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1997 MAZDA MX-5 / Miata OEM Service and Repair Workshop Manual

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Item	Definition	Unit	Condition/Specification
VT_IN_ACT	Actual intake variable valve timing control • Advance amount from max retard position	° (deg)	• Displays actual intake variable valve timing–advance amount from max retard position
VT_IN_DES	Target intake variable valve timing control • Advance amount from max retard position	° (deg)	• Displays target intake variable valve timing–advance amount from max retard position

Function Inspection Using M-MDS

STEP	INSPECTION	RESULTS	ACTION
1	PURPOSE: VERIFY RELATED REPAIR INFORMATION AVAILABILITY • Verify related Service Bulletins and/or on-line repair information availability. • Is any related repair information available?	Yes	Perform repair or diagnosis according to the available repair information. • If the vehicle is not repaired, go to the next step.
		No	Go to the next step.
2	PURPOSE: RECORD VEHICLE STATUS AT TIME OF DTC DETECTION TO UTILIZE WITH REPEATABILITY VERIFICATION Note • Recording can be facilitated using the screen capture function of the PC. • Record the FREEZE FRAME DATA/snapshot data on the repair order.	–	Go to the next step.
3	PURPOSE: VERIFY IF DIAGNOSTIC RESULT IS AFFECTED BY OTHER RELATED DTCs OCCURRING • Switch the ignition off, then ON (engine off). • Perform the Pending Trouble Code Access Procedure and DTC Reading Procedure. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].) • Is the PENDING CODE/DTC P0010:00, P0335:00, P0340:00 or P1380:00 also present?	Yes	Go to the applicable DTC inspection. (See DTC P0010:00 [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].) (See DTC P0335:00 [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].) (See DTC P0340:00 [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].) (See DTC P1380:00 [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].) Go to the next step.
		No	Go to the next step.

STEP	INSPECTION	RESULTS	ACTION
		No	Inspect the MAIN 200 A fuse and EVVT 20 A fuse. • If the fuse is blown: — Refer to the wiring diagram and verify whether or not there is a common connector between battery positive terminal and electric variable valve timing relay terminal D. **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 ground. • Repair or replace the malfunctioning part. **If there is no common connector:** • Repair or replace the wiring harness which has a short to ground. • Replace the malfunctioning fuse. • If the fuse is damaged: — Replace the malfunctioning fuse. • If all fuses are normal: — Refer to the wiring diagram and verify whether or not there is a common connector between battery positive terminal and electric variable valve timing relay terminal D. **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 circuit. • Repair or replace the malfunctioning part. **If there is no common connector:**

DTC P2096:00, P2097:00 [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))]

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Note

• To determine the malfunctioning part, proceed with the diagnostics from "Function Inspection Using M-MDS".

Details On DTCs

DESCRIPTION	HO2S fuel injection control system: • P2096:00: Air fuel too lean • P2097:00: Air fuel too rich	
DETECTION CONDITION	Determination conditions	• P2096:00: Depending on the correction deviation of the A/F sensor, a condition in which the fuel feedback correction amount (SHRTFT12) for the HO2S is the specified value (2 %) or more and the sum (SHRTFT12+LONGFT12) of the fuel feedback correction amount and the fuel learning correction amount is the specified value (2.2 %) or more continues for a period of 25 s.
		• P2097:00: Depending on the correction deviation of the A/F sensor, a condition in which the fuel feedback correction amount (SHRTFT12) for the HO2S is the specified value (−2 %) or less and the sum (SHRTFT12+LONGFT12) of the fuel feedback correction amount and the fuel learning correction amount is the specified value (−2.2 %) or less continues for a period of 25 s.
	Preconditions	• HO2S estimated temperature: above 450 °C {842 °F}
	Malfunction determination period	• 25 s period
	Drive cycle	• 2
	Self test type	• CMDTC self test
	Sensor used	• HO2S
FAIL-SAFE FUNCTION	• Not applicable	
VEHICLE STATUS WHEN DTCs ARE OUTPUT	• Illuminates check engine light.	

Repeatability Verification Procedure

1. Warm up the engine to allow the engine coolant temperature to reach 80 °C {176 °F} or more.
2. Shift to 3rd gear and drive the vehicle for 20 min at an engine speed of 1,500 rpm or more and a vehicle speed of 50 km/h {31 mph} or more.

Note

• Match the engine coolant temperature in the recorded FREEZE FRAME DATA/snapshot data, the vehicle speed, and engine speed values to the best extent possible while driving the vehicle.

