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1999 MAZDA RX-7 (FD) OEM Service and Repair Workshop Manual

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Troubleshooting Diagnostic Procedure

Intention of troubleshooting procedure

- Step 1
  - — Perform a PCM input signal part-related inspection.
- Step 2–4
  - — Verify if there is restriction in atmosphere release passage.
- Step 5
  - — Perform the inspection for a purge solenoid valve stuck open.
- Step 6–7
  - — Verify that the primary malfunction is resolved and there are no other malfunctions.

STEP	INSPECTION	RESULTS	ACTION
1	**PURPOSE: DETERMINE INTEGRITY OF FUEL TANK PRESSURE SENSOR** • Inspect the fuel tank pressure sensor. (See FUEL TANK PRESSURE SENSOR INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is there any malfunction?	Yes	Replace the charcoal canister, then go to Step 6. (See CHARCOAL CANISTER REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].)
		No	Go to the next step.
2	**PURPOSE: DETERMINE INTEGRITY OF CV SOLENOID VALVE** • Inspect the CV solenoid valve. (See CANISTER VENT (CV) SOLENOID VALVE INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is there any malfunction?	Yes	Replace the CV solenoid valve, then go to Step 6. (See CANISTER VENT (CV) SOLENOID VALVE REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].)
		No	Go to the next step.
3	**PURPOSE: VERIFY IF THERE IS RESTRICTION BETWEEN CHARCOAL CANISTER AND ATMOSPHERE RELEASE PASSAGE** • Verify the following passage hoses, pipe connection condition, and that there is no restriction. — Between charcoal canister and CV solenoid valve — Between CV solenoid valve and atmosphere release • Is there any poor connection or restriction?	Yes	Repair or replace the malfunctioning part according to the inspection results, then go to Step 6.
		No	Go to the next step.
4	**PURPOSE: DETERMINE INTEGRITY OF CHARCOAL CANISTER** • Inspect the charcoal canister. (See CHARCOAL CANISTER INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is there any malfunction?	Yes	Replace the charcoal canister, then go to Step 6. (See CHARCOAL CANISTER REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].)
		No	Go to the next step.
5	**PURPOSE: DETERMINE INTEGRITY OF PURGE SOLENOID VALVE** • Inspect the purge solenoid valve. (See PURGE SOLENOID VALVE INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is there any malfunction?	Yes	Replace the purge solenoid valve, then go to the next step. (See PURGE SOLENOID VALVE REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].)
		No	Go to the next step.

DESCRIPTION	P013A:00 • HO2S: Slow response (during transition from rich to lean) P013B:00 • HO2S: Slow response (during transition from lean to rich)
POSSIBLE CAUSE	• HO2S malfunction — HO2S connector or terminals malfunction — HO2S loose — Exhaust system leakage — TWC damaged or malfunction • HO2S deterioration • HO2S heater malfunction • Improper operation of purge control system — Purge solenoid valve malfunction — Improper connection of evaporative hose (purge solenoid valve side) • Engine malfunction — Insufficient engine compression • PCM malfunction

System Wiring Diagram

• Not applicable

Function Explanation (DTC Detection Outline)

P013A:00
• If the rate at which the HO2S output voltage is lowered is slow during fuel cut, a DTC is stored.
P013B:00
• If the speed at which the HO2S output voltage rises is slow during fuel cut recovery, a DTC is stored.

Repeatability Verification Procedure

1. Warm up the engine to allow the engine coolant temperature to reach 80 °C {176 °F} or more.
2. Verify that OBD-II information (such as FREEZE FRAME DATA) has been obtained and recorded.
3. Clear the DTC from the PCM memory using the M-MDS. (See CLEARING DTC [PCM (SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION))].)
4. Switch the ignition off.
5. Drive the vehicle for 15 min at a speed of 40 km/h {25 mph} or more.
6. Shift to 3rd gear and rapidly accelerate the vehicle to 60 km/h {37 mph}.
7. Release the accelerator pedal and decelerate the vehicle to 40 km/h {25 mph}.
8. Repeat Step 5 to 7 operations above 5 times.
9. Try to reproduce the malfunction by driving the vehicle for 5 min based on the values in the FREEZE FRAME DATA/snapshot data.

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.

