DTC P2096:00, P2097:00 [SKYACTIV-G 2.0, SKYACTIV-G 2.5]

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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 (**2.5 %**) 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 (**−2.5 %**) 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. • Engine speed rough	
POSSIBLE CAUSE	• Erratic signal to PCM — ECT sensor No.1 signal malfunction — MAF sensor signal malfunction — MAP sensor signal malfunction — IAT sensor No.2 signal malfunction — Related connector or terminals malfunction — Related wiring harness malfunction • 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 • Air suction in intake air system • Poor fuel quality • HO2S malfunction — HO2S loose • A/F sensor malfunction — A/F sensor loose — Exhaust system leakage — A/F sensor deterioration • Fuel leakage or restriction in fuel line • Fuel injector malfunction — Improper operation of fuel injector — Fuel injector related wiring harness malfunction • Improper operation of purge control system — Purge solenoid valve malfunction (stuck open) — Purge solenoid hoses improper connection • MAP sensor malfunction • MAF sensor malfunction • Air cleaner element restricted • PCM malfunction	

System Wiring Diagram

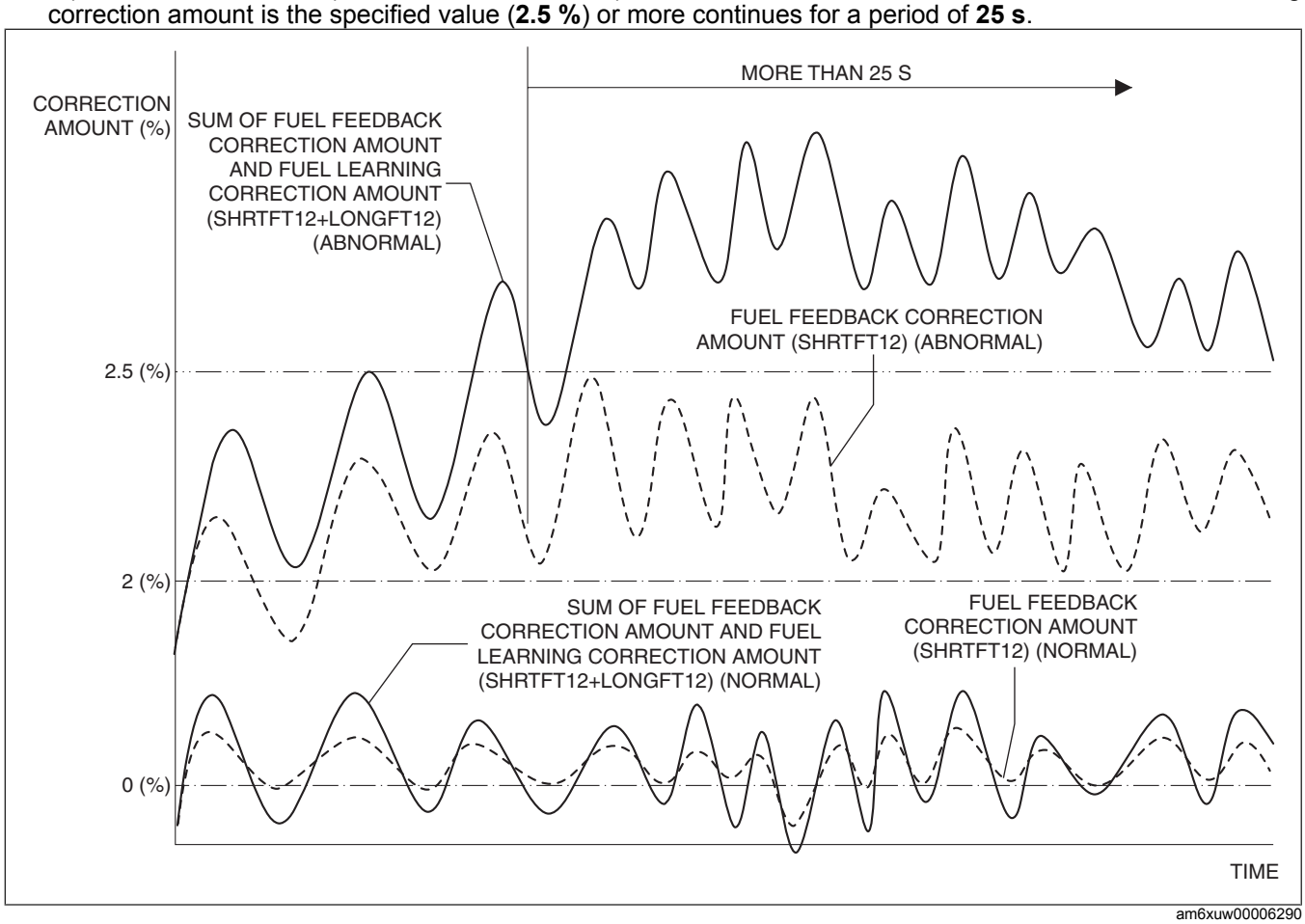
- Not applicable

Function Explanation (DTC Detection Outline)

- The PCM detects the oxygen concentration passing through the catalyst by the HO2S signal and performs fuel injection amount correction to maintain optimum purification conditions in the catalyst. To maintain optimum purification conditions in the catalyst, the fuel injection correction has a “Feedback correction amount” which performs correction according to the driving conditions relative to the previously set air/fuel ratio, and a “Learning correction amount” which corrects for deterioration over time.
- “Fuel feedback correction amount (SHRTFT12)” and “Fuel learning correction amount (LONGFT12)” can be verified from the M-MDS PID item.

P2096:00

- If a condition in which the feedback correction amount from the HO2S signal is large (fuel injection amount being increased) continues for the specified time (**25 s**), the PCM determines a feedback correction amount malfunction and stores a DTC.
- 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 (**2.5 %**) or more continues for a period of **25 s**.



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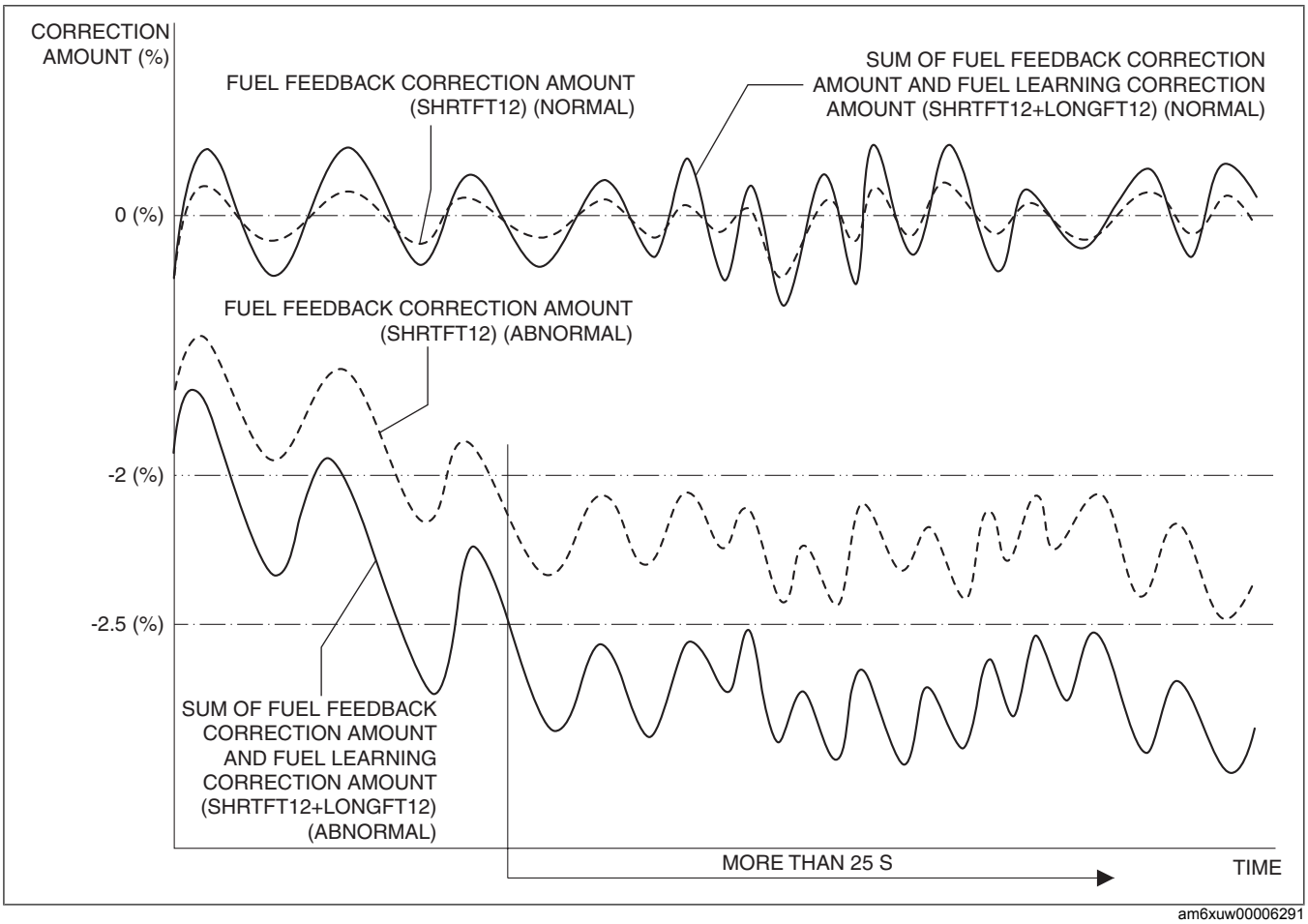
P2097:00