3. Try to reproduce the malfunction by driving the vehicle for 5 min based on the values in the FREEZE FRAME DATA/snapshot data.

PID Item/Simulation Item Used In Diagnosis

PID/DATA monitor item table

−: Not applicable

Item	Definition	Unit	Condition/Specification
EQ_RAT11_DSD	Target excess air factor (estimated value) to theoretical air/fuel ratio (14.7) by fuel feedback control	−	• Indicate target lambda (Excess air factor = supplied air amount / theoretical air/fuel ratio)
O2S11	A/F sensor current	μA	• Idle (after warm up): Approx. −39 μA • Deceleration fuel cut (accelerator pedal released from engine speed of 4,000 rpm or more): Approx. 3.84 mA
O2S12	HO2S voltage	V	• Idle (after warm up): 0−1.0 V • Deceleration fuel cut (accelerator pedal released from engine speed of 4,000 rpm or more): Approx. 0 V

Simulation item table

Item	Applicable component	Operation	Operation condition	
			Engine condition	Other condition
EVAPCP	Purge solenoid valve	Changes % and forcibly drives/stops purge solenoid valve.	• Under the following conditions: — Ignition is switched ON (engine off) — Idle (no load)	Not applicable

STEP	INSPECTION	RESULTS	ACTION
8	**PURPOSE: VERIFY A/F SENSOR AND HO2S INPUT SIGNAL** • Start the engine and warm it up completely. • Access the following PIDs using the M-MDS: (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].) — O2S11 — O2S12 • Drive the vehicle under the following conditions. **Warning** **• 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.** **• While performing this step, always operate the vehicle in a safe and lawful manner.** — After increasing the engine speed to 3,000 rpm, decelerate using engine braking. • Is the displayed PID value as follows? — O2S11: 0.25 mA or more — O2S12: 0.3 V or less	Yes	Go to Step 10.
		No	Go to the next step.
9	**PURPOSE: INSPECT RELATED SENSOR WIRING HARNESS AND CONNECTOR** • Access the following PIDs using the M-MDS: (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].) — O2S11 — O2S12 • When the PCM, A/F sensor and HO2S are shaken, does the PID value include a PID item which has changed?	Yes	Inspect the related wiring harness and connector. • Repair or replace the malfunctioning part. Go to Troubleshooting Diagnostic Procedure to perform the procedure from Step 13.
		No	Go to Troubleshooting Diagnostic Procedure to perform the procedure from Step 1.
10	**PURPOSE: VERIFY IF MALFUNCTION CAUSED BY FUEL INJECTOR IMPROPER OPERATION** • Start the engine and idle it. • Access the following simulation items using the M-MDS: (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].) — INJ_1 — INJ_2 — INJ_3 — INJ_4 • Using the simulation function, can the change in engine speed be verified when operation of each of the fuel injectors is stopped?	Yes	Go to the next step.
		No	Go to Troubleshooting Diagnostic Procedure to perform the procedure from Step 3.
11	**PURPOSE: VERIFY IF MALFUNCTION CAUSED BY PURGE SOLENOID VALVE IMPROPER OPERATION** • Start the engine and idle it. • Access the EQ_RAT11_DSD PID and simulation item EVAPCP using the M-MDS. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].) • Using the simulation function, does the EQ_RAT11_DSD PID value change when the purge solenoid valve is opened/closed?	Yes	Go to Troubleshooting Diagnostic Procedure to perform the procedure from Step 5.
		No	Go to Troubleshooting Diagnostic Procedure to perform the procedure from Step 4.

STEP	INSPECTION	RESULTS	ACTION
12	PURPOSE: AIR CLEANER ELEMENT • Remove the air cleaner element with the engine is running. (See AIR CLEANER ELEMENT REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION)].) • Does the engine speed increase?	Yes	Inspect the air cleaner element. (See AIR CLEANER ELEMENT INSPECTION [SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION)].) • If there is any malfunction: — Clean or replace the air cleaner element, then go to the next step. (See AIR CLEANER ELEMENT REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION)].) • If there is no malfunction: — Go to the next step.
		No	Go to the next step.
13	PURPOSE: VERIFICATION OF VEHICLE REPAIR COMPLETION • Always reconnect all disconnected connectors. • Clear the DTC from the PCM memory using the M-MDS. (See CLEARING DTC [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].) • Implement the repeatability verification procedure. (See Repeatability Verification Procedure.) • Perform the Pending Trouble Code Access Procedure. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].) • Is the PENDING CODE/DTC P2096:00 or P2097:00 also present?	Yes	Repeat the inspection from Step 1. • If the malfunction recurs, replace the PCM. (See PCM REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION)].) Go to the next step.
		No	Go to the next step.
14	PURPOSE: VERIFY IF THERE IS ANY OTHER MALFUNCTION • Is any other DTC or pending code stored?	Yes	Go to the applicable DTC inspection. (See DTC TABLE [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].)
		No	DTC troubleshooting completed.

