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1993 MAZDA RX-7 (FD) OEM Service and Repair Workshop Manual

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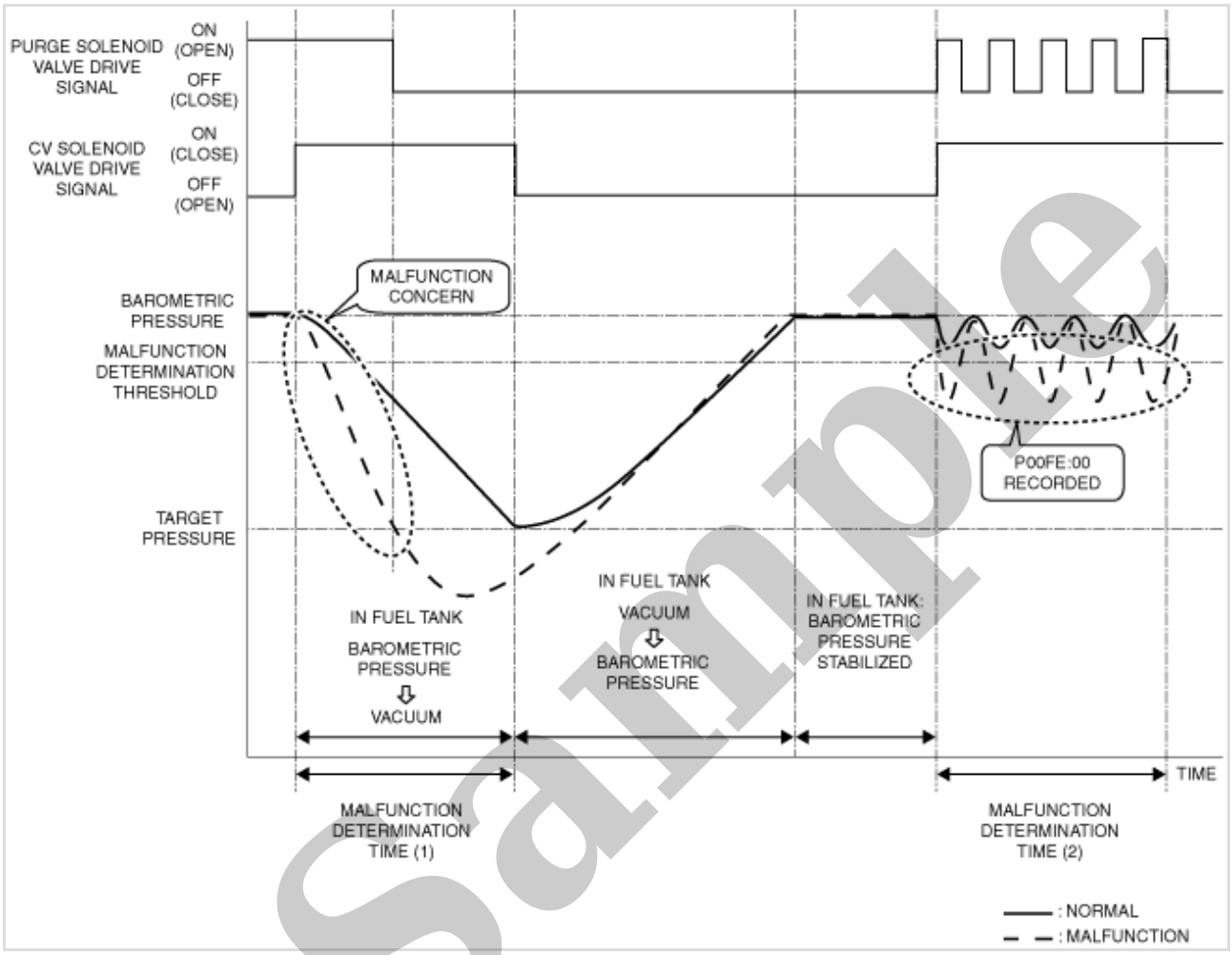
Function Explanation (DTC Detection Outline)

