting/connecting the quick release connector without cleaning it may possibly cause damage to the fuel pipe and quick release connector. Always clean the quick release connector joint area before disconnecting/connecting, and make sure that it is free of foreign material.

Diagnostic Procedure

21	ENGINE NOISE
POSSIBLE CAUSE	**Buzzing sound is heard from exhaust pipe during cold engine start:** **Note** **• During a cold engine start, sound occurs for up to approx. 30 s with fast idle up for a drive-by-wire control and the warm-up promotion spark retard correction for ignition timing control.** • Sound occurs from drive-by-wire control, ignition control (vehicle is normal) • Dynamic damper loose • Exhaust system installation condition • Intake system installation condition **Squeal, click, or chirp noise:** • Improper engine oil level • Loose installation of solenoid valves • Improper drive belt tension • Generator installation • Auto tensioner bearing malfunction • Splash shield or under cover loose (splash water to drive belt) **Thumping/rattling or creaking sound noise:** • Improper drive belt tension • Loose parts • Loose fitting heater hoses vibrating the heater hose bracket protector **Hissing sound noise:** • Vacuum leakage • Loose spark plug • Air leakage from the intake-air system **Clattering noise:** • Loose parts **Lightly tapping or rumbling noise:** • Dynamic damper loose • Exhaust system loose • Intake-air system loose **Excessive noise from turbocharger:** • Foreign objects or material in the compressor inlet to the intake manifold ducting or the compressor housing • Carbon built-up in the turbine housing • Turbocharger routing assembly banding or dragging • Loose intake or exhaust ducting systems **Other noise:** • Electric variable valve timing actuator malfunction • Hydraulic variable valve timing actuator malfunction • Timing chain noise • Hydraulic lash adjuster (HLA) noise **Warning** **• The following troubleshooting flow chart contains the fuel system diagnosis and repair procedures. Read the following warnings before performing the fuel system services:** **— Fuel vapor is hazardous. It can easily ignite, causing serious injury and damage. Always keep sparks and flames away from fuel.** **— Highly pressurized fuel may spray out if the fuel line is cut. Due to the following dangers occurring with a fuel spray, always complete the "Fuel Line Safety Procedure" to prevent the fuel from spraying. (See BEFORE SERVICE PRECAUTION [SKYACTIV-G 2.5T].)** **• Fuel may cause irritation if it comes in contact with skin and eyes.** **• If fuel ignites and causes a fire, it may lead to serious injury or death, and damage to property and facilities.** **— Fuel is highly flammable and dangerous. Fuel line spills and leakage can cause serious injury or death, and damage to equipment. Always refer to the "Quick Release Connector Removal/Installation (fuel system)" before performing the fuel hose installation, and execute the "Fuel Leakage Inspection" after installation. (See QUICK RELEASE CONNECTOR (FUEL SYSTEM) REMOVAL/INSTALLATION [SKYACTIV-G 2.5T].) (See AFTER SERVICE PRECAUTION [SKYACTIV-G 2.5T].)**

STEP	INSPECTION	RESULTS	ACTION
9	VISUALLY INSPECT THE TURBINE HOUSING • Visually inspect the turbine housing. • Is there any carbon built-up or foreign material on the turbine housing?	Yes	Clean built-up carbon or remove foreign materials. • If turbine housing damaged: — Replace the dynamic pressure turbo. (See DYNAMIC PRESSURE TURBO REMOVAL/INSTALLATION [SKYACTIV-G 2.5T].)
		No	Replace the intake air system. (See INTAKE-AIR SYSTEM REMOVAL/INSTALLATION [SKYACTIV-G 2.5T].)
10	VERIFY IF THERE IS KNOCK SOUND • Is knocking noise present?	Yes	Perform the symptom troubleshooting "NO.13 KNOCKING/PINGING-ACCELERATION/CRUISE". (See NO.13 KNOCKING/PINGING-ACCELERATION/CRUISE [SKYACTIV-G 2.5T].)
		No	If noise comes from engine internal: • Inspect the following: — Timing chain — Hydraulic lash adjuster (HLA) noise — Electric variable valve timing actuator — Hydraulic variable valve timing actuator — Engine compression • Repair or replace the malfunctioning part according to the inspection results.
11	Verify the test results. • If normal, return to the diagnostic index to service any additional symptoms. (See SYMPTOM DIAGNOSTIC INDEX [SKYACTIV-G 2.5T].) • If the malfunction remains, inspect the related Service Bulletins and/or On-line Repair Information and perform repair or diagnosis. — If the vehicle is repaired, troubleshooting is completed. — If the vehicle is not repaired or additional diagnostic information is not available, reprogram the PCM if a later calibration is available. Retest.		