STEP	INSPECTION	RESULTS	ACTION
3	VERIFY RELATED PENDING CODE AND/OR DTC • Switch the ignition off, then ON (engine off). • Perform the Pending Trouble Code Access Procedure and DTC Reading Procedure. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].) • Is the PENDING CODE/DTC P0301:00 also present?	Yes	Go to the applicable PENDING CODE or DTC inspection. (See DTC P0301:00, P0302:00, P0303:00, P0304:00 [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].)
		No	Go to the next step.
4	INSPECT IGNITION COIL/ION SENSOR No.1 CONNECTOR CONDITION • Switch the ignition off. • Disconnect the ignition coil/ion sensor No.1 connector. • Inspect for poor connection (such as damaged/pulled-out pins, corrosion). • Is there any malfunction?	Yes	Repair or replace the connector and/or terminals, then go to Step 12.
		No	Go to the next step.

STEP	INSPECTION	RESULTS	ACTION
10	**INSPECT ION SENSOR No.1 SIGNAL CIRCUIT FOR OPEN CIRCUIT** • Verify that the ignition coil/ion sensor No.1 and PCM connectors are disconnected. • Switch the ignition off. • Inspect for continuity between ignition coil/ion sensor No.1 terminal C (wiring harness-side) and PCM terminal 1AL (wiring harness-side). • Is there continuity?	Yes	Go to the next step.
		No	Refer to the wiring diagram and verify whether or not there is a common connector between ignition coil/ion sensor No.1 terminal C and PCM terminal 1AL. **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 circuit. • Repair or replace the malfunctioning part. **If there is no common connector:** • Repair or replace the wiring harness which has an open circuit. Go to Step 12.
11	**INSPECT ION SENSOR No.1** • Inspect the ion sensor No.1. (See ION SENSOR INSPECTION [SKYACTIV-G (WITHOUT EGR COOLER)].) • Is there any malfunction?	Yes	Replace the ignition coil/ion sensor No.1, then go to the next step. (See IGNITION COIL/ION SENSOR REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION)].)
		No	Go to the next step.
12	**VERIFY DTC TROUBLESHOOTING COMPLETED** • Always reconnect all disconnected connectors. • Clear the DTC from the PCM memory using the M-MDS. (See CLEARING DTC [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].) • Perform the KOER self test. (See KOEO/KOER SELF TEST [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].) • Is the same Pending DTC present?	Yes	Repeat the inspection from Step 1. • If the malfunction recurs, replace the PCM. (See PCM REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION)].) Go to the next step.
		No	Go to the next step.
13	**VERIFY AFTER REPAIR PROCEDURE** • Perform the "AFTER REPAIR PROCEDURE". (See AFTER REPAIR PROCEDURE [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].) • Are any DTCs present?	Yes	Go to the applicable DTC inspection. (See DTC TABLE [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].)
		No	DTC troubleshooting completed.

STEP	INSPECTION	RESULTS	ACTION
3	VERIFY RELATED PENDING CODE AND/OR DTC • Switch the ignition off, then ON (engine off). • Perform the Pending Trouble Code Access Procedure and DTC Reading Procedure. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].) • Is the PENDING CODE/DTC P0302:00 also present?	Yes	Go to the applicable PENDING CODE or DTC inspection. (See DTC P0301:00, P0302:00, P0303:00, P0304:00 [PCM (SKYACTIV-G 2.5 (WITH CYLINDER DEACTIVATION))].)
		No	Go to the next step.
4	INSPECT IGNITION COIL/ION SENSOR No.2 CONNECTOR CONDITION • Switch the ignition off. • Disconnect the ignition coil/ion sensor No.2 connector. • Inspect for poor connection (such as damaged/pulled-out pins, corrosion). • Is there any malfunction?	Yes	Repair or replace the connector and/or terminals, then go to Step 12.
		No	Go to the next step.