NO.27 SPARK PLUG CONDITION [SKYACTIV-G 2.0, SKYACTIV-G 2.5]

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27	SPARK PLUG CONDITION
DESCRIPTION	• Incorrect spark plug condition.
POSSIBLE CAUSE	**Note** • Inspecting the spark plug conditions can determine whether a problem is related to a specific cylinder or possibly all cylinders. **Wet/carbon stuck on specific plug:** • Spark—Weak, not visible • Air/fuel mixture—Excessive fuel injection volume • Compression—No compression, low compression • Malfunction spark plug **Grayish white with specific plug:** • Air/fuel mixture—Insufficient fuel injection volume • Malfunction spark plug **Wet/carbon is stuck on all plugs:** • Spark—Spark weak • Air/fuel mixture—Too rich, excessive fuel line pressure • Erratic signal to PCM — ECT sensor or related circuit malfunction — MAF sensor or related circuit malfunction — A/F sensor or related circuit malfunction — HO2S or related circuit malfunction • Compression—Low compression • Restriction in intake/exhaust system **Grayish white with all plugs:** • Erratic signal to PCM — ECT sensor or related circuit malfunction — MAF sensor or related circuit malfunction — A/F sensor or related circuit malfunction — HO2S or related circuit malfunction • Air/fuel mixture—Too lean, insufficient fuel line pressure **Warning** **• The following troubleshooting flow chart contains the fuel system diagnosis and repair procedures. Read the following warnings before servicing the fuel system:** **— 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 injuries 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 2.0, SKYACTIV-G 2.5].) (See AFTER SERVICE PRECAUTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)** **Caution** **• Disconnecting/connecting the quick release connector without cleaning it may cause damage to the fuel pipe and the quick release connector. Always clean the quick release connector joint area before disconnecting/connecting, and make sure that it is free of foreign matter.**

Diagnostic Procedure

STEP	INSPECTION	RESULTS	ACTION
1	**VERIFY SPARK PLUG CONDITION** • Remove all spark plugs. (See SPARK PLUG REMOVAL/ INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Inspect the spark plug. (See SPARK PLUG INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is there any malfunction?	Yes	Specific plug is wet or covered with carbon: • Go to the next step. Specific plug looks grayish white: • Go to Step 7. All plugs are wet or covered with carbon: • Go to Step 9. All plugs look grayish white: • Go to Step 15.
		No	Symptom troubleshooting completed.
2	**DETERMINE IF MALFUNCTION CAUSE IS ENGINE OIL LOSS OR OTHER** • Are the spark plugs wet/covered with carbon from the engine oil?	Yes	Inspect all areas related to oil, working up and down. Repair or replace the malfunctioning part according to the inspection results.
		No	Go to the next step.

STEP	INSPECTION	RESULTS	ACTION
3	**INSPECT SPARK PLUG** • Inspect the spark plugs for the following: — Air gap — Cracked insulator — Heat range — Worn electrode • Is there any malfunction?	Yes	Replace the spark plug. (See SPARK PLUG REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	Go to the next step.
4	**INSPECT ENGINE COMPRESSION** • Inspect the compression pressure at the suspected cylinder. (See COMPRESSION INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Are compression pressures within specification? **Specification:** • Compression [SKYACTIV-G 2.0, European (L.H.D. U.K.) specs.] — Standard: **978 kPa {9.97 kgf/cm^2, 142 psi} (300 rpm)** — Minimum: **783 kPa {7.98 kgf/cm^2, 114 psi} (300 rpm)** — Maximum difference between cylinders: **166 kPa {1.69 kgf/cm^2, 24.1 psi}** (**300 rpm**) • Compression [SKYACTIV-G 2.0, Except European (L.H.D. U.K.) specs.] — Standard: **885 kPa {9.02 kgf/cm^2, 128 psi} (300 rpm)** — Minimum: **708 kPa {7.22 kgf/cm^2, 103 psi} (300 rpm)** — Maximum difference between cylinders: **150 kPa {1.53 kgf/cm^2, 21.8 psi}** (**300 rpm**) • Compression [SKYACTIV-G 2.5] — Standard: **954 kPa {9.73 kgf/cm^2, 138 psi} (300 rpm)** — Minimum: **763 kPa {7.78 kgf/cm^2, 111 psi} (300 rpm)** — Maximum difference between cylinders: **161 kPa {1.64 kgf/cm^2, 23.4 psi}** (**300 rpm**) **Note** • Because the SKYACTIV-G 2.0 and SKYACTIV-G 2.5 retards the intake valve closing timing, compression pressure is low.	Yes	Go to the next step.
		No	Repair or replace the malfunctioning part according to the inspection results.
5	**INSPECT IGNITION SYSTEM OPERATION** • Reinstall all spark plugs. (See SPARK PLUG REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Perform the Spark Test at the suspected cylinder. (See ENGINE CONTROL SYSTEM OPERATION INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is a strong blue spark visible (compare with normal cylinder)?	Yes	Go to the next step.
		No	Repair or replace the malfunctioning part according to the inspection results.

