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1990 MAZDA MX-5 / Miata OEM Service and Repair Workshop Manual

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DESCRIPTION	Random misfire detected
POSSIBLE CAUSE	• Fuel shortage in fuel tank • Fuel injector malfunction — Fuel injector connector or terminals malfunction — Fuel injector related circuit malfunction • Erratic signal to PCM — CKP sensor signal malfunction — ECT sensor No.1 signal malfunction — MAF sensor signal malfunction — IAT sensor No.1 signal malfunction — CMP sensor signal malfunction — A/F sensor signal malfunction — EGR valve position sensor signal malfunction — EGR cooler bypass valve position sensor signal malfunction — APP sensor signal malfunction — VSS signal malfunction — Related connector or terminals malfunction — Related wiring harness malfunction • Air suction or restriction in intake-air system (between MAF sensor and intake manifold) • MAF sensor malfunction • Turbocharger malfunction (turbine wheel and/or compressor wheel damaged, stuck) • CMP sensor malfunction • CKP sensor malfunction — Foreign matter on CKP sensor — Damaged or scratched CKP sensor pulse wheel • Improper operation of fuel injector • Fuel pressure sensor No.2 (built-into fuel injector No.2) malfunction • Fuel pressure sensor No.3 (built-into fuel injector No.3) malfunction • Fuel system malfunction — Suction control valve malfunction — Supply pump malfunction — Fuel line restricted or leakage • Engine malfunction — Insufficient engine compression — Engine coolant leakage to combustion chamber — Cylinder No.1 power system malfunction (such as piston, cylinder) — Cylinder No.2 power system malfunction (such as piston, cylinder) — Cylinder No.3 power system malfunction (such as piston, cylinder) — Cylinder No.4 power system malfunction (such as piston, cylinder) • Poor fuel quality • PCM malfunction

System Wiring Diagram

• Not applicable.

Function Explanation (DTC Detection Outline)

• The PCM detects the crankshaft rotation speed based on the crankshaft position sensor signal. While the engine is running, the crankshaft rotation speed fluctuates slightly by the effect of combustion in each cylinder, however, the rotation speed changes rapidly if a misfire occurs in any of the cylinders. The PCM adds the number of changes in rapid rotation speed (misfire rate) for every specified crankshaft rotation speed, and if the misfire rate exceeds a certain value, a DTC is stored.

Item	Definition	Unit	Condition/Specification
MF_EMI_2	Number of misfires in No.2 cylinder under conditions required by emission regulations	–	• Displays number of misfires possibly affecting emission (No.2 cylinder)
MF_EMI_3	Number of misfires in No.3 cylinder under conditions required by emission regulations	–	• Displays number of misfires possibly affecting emission (No.3 cylinder)
MF_EMI_4	Number of misfires in No.4 cylinder under conditions required by emission regulations	–	• Displays number of misfires possibly affecting emission (No.4 cylinder)
RPM	Engine speed	RPM	• Displays engine speed
TP_REL	Throttle valve opening angle (relative value) with value at throttle valve fully close timing as the start point	%	• Accelerator pedal released: Approx. 12% • Accelerator pedal fully depressed: Approx. 82%
VSS	Vehicle speed	KPH, MPH	• Displays vehicle speed

Function Inspection Using M-MDS

STEP	INSPECTION	RESULTS	ACTION
1	**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.
2	**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.
3	**PURPOSE: 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-D 2.2)].) • Is the PENDING CODE/DTC P115A:00, P0313:00 or P115B:00 also present?	Yes	Go to the applicable PENDING CODE or DTC inspection. (See DTC P115A:00 [PCM (SKYACTIV-D 2.2)].) (See DTC P0313:00 [PCM (SKYACTIV-D 2.2)].) (See DTC P115B:00 [PCM (SKYACTIV-D 2.2)].)
		No	Go to the next step.
4	**PURPOSE: VERIFY IF DIAGNOSTIC RESULT IS AFFECTED BY DTC OCCURRING FROM FUEL INJECTOR** • Perform the Pending Trouble Code Access Procedure and DTC Reading Procedure. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-D 2.2)].) • Is a DTC related to the fuel injector present?	Yes	Go to the applicable PENDING CODE or DTC inspection. (See DTC TABLE [PCM (SKYACTIV-D 2.2)].)
		No	Go to the next step.

