DTC P0421:00 [SKYACTIV-G 2.0, SKYACTIV-G 2.5]

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SKYACTIV-G 2.0 (MTX)

DTC P0421:00	**Warm up catalyst system efficiency below threshold**
DETECTION CONDITION	• The PCM compares the number of the A/F sensor and HO2S inversions for a predetermined time to detect the inversion ratio. It does this by monitoring the HO2S inversion counts when the following conditions are met. If the inversion ratio is below specification, the PCM determine that the catalyst system has deteriorated. — The A/F sensor inversion counts is as prescribed when the following monitoring conditions are met: — The accumulated occurrence time of the following monitoring conditions has exceeded the prescribed time limit: **MONITORING CONDITIONS** • Calculated TWC temperature: **above 400 °C {752 °F}** • Engine speed: **1,100—3,000 rpm** • LOAD: **15—50 %** (at engine speed of **2,000 rpm**) **Diagnostic support note** • This is an intermittent monitor (catalyst). • The check engine light illuminates if the PCM detects the above malfunction condition in two consecutive drive cycles or in one drive cycle while the DTC for the same malfunction has been stored in the PCM. • PENDING CODE is available if the PCM detects the above malfunction condition during first drive cycle. • FREEZE FRAME DATA (Mode 2)/Snapshot data is available. • DTC is stored in the PCM memory.
FAIL-SAFE FUNCTION	Not applicable
POSSIBLE CAUSE	• Exhaust system leakage • A/F sensor loose • HO2S loose • TWC deterioration or malfunction • PCM malfunction
SYSTEM WIRING DIAGRAM	Not applicable

Diagnostic Procedure

STEP	INSPECTION		ACTION
1	**VERIFY FREEZE FRAME DATA (MODE 2)/SNAPSHOT DATA AND DIAGNOSTIC MONITORING TEST RESULTS HAVE BEEN RECORDED** • Have the FREEZE FRAME DATA (Mode 2)/snapshot data and DIAGNOSTIC MONITORING TEST RESULTS (catalyst related) been recorded?	Yes	Go to the next step.
		No	Record the FREEZE FRAME DATA (Mode 2)/ snapshot data and DIAGNOSTIC MONITORING TEST RESULTS on the repair order, then go to the next step.
2	**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.
3	**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 [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Are any other PENDING CODEs and/or DTCs present?	Yes	Go to the applicable PENDING CODE or DTC inspection. (See DTC TABLE [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	Go to the next step.
4	**INSPECT EXHAUST SYSTEM FOR LEAKAGE** • Visually inspect for exhaust leakage in the exhaust system. • Is there any leakage?	Yes	Repair or replace the malfunctioning part according to the inspection results, then go to Step 7.
		No	Go to the next step.

STEP	INSPECTION		ACTION
5	**INSPECT INSTALLATION OF A/F SENSOR AND HO2S** • Inspect installation of A/F sensor and HO2S. • Are the A/F sensor and HO2S installed securely?	Yes	Go to the next step.
		No	Retighten the A/F sensor and/or HO2S, then go to Step 7. (See AIR FUEL RATIO (A/F) SENSOR REMOVAL/ INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) (See HEATED OXYGEN SENSOR (HO2S) REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
6	**VERIFY WHETHER MALFUNCTION IS IN TWC OR ELSEWHERE** • Perform the Idle Mixture Inspection. (See ENGINE TUNE-UP [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is there any malfunction?	Yes	Perform the symptom troubleshooting “NO.15 EMISSION COMPLIANCE”. (See NO.15 EMISSION COMPLIANCE [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • If there is any malfunction: — Repair or replace the malfunctioning part according to the inspection results. • If there is no malfunction: — Replace the TWC. (See EXHAUST SYSTEM REMOVAL/ INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) Go to the next step.
		No	Go to the next step.
7	**VERIFY DTC TROUBLESHOOTING COMPLETED** • 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].) • Perform the Drive Mode 03 (Variable Valve Timing, A/F Sensor Heater, HO2S Heater, A/F Sensor, HO2S and TWC Repair Verification Drive Mode). (See OBD DRIVE MODE [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is the PENDING CODE for this DTC 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.
8	**VERIFY AFTER REPAIR PROCEDURE** • Perform the “AFTER REPAIR PROCEDURE”. (See AFTER REPAIR PROCEDURE [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Are any DTCs present?	Yes	Go to the applicable DTC inspection. (See DTC TABLE [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	DTC troubleshooting completed.