• The PCM closes the purge solenoid valve and CV solenoid valve while the vehicle is being driven and seals the fuel tank. Then, gas in the fuel tank is inducted into the intake manifold and the pressure in the fuel tank is decreased by opening the purge solenoid valve, and the pressure change in the fuel tank is measured using the fuel tank pressure sensor. If the pressure in the fuel tank decreases below the target negative pressure during the specified period from the pressure measurement (malfunction determination time (1)), positive pressure is inducted to the fuel tank via the intake manifold by closing the purge solenoid valve and opening the CV solenoid valve. After positive pressure is inducted to the fuel tank, the fuel tank is sealed, opening/closing of the purge solenoid valve is performed repeatedly, and the pressure change in the fuel tank is monitored at that time (malfunction determination time (2)). If the amount of pressure change veers towards negative pressure exceeding the malfunction determination threshold, the PCM determines that there is clogging between the fuel tank pressure sensor and fuel tank, and stores a DTC.



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Repeatability Verification Procedure

1. Set the remaining fuel quantity in the fuel tank between 30–85%.
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 2.5T)].)
4. Start the engine and switch the ignition off after 5 s have elapsed.
5. Leave the vehicle for 6 h or more.
6. Start the engine and leave it idling for 2 min.
7. Drive the vehicle for 30 min at a speed of 50 km/h {31 mph} or more (to increase temperature in fuel tank and generate evaporative gas).

Note

• If driving the vehicle for 30 min at a speed of 50 km/h {31 mph} or more is not feasible, the vehicle can be driven for a continuous 15 min or more with the engine coolant temperature at 80 °C {176 °F} or more.

8. Stop the engine.
9. Leave the vehicle for 1 h or more.

STEP	INSPECTION	RESULTS	ACTION
5	**PURPOSE: VERIFY IF PURGE SOLENOID VALVE IS STUCK OPEN** • Perform the following procedure to induct barometric pressure to the fuel tank. — Access the following simulation items using the M-MDS: (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5T)].) • EVAPCP • EVAPCV — Change to the following conditions using the simulation function. • EVAPCP: 0% • EVAPCV: Off — Access the FTP PID using the M-MDS. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5T)].) **Note** **• The displayed PID value is as follows:** **— Approx. 2.6 V (barometric pressure)** • Perform the following procedure to force drive the CV solenoid valve. — Access the following simulation items using the M-MDS: (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5T)].) • EVAPCP • EVAPCV — Change to the following conditions using the simulation function. • EVAPCP: 0% • EVAPCV: On • Access the FTP PID using the M-MDS. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5T)].) • Is the FTP PID value negative pressure?	Yes	The possibility of a stuck purge solenoid valve open is high. • Go to the Troubleshooting Diagnostic Procedure to perform the procedure from Step 2.
		No	The possibility of clogging between fuel tank pressure sensor and fuel tank is high. • Go to the Troubleshooting Diagnostic Procedure to perform the procedure from Step 3.

Troubleshooting Diagnostic Procedure

Intention of troubleshooting procedure

• Step 1

— Perform a PCM input signal part-related inspection.