STEP	INSPECTION	RESULTS	ACTION
1	**PURPOSE: INSPECT INTAKE AIR SYSTEM FOR EXCESSIVE AIR SUCTION** • Visually inspect for loose, cracked or damaged hoses on intake air system. **Note** **• Engine speed may change when rust penetrating agent is sprayed on the air suction area.** • Is there any malfunction?	Yes	Repair or replace the malfunctioning part according to the inspection results, then go to Step 15.
		No	Go to the next step.
2	**PURPOSE: INSPECT FOR RESTRICTION OR CLOGGED IN INTAKE AIR SYSTEM** • Verify if there is restriction or clogged into the intake air system (such as between MAF sensor and intake manifold). • Is there any malfunction?	Yes	Repair or replace the malfunctioning part according to the inspection results, then go to Step 15.
		No	Go to the next step.
3	**PURPOSE: INSPECT TURBOCHARGER** • Inspect the turbocharger. (See TURBOCHARGER INSPECTION [SKYACTIV-D 2.2].) • Is there any malfunction?	Yes	Replace the turbocharger, then go to Step 15. (See TURBOCHARGER REMOVAL/INSTALLATION [SKYACTIV-D 2.2].)
		No	Replace the MAF sensor/IAT sensor No.1, then go to Step 15. (See MASS AIR FLOW (MAF) SENSOR/INTAKE AIR TEMPERATURE (IAT) SENSOR NO.1 REMOVAL/INSTALLATION [SKYACTIV-D 2.2].)
4	**PURPOSE: DETERMINE INTEGRITY OF CMP SENSOR** • Inspect the CMP sensor. (See CAMSHAFT POSITION (CMP) SENSOR INSPECTION [SKYACTIV-D 2.2].) • Is there any malfunction?	Yes	Replace the CMP sensor, then go to Step 15. (See CAMSHAFT POSITION (CMP) SENSOR REMOVAL/INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
5	**PURPOSE: DETERMINE INTEGRITY OF CKP SENSOR** • Inspect the CKP sensor. (See CRANKSHAFT POSITION (CKP) SENSOR INSPECTION [SKYACTIV-D 2.2].) • Is there any malfunction?	Yes	Replace the CKP sensor, then go to Step 15. (See CRANKSHAFT POSITION (CKP) SENSOR REMOVAL/INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
6	**PURPOSE: INSPECT CKP SENSOR PULSE WHEEL** • Visually inspect the CKP sensor pulse wheel. • Is there any damage or scratching on the CKP sensor pulse wheel?	Yes	Replace the CKP sensor pulse wheel, then go to Step 15.
		No	Go to the next step.
7	**PURPOSE: INSPECT FUEL INJECTOR OPERATION** • Perform the Fuel Injector Operation Inspection. (See ENGINE CONTROL SYSTEM OPERATION INSPECTION [SKYACTIV-D 2.2].) • Is there any malfunction?	Yes	Repair or replace the malfunctioning part according to the inspection results, then go to Step 15.
		No	Go to the next step.
8	**PURPOSE: INSPECT FUEL PRESSURE SENSOR No.2 AND No.3** • Inspect the fuel pressure sensor No.2 and No.3. (See FUEL PRESSURE SENSOR INSPECTION [SKYACTIV-D 2.2].) • Is there any malfunction?	Yes	Replace the suspected fuel injector, then go to Step 15. (See FUEL INJECTOR REMOVAL/INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.
9	**PURPOSE: INSPECT SUCTION CONTROL VALVE** • Inspect the suction control valve. (See SUCTION CONTROL VALVE INSPECTION [SKYACTIV-D 2.2].) • Is there any malfunction?	Yes	Replace the suction control valve, then go to Step 15. (See SUCTION CONTROL VALVE REMOVAL/INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.

DTC P0301:00, P0302:00, P0303:00, P0304:00 [PCM (SKYACTIV-D 2.2)]