- Installation area of charge air cooler
- Installation area of throttle body
- Installation area of fuel injector
- Installation area of PCV valve
- Installation area of intake manifold

Standard

Approx. -60.0 kPa {-450.0 mmHg, -17.7 inHg}

Note

• Air suction can be located by the engine speed change when lubricant is sprayed on the area where suction is occurring. Check the following places:

— Air suction at throttle body, evaporative hose, vacuum hose, ventilation hose, check valve (built-into vacuum hose), fuel injector, intake manifold and PCV valve installation points

• Check valve (built-into vacuum hose) (See VACUUM LINE INSPECTION [SKYACTIV-G 2.5T].)

• Engine compression (See COMPRESSION INSPECTION [SKYACTIV-G 2.5T].)

Electric Variable Valve Timing Driver Control System Inspection

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

2.Perform the KOER self test. (See KOEO/KOER SELF TEST [PCM (SKYACTIV-G 2.5T)].)

3.Verify that DTC P0010:00 or P1380:00 is not displayed. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5T)].)

• If DTC P0010:00 or P1380:00 is displayed, perform the DTC inspection. (See DTC P0010:00 [PCM (SKYACTIV-G 2.5T)].) (See DTC P1380:00 [PCM (SKYACTIV-G 2.5T)].)

4.Perform the Drive Mode 03 (Variable Valve Timing, A/F Sensor, HO2S and TWC Repair Verification Drive Mode). (See OBD-II DRIVE MODE [PCM (SKYACTIV-G 2.5T)].)

5.Verify that DTC P0011:00 or P0012:00 is not displayed. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5T)].)

• If DTC P0011:00 or P0012:00 is displayed, perform the DTC inspection. (See DTC P0011:00, P0012:00 [PCM (SKYACTIV-G 2.5T)].)

6.Access the following PCM PIDs using the M-MDS. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5T)].)

• VT_IN_ACT
• VT_IN_DES

Caution

• While performing this step, always operate the vehicle in a safe and lawful manner.
• When the M-MDS is used to observe monitor system status while driving, be sure to have another technician with you, or record the data in the M-MDS using the PID/DATA MONITOR AND RECORD capturing function and inspect later.

2.Perform the KOEO or KOER self test. (See KOEO/KOER SELF TEST [PCM (SKYACTIV-G 2.5T)].)

3.Verify that none of the following DTCs are displayed:

- P0122:00, P0123:00, P0222:00, P0223:00, P0638:00, P2101:00, P2107:00, P2109:00, P2110:00, P2112:00, P2119:00, 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 [PCM (SKYACTIV-G 2.5T)].)

4.Access the following PCM PIDs using the M-MDS. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5T)].)

- ETC_ACT
- ETC_DSD

5.With the accelerator pedal not depressed and with it depressed to the floor, verify that the data monitor item ETC_ACT value changes in conjunction with the ETC_DSD value.

- If this change cannot be verified, perform the Resistance Inspection for the throttle body. (See THROTTLE BODY INSPECTION [SKYACTIV-G 2.5T].)

Brake override system operation inspection

Note

- **If the brake override system operates normally after performing the following inspection, the PCM detects DTC P2299:00.**

1.Start the engine and let it idle.

2.Verify that the engine speed becomes less than 1,200 rpm under the following conditions.