SKYACTIV-G 2.0 (ATX), SKYACTIV-G 2.5

Note

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

Details On DTCs

DESCRIPTION	Catalytic converter system	
DETECTION CONDITION	Determination conditions	• The amount*1 of fuel supplied to the catalyst, from the period of recovery by fuel cut control until the HO2S indicates rich output (**0.2 V**), decreases below the specified value. *1: The estimated value is calculated based on the A/F sensor signal.
	Preconditions	• Catalytic converter is activated sufficiently. • HO2S is activated sufficiently. • The following DTCs are not detected: — Misfire: P0300:00, P0301:00, P0302:00, P0303:00, P0304:00 — Fuel injection correction: P0171:00, P0172:00, P2096:00, P2097:00 — A/F sensor: P0130:00, P0131:00, P0132:00, P0133:00, P0134:00, P064D:00, P2237:00, P2243:00, P2251:00 — HO2S: P0137:00, P0138:00, P013A:00, P0140:00 — A/F sensor heater: P0031:00, P0032:00 — HO2S heater: P0037:00, P0038:00
	Drive cycle	• 2
	Self test type	• CMDTC self test
	Sensor used	• A/F sensor, HO2S
FAIL-SAFE FUNCTION	• Not applicable	
VEHICLE STATUS WHEN DTCs ARE OUTPUT	• Illuminates check engine light.	
POSSIBLE CAUSE	• HO2S malfunction — HO2S loose • A/F sensor malfunction — A/F sensor loose — Exhaust system leakage — A/F sensor deterioration • TWC deterioration or malfunction • PCM malfunction	