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Note

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

Details On DTCs

DESCRIPTION	**P0301:00: Cylinder No.1 misfire detected** **P0302:00: Cylinder No.2 misfire detected** **P0303:00: Cylinder No.3 misfire detected** **P0304:00: Cylinder No.4 misfire detected**	
DETECTION CONDITION	Determination conditions	• The misfire rate for every 1,000 rotations of the crankshaft is 5% or more
	Preconditions	• Battery voltage: 8 V or more *1 • Engine speed: 650–4,200 rpm *1 • Engine coolant temperature: 21 °C {70 °F} or more *1 • Not cranking • Not stalling • Fuel-cut control not implemented • VERIFY IF MISFIRE IS OCCURRING • Verify if a misfire is occurring referring to the troubleshooting procedure for DTC P0300:00. • The following DTCs are not detected: — Fuel injector: P0201:00, P0202:00, P0203, P0204:00, P2146:00, P2147:00, P2148:00, P2149:00, P2150:00, P2151:00, P1378:00, P1379:00 — Misfire Detection: P0300:00, P0301:00, P0302:00, P0303:00, P0304:00 *1: Standard can be verified by displaying PIDs using the M-MDS
	Malfunction determination period	• 1,000 rotations of crankshaft (misfire going against emission regulations)
	Drive cycle	• 2
	Self test type	• CMDTC self test
	Sensor used	• CKP sensor • Fuel injector No.1 • Fuel injector No.2 • Fuel injector No.3 • Fuel injector No.4 • ECT sensor
FAIL-SAFE FUNCTION	• Fuel injection for the cylinder misfiring the most is cut. • Inhibits the automatic diesel particulate filter regeneration control /compulsory diesel particulate filter regeneration control. • Inhibits the DENOx/DESOx control. • Inhibits the EGR control. • PCM restricts engine-transaxle integration control.	
VEHICLE STATUS WHEN DTCs ARE OUTPUT	• Illuminates check engine light.	

STEP	INSPECTION	RESULTS	ACTION
3	**PURPOSE: 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-D 2.2)].) • Is the PENDING CODE/DTC P115A:00, P0313:00 or P115B:00 also present?	Yes	Go to the applicable PENDING CODE or DTC inspection. (See DTC P115A:00 [PCM (SKYACTIV-D 2.2)].) (See DTC P0313:00 [PCM (SKYACTIV-D 2.2)].) (See DTC P115B:00 [PCM (SKYACTIV-D 2.2)].)
		No	Go to the next step.
4	**PURPOSE: VERIFY IF DIAGNOSTIC RESULT IS AFFECTED BY DTC OCCURRING FROM FUEL INJECTOR** • Perform the Pending Trouble Code Access Procedure and DTC Reading Procedure. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-D 2.2)].) • Is a DTC related to the fuel injector present?	Yes	Go to the applicable PENDING CODE or DTC inspection. (See DTC TABLE [PCM (SKYACTIV-D 2.2)].)
		No	Go to the next step.
5	**PURPOSE: VERIFY CURRENT INPUT SIGNAL STATUS (KEY TO ON/IDLE)** • Start the engine. • Access the following PIDs using the M-MDS: (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-D 2.2)].) — ECT — IAT — MAF — RPM — APP1 — APP2 — O2S11 — EGRP — EGRB_DC_POS — VSS • Is there any signal that is far out of specification when the ignition is switched to ON and the engine idles? (See PCM INSPECTION [SKYACTIV-D 2.2].)	Yes	Inspect the suspected sensor and related wiring harness. • If there is any malfunction: — Repair or replace the malfunctioning part. — Go to the troubleshooting procedure to perform the procedure from Step 15. • If there is no malfunction: — Go to the next step.
		No	Go to the next step.
6	**PURPOSE: VERIFY CURRENT INPUT SIGNAL STATUS UNDER FREEZE FRAME DATA/SNAPSHOT DATA CONDITION** **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.** • Access the same PIDs as in Step 5 while simulating under the FREEZE FRAME DATA/snapshot data conditions. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-D 2.2)].) • Is there any signal which causes drastic changes?	Yes	Inspect the suspected sensor and related wiring harness. • If there is any malfunction: — Repair or replace the malfunctioning part. — Go to the troubleshooting procedure to perform the procedure from Step 15. • If there is no malfunction: — Go to the next step.
		No	Go to the next step.
7	**PURPOSE: VERIFY CURRENT INPUT SIGNAL STATUS OF MAF SENSOR** • Start the engine. • Access the MAF PID using the M-MDS. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-D 2.2)].) • Verify that the MAF PID value changes quickly while increasing (racing) the engine rpm. • Is the MAF PID value normal? (See PCM INSPECTION [SKYACTIV-D 2.2].)	Yes	Go to the troubleshooting procedure to perform the procedure from Step 4.
		No	Go to the troubleshooting procedure to perform the procedure from Step 1.