- If a condition in which the feedback correction amount from the HO2S signal is small (fuel injection amount being decreased) continues for the specified time (**25 s**), the PCM determines a feedback correction amount malfunction and stores a DTC.
- 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 (**−2.5 %**) or less continues for a period of **25 s**.



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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 (Mode 2)/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 (Mode 2)/snapshot data.

PID Item/Simulation Item Used In Diagnosis

PID/DATA monitor item table

—: Not applicable

Item	Definition	Unit/ Condition	Condition/Specification (Reference)
EQ_RAT11	Equivalence ratio (lambda)	—	• Idle (after warm up): Approx. 1
O2S11	A/F sensor	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	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	Unit/ Condition	Item
EVAPCP	Purge solenoid valve	%	• Changes % and forcibly drives/stops purge solenoid valve.

Item	Applicable component	Unit/ Condition	Item
INJ_1	Fuel injector No.1	ON/OFF	• Select OFF to forcibly stop fuel injector No.1.
INJ_2	Fuel injector No.2	ON/OFF	• Select OFF to forcibly stop fuel injector No.2.
INJ_3	Fuel injector No.3	ON/OFF	• Select OFF to forcibly stop fuel injector No.3.
INJ_4	Fuel injector No.4	ON/OFF	• Select OFF to forcibly stop fuel injector No.4.

Function Inspection Using M-MDS

STEP	INSPECTION	RESULTS	ACTION
1	**PURPOSE: VERIFY RELATED SERVICE INFORMATION AVAILABILITY** • Verify related Service Information availability. • Is any related Service Information available?	Yes	Perform repair or diagnosis according to the available Service Information. • If the vehicle is not repaired, go to the next step.
		No	Go to the next step.
2	**PURPOSE: IDENTIFY TRIGGER DTC FOR FREEZE FRAME DATA (MODE 2)** • Is the DTC P2096:00 or P2097:00 on FREEZE FRAME DATA (Mode 2)?	Yes	Go to the next step.
		No	Go to the troubleshooting procedure for DTC on FREEZE FRAME DATA (Mode 2). (See DTC TABLE [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
3	**PURPOSE: RECORD VEHICLE STATUS AT TIME OF DTC DETECTION TO UTILIZE WITH REPEATABILITY VERIFICATION** • Has the FREEZE FRAME DATA (Mode 2)/ snapshot data been recorded?	Yes	Go to the next step.
		No	Record the FREEZE FRAME DATA (Mode 2)/snapshot data on the repair order, then go to the next step. **Note** • Recording can be facilitated using the screen capture function of the PC.
4	**PURPOSE: VERIFICATION IF MALFUNCTION CAUSED BY LACK OF FUEL** • Verify the snapshot data FLI. (See ON-BOARD DIAGNOSTIC TEST [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is the snapshot data FLI 5% or less?	Yes	Refill the fuel. Go to the troubleshooting procedure to perform the procedure from Step 13.
		No	Go to the next step.
5	**PURPOSE: VERIFY DTCs FOR FUEL PRESSURE SENSOR** • Switch the ignition off, then ON (engine off). • Perform the Pending Trouble Code Access Procedure and DTC Reading Procedure. (See ON-BOARD DIAGNOSTIC TEST [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is the PENDING CODE/DTC P0191:00, P0192:00 or P0193:00 also present?	Yes	Go to the applicable DTC inspection. (See DTC P0191:00 [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) (See DTC P0192:00 [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) (See DTC P0193:00 [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	Go to the next step.
6	**PURPOSE: VERIFY DTCs FOR ELECTRIC VARIABLE VALVE TIMING CONTROL SYSTEM AND HYDRAULIC VARIABLE VALVE TIMING** • Perform the Pending Trouble Code Access Procedure and DTC Reading Procedure. (See ON-BOARD DIAGNOSTIC TEST [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is the PENDING CODE/DTC P0010:00, P0011:00, P0012:00, P0014:00, P0015:00, P1380:00, P2090:00 or P2091:00 also present?	Yes	Go to the applicable DTC inspection. (See DTC P0010:00 [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) (See DTC P0011:00, P0012:00 [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) (See DTC P0014:00 [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) (See DTC P0015:00 [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) (See DTC P1380:00 [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) (See DTC P2090:00 [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) (See DTC P2091:00 [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	Go to the next step.