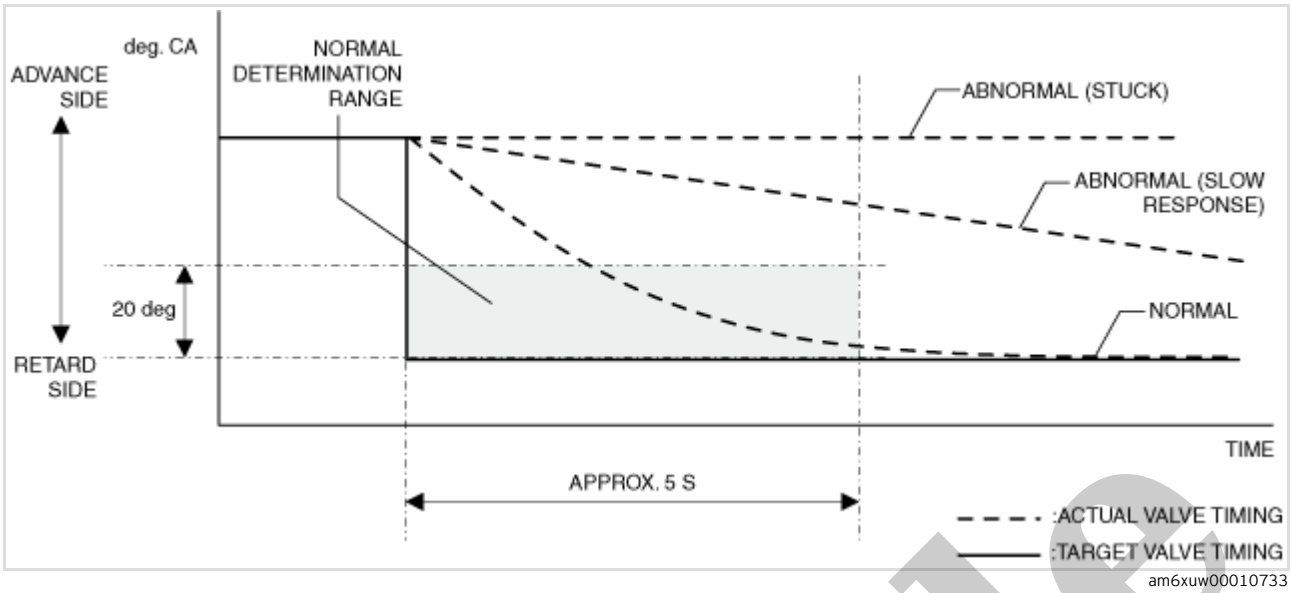
• Step 2

— Perform a unit inspection of the purge solenoid valve.

• Step 3–5

— Inspect for clogging between fuel tank pressure sensor and fuel tank.

• With the preconditions met, the PCM verifies the conformity of the actual timing relative to the target valve timing. If it does not conform to the normal determination range (difference between target valve timing and actual valve timing is 20 degrees or less) during the malfunction determination period (approx. 5 s), even if the target valve timing is set to the retard side, the PCM determines an excess advance malfunction condition and stores a DTC.



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 D position and rapidly accelerate the vehicle to 50 km/h {31 mph} (to operate hydraulic variable valve timing control).
3. Decelerate to idling.
4. Shift to D position and rapidly accelerate the vehicle to 50 km/h {31 mph} again.

PID Item Used In Diagnosis

PID/DATA monitor item table

Item	Definition	Unit	Condition/Specification
VT_EX_ACT	Actual exhaust variable valve timing control - retard amount from max advance position	°	• Displays actual exhaust variable valve timing - retard amount from max advance position
VT EX_DES	Target exhaust variable valve timing control - retard amount from max advance position	°	• Displays target exhaust variable valve timing - retard amount from max advance 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.

STEP	INSPECTION	RESULTS	ACTION
8	PURPOSE: VERIFY IF MALFUNCTION RELATED TO ENGINE OIL LEAK OR RESTRICTION AFFECTS DIAGNOSTIC RESULTS • Start the engine. • Verify if there is engine oil leakage in the oil passage or restriction. • Is there engine oil leakage in the oil passage or restriction?	Yes	Repair or replace the malfunctioning part according to the inspection results. Add genuine engine oil, then go to the next step. (See ENGINE OIL REPLACEMENT [SKYACTIV-G 2.5T].)
		No	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 2.5T)].) • Implement the repeatability verification procedure. (See Repeatability Verification Procedure.) • Perform the Pending Trouble Code Access Procedure. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5T)].) • 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 2.5T].) 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 2.5T)].)
		No	DTC troubleshooting completed.