STEP	INSPECTION	RESULTS	ACTION
12	PURPOSE: INSPECT ENGINE COMPRESSION • Inspect the engine compression. (See COMPRESSION INSPECTION [SKYACTIV-D 2.2].) • Are compression pressures within specification?	Yes	Go to the next step.
		No	Repair or replace the malfunctioning part according to the inspection results, then go to Step 15.
13	PURPOSE: INSPECT SEALING OF ENGINE COOLANT PASSAGE • Perform the "ENGINE COOLANT LEAKAGE INSPECTION". (See ENGINE COOLANT LEAKAGE INSPECTION [SKYACTIV-D 2.2].) • Does the radiator cap tester needle drop even though there is no engine coolant leakage from the radiator or the hoses?	Yes	Engine coolant leakage from the engine (between the combustion chamber and the engine coolant passage) may have occurred. • Verify the conditions of the gasket and the cylinder head. — If there is any malfunction: • Repair or replace the malfunctioning part according to the inspection results, then go to Step 15.
		No	Go to the next step.
14	PURPOSE: INSPECT FOR MALFUNCTION DUE TO POOR FUEL • Replace the fuel. (See FUEL DRAINING PROCEDURE [SKYACTIV-D 2.2].) • Clear the DTC from the PCM memory using the M-MDS. (See CLEARING DTC [PCM (SKYACTIV-D 2.2)].) • Implement the repeatability verification procedure. (See Function Explanation (DTC Detection Outline).) • Perform the DTC Reading Procedure. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-D 2.2)].) • Is the same DTC present?	Yes	Remove the accumulated matter in the cylinder head using the following procedure, then go to the next step. • Carbon remover • Overhauling
		No	Advise the customer as to the change in the fuel used. Go to Step 16.
15	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-D 2.2)].) • Implement the repeatability verification procedure. (See Repeatability Verification Procedure.) • Perform the DTC Reading Procedure. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-D 2.2)].) • Is the same DTC present?	Yes	Repeat the inspection from Step 1. • If the malfunction recurs, replace the PCM. (See PCM REMOVAL/INSTALLATION [SKYACTIV-D 2.2].) Go to the next step.
		No	Go to the next step.
16	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-D 2.2)].)
		No	DTC troubleshooting completed.

DESCRIPTION	EGR flow insufficient detected
POSSIBLE CAUSE	• Erratic signal to PCM — Exhaust gas pressure sensor No.1 signal malfunction — Exhaust gas temperature sensor No.1 signal malfunction — MAF sensor signal malfunction — MAP sensor No.2 signal malfunction — Input signal part connector or terminals malfunction — Input signal part related circuit malfunction • Open or short circuit in wiring harness between the following terminals: — MAF sensor−PCM — MAP sensor No.2−PCM — Exhaust gas pressure sensor No.1−PCM — Exhaust gas temperature sensor No.1−PCM • Intake shutter valve malfunction • Intake shutter valve position sensor malfunction • EGR valve malfunction (stuck close) • EGR valve position sensor malfunction • Exhaust gas leakage from exhaust system or clogging (EGR) • Air suction in intake air system between turbocharger and intake manifold • Air suction or clogged in EGR cooler bypass valve • PCM malfunction

System Wiring Diagram

• Not applicable

Function Explanation (DTC Detection Outline)

• The PCM performs diagnosis of the EGR system by comparing the target EGR volume with the actual.
• The PCM monitors the flow volume during EGR implementation.
• The PCM calculates the difference between the target EGR flow volume and the actual EGR flow volume during EGR implementation. If the monitored, actual flow volume is lower than the specification for the target flow volume, the PCM determines that there is inadequate flow volume.
• The PCM performs diagnosis when each of the preconditions the during drive cycle is met. If a malfunction is detected, the malfunction detection counter begins counting up. If it is normal, the counter begins counting down. The value of the malfunction detection counter is maintained while the preconditions are not being met. If the cumulative value of the malfunction detection counter exceeds the threshold during the first drive cycle, a malfunction is determined and a pending code is stored.
• If the PCM determines that the malfunction recurs from the next drive cycle and thereafter, it stores a DTC and turns on the check engine light.

STEP	INSPECTION		ACTION
6	PURPOSE: VERIFY CONNECTOR CONNECTIONS • Access the following PIDs using the M-MDS: (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-D 2.2)].) — EXHPRES1 — EXHTEMP1 — MAF — INTK_MAPA • When the following parts are shaken, does the PID value include a PID item which has changed? — Exhaust gas pressure sensor No.1 — Exhaust gas temperature sensor No.1 — MAF sensor — MAP sensor No.2 — PCM	Yes	Inspect the related wiring harness and connector. • Repair or replace the malfunctioning part. Go to the troubleshooting procedure to perform the procedure from Step 9.
		No	Go to the troubleshooting procedure to perform the procedure from Step 1.

