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2003 MAZDA RX-8 OEM Service and Repair Workshop Manual

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12	LACK/LOSS OF POWER-ACCELERATION/CRUISE
POSSIBLE CAUSE	• Engine overheating • The engine torque control is activated when the engine coolant temperature is high • Drive-by-wire control system operates with brake override system • PCM DTC is stored • Erratic signal to PCM — APP sensor or related circuit malfunction — Communication error between TCM and PCM — ECT sensor No.1 or related circuit malfunction — Fuel pressure sensor or related circuit malfunction — IAT sensor No.1 (integrated in MAF sensor/IAT sensor No.1) or related circuit malfunction — MAF sensor or related circuit malfunction — MAP sensor or related circuit malfunction — A/F sensor or related circuit malfunction — HO2S or related circuit malfunction • Improper operation of A/C system • Improper operation of drive-by-wire control system • Throttle body malfunction • Incorrect fuel injection timing • Fuel injector malfunction • Purge solenoid valve malfunction • Fuel leakage • Poor fuel quality • Air leakage or restriction in intake-air system • Vacuum leakage • Air cleaner restricted or dirty • Brake dragging • Tire air pressure malfunction • Erratic signal from CKP sensor — Loose installation — Damaged trigger wheel (crankshaft pulley) — Open or short circuit in related wiring harness • Erratic or no signal from CMP sensor — Loose installation — Damaged trigger wheel (intake camshaft) — Damaged trigger wheel (exhaust camshaft) — Open or short circuit in related wiring harness • Inadequate fuel pressure (high or low pressure side) — Fuel pressure sensor malfunction — High pressure fuel pump malfunction — Spill valve control solenoid valve control circuit malfunction (damage to driver in PCM caused by short circuit to ground system) — Spill valve control solenoid valve (built-into high pressure fuel pump) malfunction — Relief valve (built-into high pressure fuel pump) malfunction — Fuel line restricted or clogged — Fuel filter clogged (built-into fuel pump unit) — Fuel pump mechanical malfunction • Throttle valve restricted or clogged • Low engine compression • Improper intake valve timing • Improper exhaust valve timing • Improper operation of electric variable valve timing control system — Electric variable valve timing driver malfunction — Electric variable valve timing motor malfunction — Electric variable valve timing actuator malfunction • Improper operation of hydraulic variable valve timing control system • Spark plug malfunction • Ignition coil malfunction

STEP	INSPECTION	RESULTS	ACTION
2	**VERIFY IF MALFUNCTION CAUSE IS OVERHEATING** • Access the ECT PID using the M-MDS. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION))].) **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.** **Note** **• When engine coolant temperature is high or engine body is high temperature, PCM restricts engine torque.** • Is the ECT PID value less than 116 °C {241 °F} during driving?	Yes	Go to the next step.
		No	Perform the symptom troubleshooting "NO.17 COOLING SYSTEM CONCERNS-OVERHEATING". (See NO.17 COOLING SYSTEM CONCERNS-OVERHEATING [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].)
3	**CONFIRM DRIVE-BY-WIRE CONTROL SYSTEM OPERATES WITH BRAKE OVERRIDE SYSTEM** • Retrieve the PCM DTC using the M-MDS. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION))].) • Is the DTC P2299:00 present?	Yes	Go to the applicable DTC inspection. (drive-by-wire control system operates with brake override system.) (See DTC P2299:00 [PCM (SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION))].)
		No	Go to the next step.
4	**VERIFY PCM DTC** • Retrieve PCM DTCs using the M-MDS. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION))].) • Are any DTCs present?	Yes	Go to the applicable DTC inspection. (See DTC TABLE [PCM (SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION))].)
		No	Go to the next step.

STEP	INSPECTION	RESULTS	ACTION
10	INSPECT RELATED PART CONDITION • Inspect the following: — Fuel quality (proper octane, contamination, winter/summer blend) — Air leakage or restriction in intake-air system — Vacuum leakage — Air cleaner restricted or dirty — Brake dragging — Tire air pressure — CKP sensor and intake CMP sensor • Installation condition (See CRANKSHAFT POSITION (CKP) SENSOR REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) (See CAMSHAFT POSITION (CMP) SENSOR REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Damaged trigger wheel (intake camshaft) — Exhaust CMP sensor • Installation condition (See CAMSHAFT POSITION (CMP) SENSOR REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Damaged trigger wheel (exhaust camshaft) • Is there any malfunction?	Yes	Service if necessary. • Repeat this step.
		No	Go to the next step.