STEP	INSPECTION	RESULTS	ACTION
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 2.5T)].) • Is the PENDING CODE/DTC P0335:00, P0365:00, P2090:00 or P2091:00 also present?	Yes	Go to the applicable PENDING CODE or DTC inspection. (See DTC P0335:00 [PCM (SKYACTIV-G 2.5T)].) (See DTC P0365:00 [PCM (SKYACTIV-G 2.5T)].) (See DTC P2090:00 [PCM (SKYACTIV-G 2.5T)].) (See DTC P2091:00 [PCM (SKYACTIV-G 2.5T)].) Go to the next step.
		No	Go to the next step.
4	**PURPOSE: VERIFY IF DIAGNOSTIC RESULT IS AFFECTED BY DTC OCCURRING FROM OIL PRESSURE SWITCH** • Perform the Pending Trouble Code Access Procedure and DTC Reading Procedure. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5T)].) • Is the PENDING CODE/DTC P0524:00 also present?	Yes	Go to the applicable PENDING CODE or DTC inspection. (See DTC P0524:00 [PCM (SKYACTIV-G 2.5T)].) Go to the next step.
		No	Go to the next step.
5	**PURPOSE: VERIFY CONFORMITY OF ACTUAL EXHAUST VALVE TIMING AND DETERMINE IF MALFUNCTION IS CAUSED BY OCV OR CONNECTOR RELATED** • Start the engine and idle it. • Access the following PIDs using the M-MDS: (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5T)].) — VT_EX_ACT — VT_EX_DES • Implement the repeatability verification procedure. (See Repeatability Verification Procedure.) • Does the monitor value of the PID item VT_EX_ACT conform to the VT_EX_DES PID value?	Yes	Go to the next step.
		No	Go to the Troubleshooting Diagnostic Procedure to perform the procedure from Step 1.
6	**PURPOSE: VERIFY CONNECTOR CONNECTIONS** • Start the engine. • Access the VT_EX_ACT PID using the M-MDS. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5T)].) • Does the PID value fluctuate when the following connectors are shaken? — OCV — PCM	Yes	Repair or replace the applicable wiring harness or connector parts. Go to the Troubleshooting Diagnostic Procedure to perform the procedure from Step 9.
		No	Go to the Troubleshooting Diagnostic Procedure to perform the procedure from Step 1.

Troubleshooting Diagnostic Procedure

Intention of troubleshooting procedure

• Step 1

— Perform a unit inspection of the OCV.

• Step 2

— Verify engine oil level.

• Step 3–4

DTC P0087:00 [PCM (SKYACTIV-G 2.5T)]

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Note

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

Details On DTCs

DESCRIPTION	**High fuel pressure sensor circuit range/performance problem**	
DETECTION CONDITION	Determination conditions	• The actual fuel pressure is lower than the target fuel pressure by 1.2 MPa {12 kgf/cm^2, 174 psi} or more even though the fuel pressure feedback amount is maintained high.
	Preconditions	• Engine speed: 500 rpm or more *1 • The following DTCs are not detected: — High fuel pressure sensor: P0089:00, P0192:00, P0193:00 — High pressure fuel pump: P0091:00, P0092:00 *1: Standard can be verified by displaying PIDs using M-MDS
	Malfunction determination period	• 5 s period
	Drive cycle	• 1
	Self test type	• CMDTC self test
	Sensor used	• High fuel pressure sensor
FAIL-SAFE FUNCTION	• Limits intake air amount • Stops high pressure fuel pump control	
VEHICLE STATUS WHEN DTCs ARE OUTPUT	• Illuminates check engine light.	
POSSIBLE CAUSE	• Air suction in fuel line due to fuel is runout • High pressure fuel pump connector or terminals malfunction • High fuel pressure sensor connector or terminals malfunction • PCM connector or terminals malfunction • High fuel pressure sensor malfunction • Fuel delivery system malfunction (insufficient fuel pressure) • Fuel injector malfunction • High pressure fuel pump malfunction — Relief valve (built-into high pressure fuel pump) malfunction • PCM malfunction	

System Wiring Diagram

• Not applicable

Function Explanation (DTC Detection Outline)

• The PCM calculates the target fuel pressure appropriate to the engine conditions relative to the actual fuel pressure based on the high fuel pressure sensor signal and provides feedback to the high pressure fuel pump control. If the difference between the actual fuel pressure and the target fuel pressure relative to the feedback amount is large, the PCM determines a malfunction in the high fuel pressure sensor and stores a DTC.

STEP	INSPECTION	RESULTS	ACTION
7	PURPOSE: VERIFY FUEL PRESSURE (LOW-SIDE) MALFUNCTION Note • Verify the fuel pressure on the low pressure side with the operation of the high pressure fuel pump turned off. • Bleed the remaining pressure in the fuel line using the following procedure. 1. Switch the ignition off. 2. Disconnect the high pressure fuel pump connector. 3. Remove the fuel pump relay. (See RELAY LOCATION.) 4. Start the engine and wait until the engine stalls. • Switch the ignition off. • Install the fuel pump relay. • Switch the ignition ON (engine off). • Display PID FUEL_PRES and simulation item FP using the M-MDS. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5T)].) • Turn simulation item FP on. • Is the FUEL_PRES PID value 545–695 kPa {5.56–7.08 kgf/cm^2, 79.1–100.0 psi}?	Yes	Go to the Troubleshooting Diagnostic Procedure to perform the procedure from Step 2.
		No	Go to the Troubleshooting Diagnostic Procedure to perform the procedure from Step 1.