- N position
- Engine speed of 3,000 rpm or more with accelerator pedal depressed
- Brake pedal depressed

  — If the engine speed becomes approx. 1,200 rpm, clear the PCM DTC using the M-MDS. (Brake override system operation is normal.)
  — If the engine speed does not become approx. 1,200 rpm, inspect for the following parts, then repair or replace the malfunctioning part:

  - APP sensor (See ACCELERATOR PEDAL POSITION (APP) SENSOR INSPECTION [SKYACTIV-G 2.5T].)
  - Brake switch No.1 (See BRAKE SWITCH INSPECTION.)
  - Brake switch No.2 (See BRAKE SWITCH INSPECTION.)
  - Communication between PCM and TCM (See FOREWORD [SKYACTIV-G 2.5T].)

Wastegate Valve Operation Inspection

If data monitor function of M-MDS is used:

1.Warm up the engine and idle it.

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

3.Select the RPM and the FUELPW PIDs. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5T)].)

4.Monitor both PIDs while performing the following steps:

(1)Depress the accelerator pedal and increase the RPM PID to 4,000 rpm.

(2)Quickly release the accelerator pedal (brake pedal is not depressed) and verify that the FUELPW PID is 0 msec, and 2−5 msec when the RPM PID drops below 1,200 rpm.

- If not as specified, inspect the following:

— ECT sensor and related wiring harness (See ENGINE COOLANT TEMPERATURE (ECT) SENSOR INSPECTION [SKYACTIV-G 2.5T].)

If data monitor function of 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:

(1)Depress the accelerator pedal and increase the engine speed to 4,000 rpm.

(2)Quickly release the accelerator pedal (brake pedal is not depressed) and verify that the wave profile constant B+, and the wave appears when the engine speed drops below 1,200 rpm. (See PCM INSPECTION [SKYACTIV-G 2.5T].)

- If not as specified, inspect the following:

— ECT sensor and related wiring harness (See ENGINE COOLANT TEMPERATURE (ECT) SENSOR INSPECTION [SKYACTIV-G 2.5T].)

Fuel Pump (Low-pressure Side) Operation Inspection

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

2.Remove the fuel-filler cap.

3.Switch the ignition ON (engine off).

STEP	INSPECTION		ACTION
4	Switch the ignition off. Inspect the wiring harness between the following terminals (wiring harness-side) for an open or short circuit: • Ignition coil/ion sensor No.1 terminal B−PCM terminal 1AG • Ignition coil/ion sensor No.2 terminal B−PCM terminal 1AE • Ignition coil/ion sensor No.3 terminal B−PCM terminal 1AF • Ignition coil/ion sensor No.4 terminal B−PCM terminal 1AD Is there any malfunction?	Yes	Refer to the wiring diagram and verify whether or not there is a common connector between the following terminals: • Ignition coil/ion sensor No.1 terminal B−PCM terminal 1AG • Ignition coil/ion sensor No.2 terminal B−PCM terminal 1AE • Ignition coil/ion sensor No.3 terminal B−PCM terminal 1AF • Ignition coil/ion sensor No.4 terminal B−PCM terminal 1AD **If there is a common connector:** • Determine the malfunctioning part by inspecting the common connector and the terminal for corrosion, damage, or pin disconnection, and the common wiring harness for an open or short circuit. • Repair or replace the malfunctioning part. **If there is no common connector:** • Repair or replace the wiring harness which has an open or short circuit.
		No	Inspect the ignition coil. (See IGNITION COIL/ION SENSOR REMOVAL/INSTALLATION [SKYACTIV-G 2.5T].) • Replace the ignition coil/ion sensor. (See IGNITION COIL/ION SENSOR REMOVAL/INSTALLATION [SKYACTIV-G 2.5T].)
5	Switch the ignition off. Disconnect the ignition coil/ion sensor connectors. Switch the ignition ON (engine off). Measure the voltage at each ignition coil/ion sensor terminal A (wiring harness-side). Is the voltage B+?	Yes	Go to the next step.
		No	Inspect for power supply circuit in wiring harness between main relay and ignition coils. Refer to the wiring diagram and verify whether or not there is a common connector between the following terminals: • Main relay terminal C−Ignition coil/ion sensor No.1 terminal A • Main relay terminal C−Ignition coil/ion sensor No.2 terminal A • Main relay terminal C−Ignition coil/ion sensor No.3 terminal A • Main relay terminal C−Ignition coil/ion sensor No.4 terminal A **If there is a common connector:** • Determine the malfunctioning part by inspecting the common connector and the terminal for corrosion, damage, or pin disconnection, and the common wiring harness for a short to power supply. • Repair or replace the malfunctioning part. **If there is no common connector:** • Repair or replace the wiring harness which has a short to power supply.