STEP	INSPECTION	RESULTS	ACTION
16	**INSPECT ELECTRIC VARIABLE VALVE TIMING DRIVER** • Inspect the electric variable valve timing driver. (See ELECTRIC VARIABLE VALVE TIMING MOTOR/DRIVER INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is there any malfunction?	Yes	Replace the electric variable valve timing motor/driver. (See ELECTRIC VARIABLE VALVE TIMING MOTOR/DRIVER REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].)
		No	Go to the next step.
17	**INSPECT ELECTRIC VARIABLE VALVE TIMING MOTOR** • Inspect the electric variable valve timing motor. (See ELECTRIC VARIABLE VALVE TIMING MOTOR/DRIVER INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is there any malfunction?	Yes	Replace the electric variable valve timing motor/driver. (See ELECTRIC VARIABLE VALVE TIMING MOTOR/DRIVER REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].)
		No	Go to the next step.
18	**INSPECT ELECTRIC VARIABLE VALVE TIMING ACTUATOR** • Inspect the electric variable valve timing actuator. (See ELECTRIC VARIABLE VALVE TIMING ACTUATOR INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is there any malfunction?	Yes	Replace the electric variable valve timing actuator. (See ELECTRIC VARIABLE VALVE TIMING ACTUATOR, HYDRAULIC VARIABLE VALVE TIMING ACTUATOR REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].)
		No	Go to the next step.
19	**INSPECT HYDRAULIC VARIABLE VALVE TIMING CONTROL SYSTEM OPERATION** • Perform the Hydraulic Variable Valve Timing Control System Operation Inspection. (See ENGINE CONTROL SYSTEM OPERATION INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is there any malfunction?	Yes	Repair or replace the malfunctioning part according to the inspection results.
		No	Go to the next step.
20	**INSPECT FOR MALFUNCTION DUE TO DEVIATED VALVE TIMING** • Inspect the valve timing (timing chain installation condition). (See TIMING CHAIN REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is the valve timing normal?	Yes	Inspect for the following engine internal parts: • Cylinder • Piston ring • Intake valve • Exhaust valve • Such as cylinder head gasket — If there is any malfunction: • Repair or replace the malfunctioning part according to the inspection results.
		No	Adjust the valve timing to the correct timing.

STEP	INSPECTION	RESULTS	ACTION
2	VERIFY IF MALFUNCTION SYMPTOM IS CAUSED BY OTHER MALFUNCTION Note • There are few malfunction affecting only the fuel economy, therefore it is necessary to verify that other malfunctions are not appearing as symptoms. • Verify the vehicle engine condition. • Can malfunction symptoms other than "NO.14 POOR FUEL ECONOMY" be verified?	Yes	Go to the applicable symptom troubleshooting. (See SYMPTOM DIAGNOSTIC INDEX [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].)
		No	Go to the next step.
3	INSPECT ENGINE AND VEHICLE CONDITIONS Note • Because the vehicle malfunction cannot be verified, it is necessary to inspect the items which may be adversely affecting fuel consumption. • Perform the following inspections: — Engine oil level (See ENGINE OIL LEVEL INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) — Engine oil contamination — Engine coolant level (See ENGINE COOLANT LEVEL INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) — Engine compression pressure inspection (See COMPRESSION INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) — Spark Test (See ENGINE CONTROL SYSTEM OPERATION INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) — Tire air pressure (See SUSPENSION TECHNICAL DATA.) — Improper ATF level (See AUTOMATIC TRANSAXLE FLUID (ATF) ADJUSTMENT [FW6A-EL, FW6AX-EL].) — Brake dragging • Is there any malfunction?	Yes	Repair or adjust the malfunctioning location and explain the repair contents to the customer based on the inspection result.
		No	Go to the next step.

15	EMISSION COMPLIANCE
POSSIBLE CAUSE	• Engine overheating • Cooling system malfunction • PCM DTC is stored • Incorrect fuel injection timing • Incorrect ignition timing — Spark plug malfunction — Ignition coil malfunction — CMP sensor malfunction — CKP sensor malfunction • Purge solenoid valve malfunction • Inadequate fuel pressure — Fuel leakage at the fuel line and/or fuel injector — Fuel pressure sensor or related circuit malfunction — High pressure fuel pump malfunction — Spill valve control solenoid valve control circuit malfunction (damage to driver in PCM caused by short circuit to ground system) — Spill valve control solenoid valve (built-into high pressure fuel pump) malfunction — Relief valve (built-into high pressure fuel pump) malfunction — Fuel line restriction — Fuel pump unit malfunction • Air leakage from intake-air system • Vacuum lines leakage or blockage • Charcoal canister damage • Improper engine coolant level • Excessive carbon built-up in combustion chamber • Improper engine compression • Improper intake valve timing • Improper exhaust valve timing • Exhaust system and/or TWC restriction • Exhaust gas leakage from exhaust system • TWC malfunction (PCM DTC is stored.) • Positive crankcase ventilation system malfunction — PCV valve malfunction or incorrect valve installation — Clogging in positive crankcase ventilation system hoses (PCV valve hose, ventilation hose) 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. • Fuel line spills and leakage are dangerous. Fuel can ignite and cause serious injury or death and damage. Fuel can also irritate skin and eyes. To prevent this, always complete “BEFORE SERVICE PRECAUTION” and “AFTER SERVICE PRECAUTION” described in this manual. (See BEFORE SERVICE PRECAUTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) (See AFTER SERVICE PRECAUTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) 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 matter.