PID Item/Simulation Item Used In Diagnosis

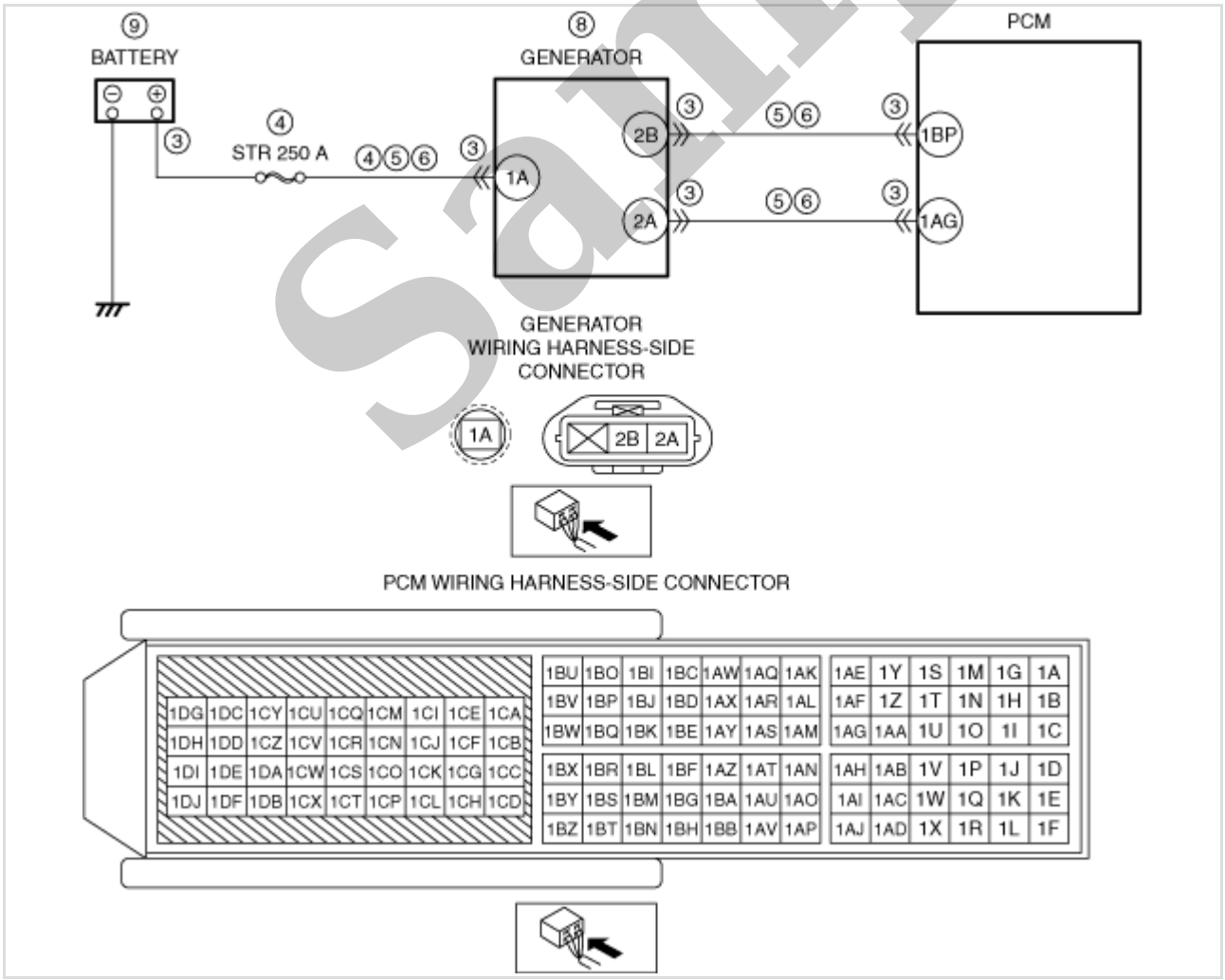
PID/DATA monitor item table

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

STEP	INSPECTION	RESULTS	ACTION
1	PURPOSE: DETERMINE INTEGRITY OF PURGE SOLENOID VALVE • Inspect the purge solenoid valve. (See PURGE SOLENOID VALVE INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is there any malfunction?	Yes	Replace the purge solenoid valve, then go to Step 10. (See PURGE SOLENOID VALVE REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].)
		No	Go to the next step.
2	PURPOSE: VERIFY IF DIAGNOSTIC RESULT IS AFFECTED BY MALFUNCTION RELATED TO POOR EVAPORATIVE HOSE CONNECTION • Verify the connection condition of the evaporative hose (purge solenoid valve side). (See PURGE SOLENOID VALVE REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is the evaporative hose (purge solenoid valve side) connection normal?	Yes	Go to the next step.
		No	Connect evaporative hose correctly, then go to Step 10. (See PURGE SOLENOID VALVE REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].)
3	PURPOSE: VERIFY IF MALFUNCTION RELATED TO ENGINE COMPRESSION AFFECTS DIAGNOSTIC RESULTS • Inspect the engine compression. (See COMPRESSION INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Are compression pressures within specification?	Yes	Go to the next step.
		No	Replace or overhaul the engine, then go to Step 10.
4	PURPOSE: INSPECT HO2S CONNECTOR CONDITION • Switch the ignition off. • Disconnect the HO2S 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 10.
		No	Go to the next step.
5	PURPOSE: INSPECT INSTALLATION OF HO2S • Inspect installation of HO2S. • Is the HO2S installed securely?	Yes	Go to the next step.
		No	Retighten the HO2S, then go to Step 10. (See HEATED OXYGEN SENSOR (HO2S) REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].)