STEP	INSPECTION	RESULTS	ACTION
7	**PURPOSE: VERIFY DTCs FOR MISFIRE** • Perform the Pending Trouble Code Access Procedure and DTC Reading Procedure. (See ON-BOARD DIAGNOSTIC TEST [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is the PENDING CODE/DTC P0300:00, P0301:00, P0302:00, P0303:00 or P0304:00 also present?	Yes	Go to the applicable DTC inspection. (See DTC P0300:00 [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) (See DTC P0301:00, P0302:00, P0303:00, P0304:00 [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	Go to the next step.
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 [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) — 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	**INSPECT RELATED SENSOR WIRING HARNESS AND CONNECTOR** • Access the following PIDs using the M-MDS: (See ON-BOARD DIAGNOSTIC TEST [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) — 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 the troubleshooting procedure to perform the procedure from Step 13.
		No	Go to the troubleshooting 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 [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) — 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 the troubleshooting procedure to perform the procedure from Step 3.

STEP	INSPECTION	RESULTS	ACTION
11	**PURPOSE: VERIFY IF MALFUNCTION CAUSED BY PURGE SOLENOID VALVE IMPROPER OPERATION** • Start the engine and idle it. • Access the EQ_RAT11 PID and simulation item EVAPCP using the M-MDS. (See ON-BOARD DIAGNOSTIC TEST [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Using the simulation function, does the EQ_RAT11 PID value change when the purge solenoid valve is opened/closed?	Yes	Go to the troubleshooting procedure to perform the procedure from Step 5.
		No	Go to the troubleshooting procedure to perform the procedure from Step 4.

Troubleshooting Diagnostic Procedure
Intention of troubleshooting procedure

- Step 1—2
  - — Perform an inspection of the HO2S and A/F sensor signal related parts.
- Step 3
  - — Perform a fuel injector control system inspection.
- Step 4
  - — Perform a purge control system inspection.
- Step 5—6
  - — Perform an inspection of the fuel line.
- Step 7—12
  - — Perform an inspection of each separate part.
- Step 13—14
  - — Verify that the primary malfunction is resolved and there are no other malfunctions.