5.Set the vehicle on a 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 contact or be caught up in any of the rotating parts.

6.Drive the vehicle at an engine speed to approx. 2,000 rpm for 30 s or more.

7.Put a finger to the purge solenoid valve and verify that there is no vacuum applied during Step 3.

- If there is no vacuum, inspect the following:
  - — Wiring harness and connector (Main relay—Purge solenoid valve—PCM terminal 1AI)
  - — Purge solenoid valve (See PURGE SOLENOID VALVE INSPECTION [SKYACTIV-G 2.5T].)
- If there is vacuum, inspect the following:
  - — Evaporative hose (Purge solenoid valve—Charcoal canister)

EGR Valve Operation Inspection

1.Verify that the MAP sensor is normal. (See MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR INSPECTION [SKYACTIV-G 2.5T].)

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

3.Start the engine.

4.Access the following PCM PIDs using the M-MDS. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5T)].)

- SEGRP
- SEGRP_DSD

5.Verify the SEGRP PID value when the simulation item SEGRP_DSD increases from 0 % to 100 %.

- If the SEGRP does not operate:
  - — Perform the EGR valve resistance inspection. (See EGR VALVE INSPECTION [SKYACTIV-G 2.5T].)

A/C Cut-off Control System Inspection

1.Start the engine.

2.Turn the A/C switch on.

7. Remove the OCV while the connector is connected. (See OIL CONTROL VALVE (OCV) REMOVAL/INSTALLATION [SKYACTIV-G 2.5T].)
8. Switch the ignition ON (engine off).
9. Access the simulation item VT_EX_DES using the M-MDS. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5T)].)
10. Increase the OCV duty value and verify that the spool valve operates in the retard direction.

- If as specified, inspect the following hydraulic passage for restriction and/or leakage:
  - — Oil pressure switch–OCV
  - — OCV–Camshaft
  - — Camshaft internal passage
- If not as specified, inspect the following:
  - — OCV operation (See OIL CONTROL VALVE (OCV) INSPECTION [SKYACTIV-G 2.5T].)

11. If they are normal, replace the hydraulic variable valve timing actuator. (See ELECTRIC VARIABLE VALVE TIMING ACTUATOR, HYDRAULIC VARIABLE VALVE TIMING ACTUATOR REMOVAL/INSTALLATION [SKYACTIV-G 2.5T].)

If simulation function of M-MDS is not used:

1. Disconnect the OCV connector. (See OIL CONTROL VALVE (OCV) REMOVAL/INSTALLATION [SKYACTIV-G 2.5T].)
2. Warm up the engine and idle it.
3. Apply the battery voltage to the OCV and verify that the engine idles rough or stalls.

- If the engine idles rough or stalls, inspect the timing chain component (valve timing deviation). (See HYDRAULIC VARIABLE VALVE TIMING ACTUATOR INSPECTION [SKYACTIV-G 2.5T].)
- If the engine does not idle rough or stalls, go to the next step.

4. Remove the OCV and perform the Spool Valve Operation Inspection. (See OIL CONTROL VALVE (OCV) INSPECTION [SKYACTIV-G 2.5T].)

- If not as specified, inspect the following:
  - — OCV (See OIL CONTROL VALVE (OCV) INSPECTION [SKYACTIV-G 2.5T].)
  - — Harnesses and connectors between OCV and PCM have an open or short circuit
- If as specified, inspect the following hydraulic passages for restriction or leakage or both:
  - — Oil pressure switch–OCV
  - — OCV–Camshaft
  - — Camshaft internal passage

5. If they are normal, replace the hydraulic variable valve timing actuator. (See ELECTRIC VARIABLE VALVE TIMING ACTUATOR, HYDRAULIC VARIABLE VALVE TIMING ACTUATOR REMOVAL/INSTALLATION [SKYACTIV-G 2.5T].)

Evaporative Emission (EVAP) System Leak Inspection (U.S.A. and Canada specs.)

- Test the EVAP system for leakage using the dual purpose diagnostic leak detector.