6	PURPOSE: DETERMINE INTEGRITY OF HO2S • Reconnect all disconnected connectors. • Inspect the HO2S. (See HEATED OXYGEN SENSOR (HO2S) INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is there any malfunction?	Yes	Replace the HO2S, then go to Step 10. (See HEATED OXYGEN SENSOR (HO2S) REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].)
		No	Go to the next step.
7	PURPOSE: DETERMINE INTEGRITY OF HO2S HEATER • Inspect the HO2S heater. (See HEATED OXYGEN SENSOR (HO2S) INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is there any malfunction?	Yes	Replace the HO2S, then go to Step 10. (See HEATED OXYGEN SENSOR (HO2S) REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].)
		No	Go to the next step.
8	PURPOSE: INSPECT EXHAUST SYSTEM FOR LEAKAGE • Visually inspect for exhaust gas leakage from the exhaust system. • Is there any malfunction?	Yes	Repair or replace the malfunctioning part according to the inspection results, then go to Step 10.
		No	Go to the next step.

DESCRIPTION	Generator system: Voltage generated by generator is low
POSSIBLE CAUSE	• Poor connection of the following parts: — Battery — Generator — PCM • Connector or terminal malfunction of the following parts: — Battery — Generator — PCM • STR 250 A fuse malfunction • Short to ground in wiring harness between the following terminals: — Battery positive terminal–Generator terminal 1A — Generator terminal 2B–PCM terminal 1BP — Generator terminal 2A–PCM terminal 1AG • Open circuit in wiring harness between the following terminals: — Battery positive terminal–Generator terminal 1A — Generator terminal 2B–PCM terminal 1BP — Generator terminal 2A–PCM terminal 1AG • Drive belt exceeds limit • Generator malfunction • Battery malfunction • PCM malfunction