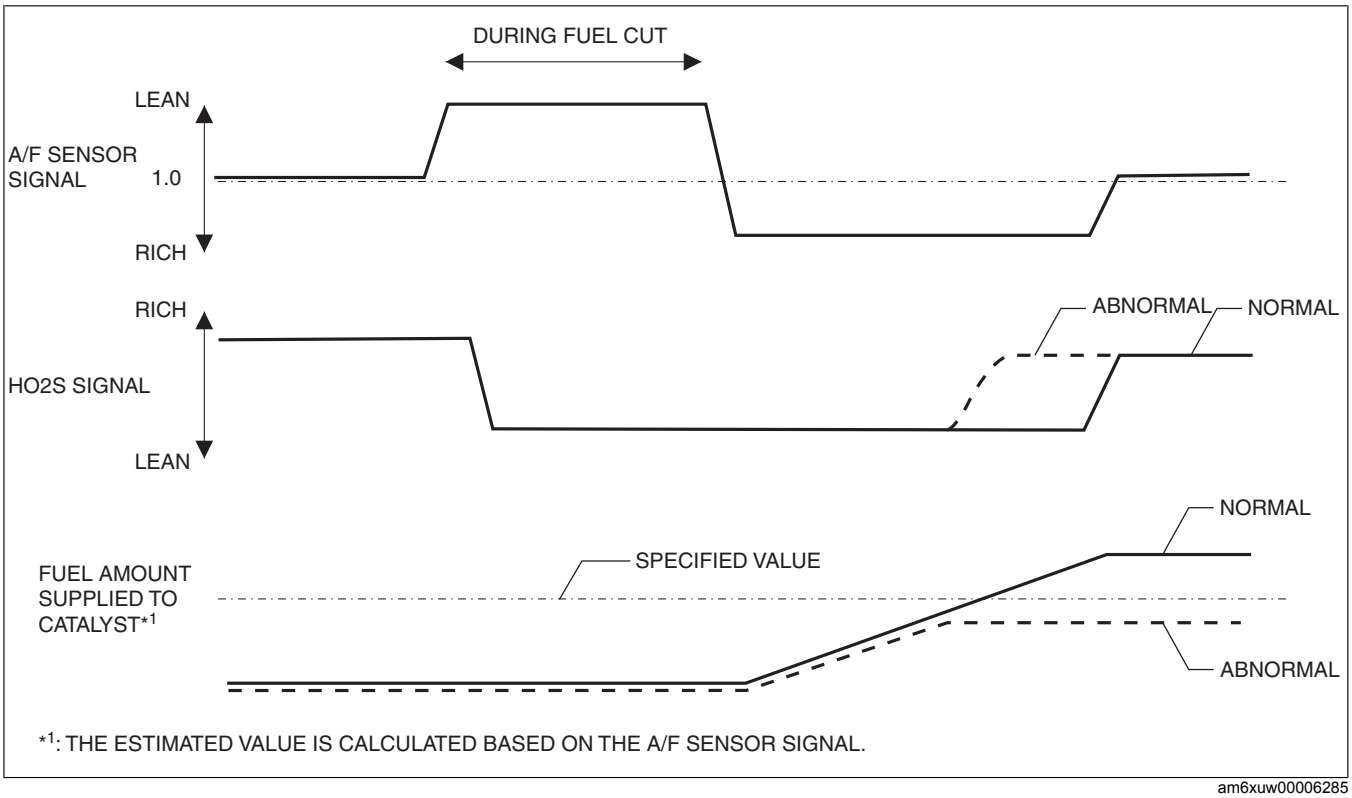
System Wiring Diagram

- Not applicable

Function Explanation (DTC Detection Outline)

- If the fuel amount*1 supplied to the catalyst, from the period of recovery by fuel cut control until the HO2S indicates a rich signal (**0.2 V or more**), is less than the specified value, the PCM determines catalytic converter deterioration and stores a DTC.

  *1: The estimated value is calculated based on the A/F sensor signal.



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Repeatability Verification Procedure

1. Start the engine and leave it idling for **1 min**.
2. Drive the vehicle normally for **15 min**. After that, shift to 3rd gear and maintain the vehicle speed at **approx. 40 km/h {25 mph}**.
3. Accelerate the vehicle to **60 km/h {37 mph}** while in 3rd gear.
4. Release the accelerator pedal and decelerate the vehicle to **40 km/h {25 mph}**.
5. Accelerate the vehicle to **60 km/h {37 mph}** again while in 3rd gear.
6. Drive the vehicle for **20 s** at a speed of **50 km/h {31 mph}** while in 3rd gear.
7. Repeat Step 4 to 6 operations above **20 times**.

   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.

8. 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

Item	Definition	Unit/ Condition	Condition/Specification (Reference)
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

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 P0421:00 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: 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 [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Are any other PENDING CODEs and/or DTCs present?	Yes	Go to the applicable PENDING CODE or DTC inspection. (See DTC TABLE [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) Go to the next step.
		No	Go to the next step.
5	**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 the troubleshooting procedure to perform the procedure from Step 3.
		No	Go to the next step.
6	**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 8.
		No	Go to the troubleshooting procedure to perform the procedure from Step 1.

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—7
  — Perform an inspection of each separate part.
- Step 8—9
  — 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 8. (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 8. (See AIR FUEL RATIO (A/F) SENSOR REMOVAL/ INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) (See HEATED OXYGEN SENSOR (HO2S) REMOVAL/ INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	Retighten the A/F sensor, then go to Step 8. (See AIR FUEL RATIO (A/F) SENSOR REMOVAL/ INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
3	**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 8. (See HEATED OXYGEN SENSOR (HO2S) REMOVAL/ INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
4	**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 8. (See AIR FUEL RATIO (A/F) SENSOR REMOVAL/ INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
5	**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 8.
		No	Go to the next step.
6	**PURPOSE: VERIFY IF OTHER DTCs ARE DISPLAYED** • 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 and DTC Reading Procedure. (See ON-BOARD DIAGNOSTIC TEST [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Are any other PENDING CODEs and/or DTCs present?	Yes	Go to the applicable PENDING CODE or DTC inspection. (See DTC TABLE [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) Go to the next step.
		No	Go to the next step.

STEP	INSPECTION	RESULTS	ACTION
7	**PURPOSE: VERIFY CATALYTIC CONVERTER MALFUNCTION** • 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 for this DTC present?	Yes	Replace the TWC, then go to the next step. (See EXHAUST SYSTEM REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	DTC troubleshooting completed.
8	**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 for this DTC 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.
9	**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.