STEP	INSPECTION	RESULTS	ACTION
1	**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 13. (See HEATED OXYGEN SENSOR (HO2S) REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
2	**PURPOSE: INSPECT INSTALLATION OF A/F SENSOR** • Inspect installation of A/F sensor. • Is the A/F sensor installed securely?	Yes	Replace the A/F sensor and/or HO2S, then go to Step 13. (See HEATED OXYGEN SENSOR (HO2S) REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) (See AIR FUEL RATIO (A/F) SENSOR REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	Retighten the A/F sensor, then go to Step 13. (See AIR FUEL RATIO (A/F) SENSOR REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
3	**PURPOSE: INSPECT FUEL INJECTOR OPERATION** • In Step 17 of the function inspection using the M-MDS, perform a fail-safe injector operation inspection on the cylinders in which engine speed fluctuation could not be verified. (See ENGINE CONTROL SYSTEM OPERATION INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is there any malfunction?	Yes	Repair or replace the malfunctioning part according to the inspection results, then go to Step 13. (See FUEL INJECTOR REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	Go to the next step.
4	**PURPOSE: DETERMINE INTEGRITY OF PURGE SOLENOID VALVE** • Inspect the purge solenoid valve. (See PURGE SOLENOID VALVE INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is there any malfunction?	Yes	Replace the purge solenoid valve, then go to Step 13. (See PURGE SOLENOID VALVE REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	Go to the next step.

STEP	INSPECTION	RESULTS	ACTION
5	**PURPOSE: VERIFY IF MALFUNCTION RELATED TO FUEL LEAK FROM FUEL SYSTEM AFFECTS DIAGNOSTIC RESULTS** • Visually inspect for leakage from fuel line between fuel distributor and fuel pump. • Is there any leakage?	Yes	Repair or replace the malfunctioning part according to the inspection results, then go to Step 13.
		No	Go to the next step.
6	**PURPOSE: INSPECT FUEL LINE (LOW-SIDE)** • Inspect for leakage or restriction in the fuel line (low-side). • Is there any malfunction?	Yes	Repair or replace the malfunctioning part according to the inspection results, then go to Step 13.
		No	Go to the next step.
7	**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 13. (See HEATED OXYGEN SENSOR (HO2S) REMOVAL/ INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
8	**PURPOSE: INSPECT INSTALLATION OF A/F SENSOR** • Inspect installation of A/F sensor. • Is the A/F sensor installed securely?	Yes	Go to the next step.
		No	Retighten the A/F sensor, then go to Step 13. (See AIR FUEL RATIO (A/F) SENSOR REMOVAL/ INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
9	**PURPOSE: INSPECT EXHAUST SYSTEM FOR LEAKAGE** • Inspect for exhaust gas leakage from the exhaust system. (between A/F sensor and HO2S) • Is there any malfunction?	Yes	Repair or replace the malfunctioning part according to the inspection results, then go to Step 13.
		No	Go to the next step.
10	**PURPOSE: DETERMINE INTEGRITY OF MAP SENSOR** • Reconnect all disconnected connectors. • Inspect the MAP sensor. (See MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is there any malfunction?	Yes	Replace the MAP sensor/IAT sensor No.2, then go to Step 13. (See MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR/INTAKE AIR TEMPERATURE (IAT) SENSOR NO.2 REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	Go to the next step.
11	**PURPOSE: DETERMINE INTEGRITY OF MAF SENSOR** • Inspect the MAF sensor. (See MASS AIR FLOW (MAF) SENSOR INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is there any malfunction?	Yes	Replace the MAF sensor/IAT sensor No.1, then go to Step 13. (See MASS AIR FLOW (MAF) SENSOR/INTAKE AIR TEMPERATURE (IAT) SENSOR NO.1 REMOVAL/ INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	Go to the next step.
12	**PURPOSE: AIR CLEANER ELEMENT** • Remove the air cleaner element with the engine is running. (See AIR CLEANER ELEMENT REMOVAL/ INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Does the engine speed increase?	Yes	Inspect the air cleaner element. (See AIR CLEANER ELEMENT INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • If there is any malfunction: — Clean or replace the air cleaner element, then go to Step 13. (See AIR CLEANER ELEMENT REMOVAL/ INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • If there is no malfunction: — Go to the next step.
		No	Go to the next step.

STEP	INSPECTION	RESULTS	ACTION
13	**PURPOSE: VERIFICATION OF VEHICLE REPAIR COMPLETION** • Always reconnect all disconnected connectors. • Clear the DTC from the PCM memory using the M-MDS. (See AFTER REPAIR PROCEDURE [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Implement the repeatability verification procedure. (See Repeatability Verification Procedure.) • Perform the Pending Trouble Code Access Procedure. (See ON-BOARD DIAGNOSTIC TEST [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • 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 2.0, SKYACTIV-G 2.5].) 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 [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	DTC troubleshooting completed.