System Wiring Diagram



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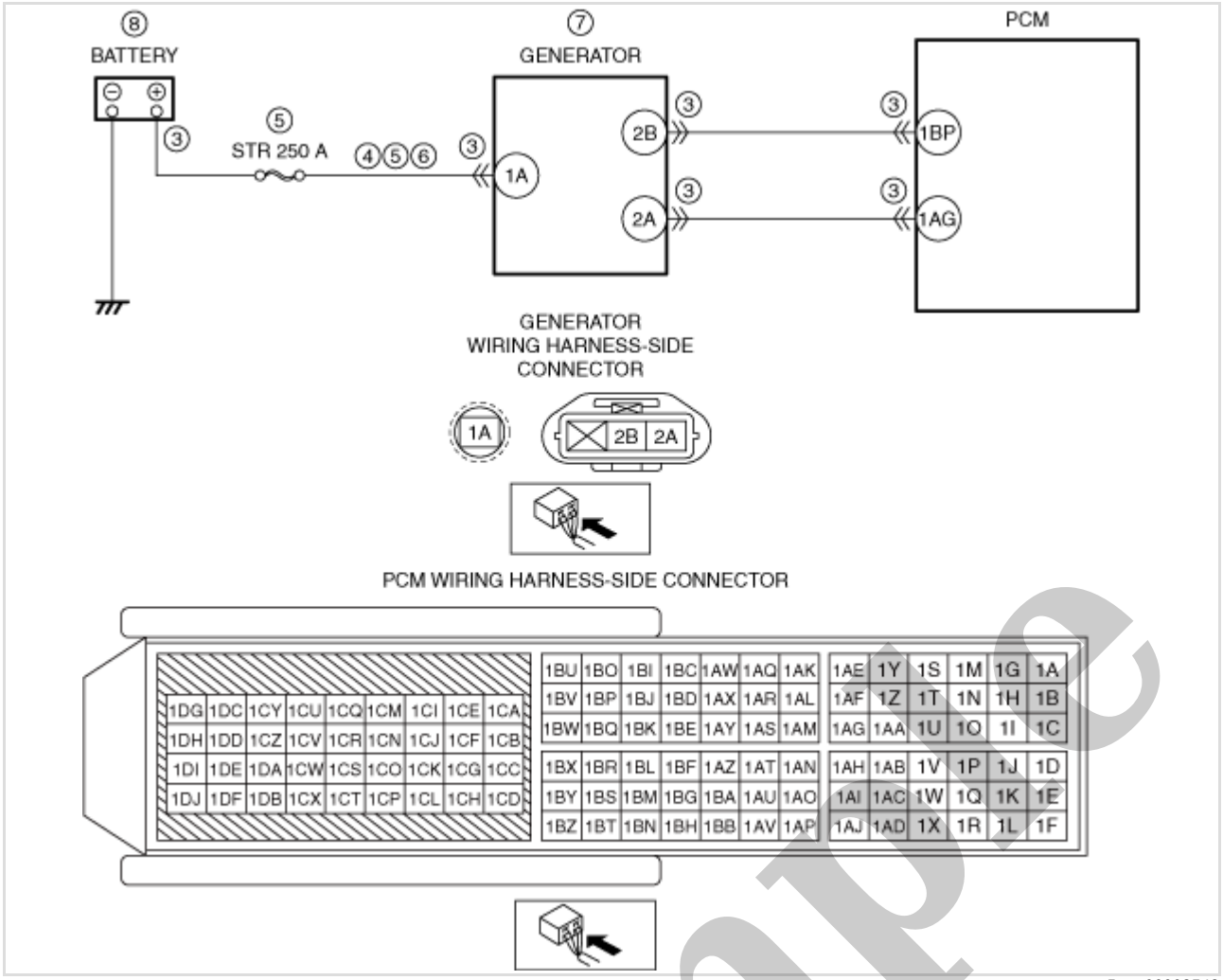
STEP	INSPECTION	RESULTS	ACTION
5	**PURPOSE: VERIFY IF SHORT TO GROUND IN EACH WIRING HARNESS AFFECTS DIAGNOSTIC RESULTS** • Verify that the battery, generator and PCM connectors are disconnected. • Inspect for continuity between the following terminals (wiring harness-side) and body ground: — Generator terminal 1A — Generator terminal 2B — Generator terminal 2A • Is there continuity?	Yes	Refer to the wiring diagram and verify whether or not there is a common connector between the following terminals: • Battery positive terminal–Generator terminal 1A • Generator terminal 2B–PCM terminal 1BP • Generator terminal 2A–PCM terminal 1AG **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. Go to Step 9.
		No	Go to the next step.
6	**PURPOSE: VERIFY IF OPEN CIRCUIT IN EACH WIRING HARNESS AFFECTS DIAGNOSTIC RESULTS** • Verify that the battery, generator and PCM connectors are disconnected. • Inspect for continuity between the following terminals (wiring harness-side): — Battery positive terminal–Generator terminal 1A — Generator terminal 2B–PCM terminal 1BP — Generator terminal 2A–PCM terminal 1AG • 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 the following terminals: • Battery positive terminal–Generator terminal 1A • Generator terminal 2B–PCM terminal 1BP • Generator terminal 2A–PCM terminal 1AG **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 9.
7	**PURPOSE: VERIFY IF MALFUNCTION RELATED TO GENERATOR DRIVE BELT AFFECTS DIAGNOSTIC RESULTS** • Inspect the generator drive belt. (See DRIVE BELT INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is the indicator mark on the drive belt auto tensioner within the normal range?	Yes	Go to the next step.
		No	Replace the generator drive belt, then go to the next step. (See DRIVE BELT REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].)
8	**PURPOSE: DETERMINE INTEGRITY OF GENERATOR** • Inspect the generator. (See GENERATOR INSPECTION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].) • Is there any malfunction?	Yes	Replace the generator, then go to the next step. (See GENERATOR REMOVAL/INSTALLATION [SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION)].)
		No	Go to the next step.
9	**PURPOSE: VERIFY CONDITIONS OF BATTERY** • Inspect the battery. (See BATTERY INSPECTION.)	–	Follow the inspection instructions, then go to the next step.