Troubleshooting Diagnostic Procedure

Intention of troubleshooting procedure

• Step 1

— Verify whether malfunction is related wiring harness or other

• Step 2–5

— Perform inspection of each separate part.

• Step 6–8

— Perform inspection of EGR valve passage

• Step 9–10

— Verify that the primary malfunction is resolved and there are no other malfunctions.

STEP	INSPECTION		ACTION
1	PURPOSE: INSPECT WHETHER MALFUNCTION IS WIRING HARNESS OR OTHER • Perform the KOEO self test. (See KOEO/KOER SELF TEST [PCM (SKYACTIV-D 2.2)].) • Is the MAF sensor, MAP sensor No.2, exhaust gas pressure sensor No.1 and/or exhaust gas temperature sensor No.1 related DTC present?	Yes	Go to the applicable DTC inspection. (See DTC TABLE [PCM (SKYACTIV-D 2.2)].)
		No	Go to the next step.
2	PURPOSE: INSPECT INTAKE SHUTTER VALVE CONTROL SYSTEM OPERATION • Perform the Intake Shutter Valve Operation Inspection. (See ENGINE CONTROL SYSTEM OPERATION INSPECTION [SKYACTIV-D 2.2].) • Is there any malfunction?	Yes	Repair or replace the malfunctioning part according to the inspection results, then go to Step 9.
		No	Go to the next step.
3	PURPOSE: INSPECT INTAKE SHUTTER VALVE POSITION SENSOR • Inspect the intake shutter valve position sensor. (See INTAKE SHUTTER VALVE POSITION SENSOR INSPECTION [SKYACTIV-D 2.2].) • Is there any malfunction?	Yes	Replace the intake shutter valve, then go to Step 9. (See INTAKE SHUTTER VALVE REMOVAL/INSTALLATION [SKYACTIV-D 2.2].)
		No	Go to the next step.

DTC P0480:00 [PCM (SKYACTIV-D 2.2)]

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DTC P0480:00	Fan control module No.1 control circuit problem
DETECTION CONDITION	• The PCM monitors the input voltage from the fan control module No.1. If the voltage at the PCM terminal 2BG remains low or high for 5 s, the PCM determines that the fan control circuit has a malfunction. Diagnostic support note • This is a continuous monitor (Other). • The check engine light does not illuminate. • FREEZE FRAME DATA is not available. • Snapshot data is available. • DTC is stored in the PCM memory.
FAIL-SAFE FUNCTION	• Not applicable
POSSIBLE CAUSE	• Fan control module No.1 connector or terminals malfunction • Cooling fan relay No.1 terminals malfunction • Cooling fan relay No.1 malfunction • Short to ground or open circuit in cooling fan relay No.1 power supply circuit — Short to ground in wiring harness between MAIN 200 A fuse and cooling fan relay No.1 terminal A — MAIN 200 A fuse malfunction — FAN DE 40 A fuse malfunction — Open circuit in wiring harness between battery positive terminal and cooling fan relay No.1 terminal A • Short to ground or open circuit in cooling fan relay No.1 power supply circuit — Short to ground in wiring harness between ENGINE3 15 A fuse and cooling fan relay No.1 terminal B — ENGINE3 15 A fuse malfunction — Open circuit in wiring harness between blow-by heater relay terminal D and cooling fan relay No.1 terminal B • PCM connector or terminals malfunction • Short to ground in wiring harness between the following terminals: — Cooling fan relay No.1 terminal C—Fan control module No.1 terminal A — Cooling fan relay No.1 terminal D—PCM terminal 2AU • Open circuit in wiring harness between the following terminals: — Cooling fan relay No.1 terminal C—Fan control module No.1 terminal A — Cooling fan relay No.1 terminal D—PCM terminal 2AU • Open circuit in wiring harness between fan control module No.1 terminal C and body ground • Short to ground in wiring harness between fan control module No.1 terminal B and PCM terminal 2BG • Short to power supply in wiring harness between fan control module No.1 terminal B and PCM terminal 2BG • Open circuit in wiring harness between fan control module No.1 terminal B and PCM terminal 2BG • Fan control module No.1 malfunction • PCM malfunction