Caution

• Verify the malfunction symptom according to not only the PID value but also the symptom troubleshooting.

STEP	INSPECTION	RESULTS	ACTION
8	INSPECT FUEL PRESSURE (HIGH-SIDE) • Start the engine and warm it up completely. • Access the FUEL_PRES PID using the M-MDS at idle. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION))].) • Is the FUEL_PRES PID value approx. 10 MPa {102 kgf/cm^2, 1,450 psi}?	Yes	Go to the next step.
		No	Lower than 10 MPa {102 kgf/cm^2, 1,450 psi}: • Inspect the following: — Fuel leakage at the fuel line and fuel injector — Fuel pump • Perform the Fuel Pump (Low-pressure Side) Operation Inspection. (See ENGINE CONTROL SYSTEM OPERATION INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) — Fuel pressure sensor (See FUEL PRESSURE SENSOR INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) — High pressure fuel pump (See HIGH PRESSURE FUEL PUMP INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) Higher than 10 MPa {102 kgf/cm^2, 1,450 psi}: • Inspect the following: — Fuel line and fuel injector restriction — Fuel pressure sensor (See FUEL PRESSURE SENSOR INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) — High pressure fuel pump (Relief valve clogged) Repair or replace the malfunctioning part according to the inspection results, then go to Step 18.
9	INSPECT INTAKE-AIR SYSTEM FOR AIR LEAKAGE • Inspect for leakage in intake-air system. • Is there any leakage?	Yes	Repair or replace the malfunctioning part according to the inspection results, then go to Step 18.
		No	Go to the next step.
10	INSPECT RESTRICTION IN VENTILATION HOSE • Inspect for restriction in the ventilation hose. • Is there any restriction?	Yes	Repair or replace the malfunctioning part according to the inspection results, then go to Step 18.
		No	Go to the next step.
11	VERIFY IF MALFUNCTION CAUSE IS CHARCOAL CANISTER • Inspect the charcoal canister. (See CHARCOAL CANISTER INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is the charcoal canister damaged?	Yes	Repair or replace the malfunctioning part according to the inspection results, then go to Step 18. (See CHARCOAL CANISTER REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].)
		No	Go to the next step.

Step	Inspection	Results	Action
5	DETERMINE IF MALFUNCTION CAUSE IS DUE TO PCV VALVE OR INTERNAL ENGINE MALFUNCTION • Inspect the PCV valve. (See POSITIVE CRANKCASE VENTILATION (PCV) VALVE INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is the PCV valve normal?	Yes	Inspect for internal engine wear, damage. • Cylinder • Piston ring • Intake/exhaust valve • Cylinder head gasket — If there is any malfunction: • Repair or replace the malfunctioning location, then go to the next step.
		No	Replace the PCV valve, then go to the next step. (See POSITIVE CRANKCASE VENTILATION (PCV) VALVE REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].)
6	VERIFY THAT REPAIRS HAVE BEEN COMPLETED • Has the malfunction symptom been eliminated?	Yes	Complete the symptom troubleshooting. (Explain repair contents to customer)
		No	Repeat the inspection from Step 1.

STEP	INSPECTION	RESULTS	ACTION
5	**INSPECT COOLING FAN CONTROL SYSTEM OPERATION** • Perform the Cooling Fan Control System Inspection. (See ENGINE CONTROL SYSTEM OPERATION INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Does the cooling fan control system operate properly?	Yes	Go to the next step.
		No	Repair or replace the malfunctioning part according to the inspection results.
6	**INSPECT COOLING SYSTEM CAP** • Inspect the cooling system cap. (See COOLING SYSTEM CAP INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is there any malfunction?	Yes	Replace the cooling system cap.
		No	Go to the next step.
7	**INSPECT RELATED PART CONDITION** • Inspect the following: — Engine coolant level — Engine coolant performance — Coolant leakage (engine internal, external) — Water and anti-freeze mixture — Thermostat (not fully open) — Radiator (clogging) — Fuses • Is there any malfunction?	Yes	Service if necessary. • Repeat this step.
		No	Go to the next step.
8	**VERIFY IF MALFUNCTION CAUSED BY LACK OF ENGINE COOLANT** • Inspect the engine coolant level. (See ENGINE COOLANT LEVEL INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is there any malfunction?	Yes	Add engine coolant and verify that there is no engine coolant leakage. (See ENGINE COOLANT REPLACEMENT [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) (See ENGINE COOLANT LEAKAGE INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • If there is any malfunction: — Repair or replace the malfunctioning part according to the inspection results.
		No	Go to the next step.