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Function Explanation (DTC Detection Outline)

• When the charge/discharge circuit for the power supplying the vehicle is normal, the vehicle will operate normally.
• The PCM determines an over-charge malfunction by detecting that the generator terminal voltage or battery terminal voltage are abnormally high, and verification of vehicle malfunctions/safety assurance is performed.

Repeatability Verification Procedure

1. Clear the DTC from the PCM memory using the M-MDS. (See CLEARING DTC [PCM (SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION))].)
2. Start the engine.
3. Leave for 30 s while idling with no electrical load.
4. Leave for 30 s while idling with high electrical load.

PID Item/Simulation Item Used In Diagnosis

• Not applicable

Function Inspection Using M-MDS

STEP	INSPECTION	RESULTS	ACTION
8	PURPOSE: VERIFY CONDITIONS OF BATTERY • Inspect the battery. (See BATTERY INSPECTION.)	–	Follow the inspection instructions, then go to the next step.
9	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 (WITHOUT CYLINDER DEACTIVATION))].) • Implement the repeatability verification procedure. (See Repeatability Verification Procedure.) • Perform the DTC Reading Procedure. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5 (WITHOUT 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 (WITHOUT CYLINDER DEACTIVATION)].) Go to the next step.
		No	Go to the next step.
10	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 (WITHOUT CYLINDER DEACTIVATION))].)
		No	DTC troubleshooting completed.

STEP	INSPECTION	RESULTS	ACTION
4	**INSPECT BACKUP VOLTAGE CIRCUIT FOR SHORT TO GROUND OR OPEN CIRCUIT** • Reconnect all disconnected connectors. • Access the VPWR PID using the M-MDS. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5 (WITHOUT CYLINDER DEACTIVATION))].) • Verify the VPWR PID value. • Is the VPWR PID value B+?	Yes	Go to the next step.
		No	Inspect the MAIN 200 A fuse and ENG.+B 7.5 A fuse. • If the fuse is blown: — Refer to the wiring diagram and verify whether or not there is a common connector between MAIN 200 A fuse and PCM terminal 2A. **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 PCM terminal 2A. **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 6.
5	**INSPECT PCM CONNECTOR CONDITION** • Switch the ignition off. • Disconnect the PCM 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 the next step.
		No	Go to the next step.

DESCRIPTION	Electric variable valve timing control system: • P0011:00: Over-advanced • P0012:00: Over-retarded
POSSIBLE CAUSE	• Electric variable valve timing motor/driver connectors or terminals malfunction • Short to ground or open circuit in electric variable valve timing relay power supply circuit — Short to ground in wiring harness between MAIN 200 A fuse and electric variable valve timing relay terminal D — MAIN 200 A fuse and/or EVVT 20 A fuse malfunction — Open circuit in wiring harness between battery positive terminal and electric variable valve timing relay terminal D • Short to ground in wiring harness between electric variable valve timing relay terminal C and electric variable valve timing motor/driver terminal 2B • Open circuit in wiring harness between electric variable valve timing relay terminal C and electric variable valve timing motor/driver terminal 2B • PCM connector or terminals malfunction • Electric variable valve timing relay malfunction • Electric variable valve timing motor malfunction • Electric variable valve timing actuator malfunction — Electric variable valve timing actuator is stuck in advanced position — Electric variable valve timing actuator is stuck in retarded position • Timing chain malfunction — Poor assembly of timing chain — Looseness or jumping • Mis-detection of intake CMP sensor • Mis-detection of CKP sensor • PCM malfunction

System Wiring Diagram