Troubleshooting Diagnostic Procedure

Intention of troubleshooting procedure

- Step 1
  - — Inspect the fuel supply system (low pressure side).
- Step 2
  - — Perform a unit inspection of the high fuel pressure sensor.
- Step 3–4
  - — Verify that the primary malfunction is resolved and there are no other malfunctions.

STEP	INSPECTION	RESULTS	ACTION
1	PURPOSE: VERIFY IF MALFUNCTION RELATED TO FUEL PIPE (LOW PRESSURE SIDE) AFFECTS DIAGNOSTIC RESULTS • Inspect the fuel pump unit. (See FUEL PUMP UNIT INSPECTION [SKYACTIV-G 2.5T].) • Is there any malfunction?	Yes	Replace the fuel pump unit, then go to Step 3. (See FUEL PUMP UNIT REMOVAL/INSTALLATION [SKYACTIV-G 2.5T].)
		No	Inspect the fuel system pipes (low to high pressure sides) for fuel leakage and restriction. • If there is any malfunction: — Repair or replace the malfunctioning part according to the inspection results, then go to Step 3. • If there is no malfunction: — Go to the next step.

Item (definition)	Unit/Condition	Definition	Condition/Specification (Reference)
FTP	Pa {KPA}, mBar {BAR}, psi, in H20	Fuel tank pressure	• Displays fuel tank pressure
	V	Fuel tank pressure sensor voltage	• Fuel tank pressure is equal to barometric pressure: Approx. 2.6 V

Diagnostic Procedure

STEP	INSPECTION	RESULTS	ACTION
1	**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	**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	**DETERMINE IF FUEL TANK PRESSURE SENSOR OR WIRING HARNESS MALFUNCTION** • Access the FTP PID using the M-MDS. (See ON-BOARD DIAGNOSTIC TEST [PCM (SKYACTIV-G 2.5T)].) • Verify the FTP PID value. • Is the FTP PID value 5 V or B+?	Yes	Go to Step 7.
		No	Go to the next step.
4	**INSPECT FUEL TANK PRESSURE SENSOR CONNECTOR CONDITION** • Switch the ignition off. • Disconnect the fuel tank pressure sensor 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.
5	**INSPECT PCM CONNECTOR CONDITION** • 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 Step 12.
		No	Go to the next step.
6	**INSPECT FUEL TANK PRESSURE SENSOR** • Inspect the fuel tank pressure sensor. (See FUEL TANK PRESSURE SENSOR INSPECTION [SKYACTIV-G 2.5T].) • Is there any malfunction?	Yes	Replace the charcoal canister, then go to Step 12. (See CHARCOAL CANISTER REMOVAL/INSTALLATION [SKYACTIV-G 2.5T].)
		No	Go to Step 12.

DTC P0454:00 [PCM (SKYACTIV-G 2.5T)]

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DTC P0454:00	Fuel tank pressure sensor intermittent malfunction
DETECTION CONDITION	• Any one of the following conditions is met: — The difference between the currently detected fuel tank pressure sensor input voltage and the previously detected input voltage is large. — The input voltage of the fuel tank pressure sensor remains low or high. **Diagnostic support note** • This is a continuous monitor (CCM). • The check engine light illuminates if the PCM detects the above malfunction condition during the first drive cycle. • FREEZE FRAME DATA/Snapshot data is available. • DTC is stored in the PCM memory.
FAIL-SAFE FUNCTION	• Not applicable
POSSIBLE CAUSE	• Wiring harness malfunction between PCM and fuel tank pressure sensor • Fuel tank pressure sensor malfunction — Intermittent open or short circuit in the fuel tank pressure sensor or fuel tank pressure sensor signal • PCM malfunction
SYSTEM WIRING DIAGRAM	• Not applicable

Diagnostic Procedure

STEP	INSPECTION	RESULTS	ACTION
1	**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	**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.