STEP	INSPECTION	RESULTS	ACTION
6	**INSPECT FUEL LINE PRESSURE** • Inspect the fuel line pressure. (See FUEL LINE PRESSURE INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is the low side fuel pressure within specification? **Specification:** • **405—485 kPa {4.13—4.94 kgf/cm^2, 58.8—70.3 psi}**	Yes	Inspect the fuel injector for the following: • Injection volume • Leakage • Open or short circuit in injector Repair or replace the malfunctioning part according to the inspection results.
		No	Zero or low: • Inspect the fuel pump relay and the fuel pump circuit. (See RELAY INSPECTION.) • Inspect the fuel line for restriction. — If there is any malfunction: • Repair or replace the malfunctioning part according to the inspection results. — If there is no malfunction: • Replace the fuel pump unit. (Pressure regulator or fuel pump malfunction) (See FUEL PUMP UNIT REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) High: • Replace the fuel pump unit. (Pressure regulator malfunction) (See FUEL PUMP UNIT REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
7	**INSPECT SPARK PLUG** • Inspect the spark plug for the following: — Air gap — Heat range • Is there any malfunction?	Yes	Replace the spark plug. (See SPARK PLUG REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	Go to the next step.
8	**INSPECT FUEL INJECTOR OPERATION** • Perform the Fuel Injector Operation Inspection. (See ENGINE CONTROL SYSTEM OPERATION INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Do the fuel injectors operate properly?	Yes	Go to the next step.
		No	Repair or replace the malfunctioning part according to the inspection results.
9	**INSPECT AIR CLEANER ELEMENT** • Is the air cleaner element clean?	Yes	Go to the next step.
		No	Replace the air cleaner element.
10	**VERIFY CURRENT INPUT SIGNAL STATUS** • Access the following PIDs using the M-MDS: (See ON-BOARD DIAGNOSTIC TEST [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) — ECT — MAF — O2S11 (When engine can be started) — O2S12 (When engine can be started) • Are the PIDs normal? (See PCM INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)	Yes	Go to the next step.
		No	ECT PID is not as specified: • Inspect for an intermittent open circuit of the ECT sensor and the related wiring harness. (See ENGINE COOLANT TEMPERATURE (ECT) SENSOR INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) MAF PID is not as specified: • Inspect for an intermittent open circuit of the MAF sensor and the related wiring harness. (See MASS AIR FLOW (MAF) SENSOR INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) O2S11 PID is not as specified: • Inspect for an intermittent open circuit of the A/F sensor and the related wiring harness. (See AIR FUEL RATIO (A/F) SENSOR INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) O2S12 PID is not as specified: • Inspect for an intermittent open circuit of the HO2S and the related wiring harness. (See HEATED OXYGEN SENSOR (HO2S) INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) Repair or replace the malfunctioning part according to the inspection results.

STEP	INSPECTION	RESULTS	ACTION
11	**INSPECT PURGE CONTROL SYSTEM OPERATION** • Perform the Purge Control System Inspection when the engine can be started. (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.
		No	Go to the next step.
12	**INSPECT IGNITION SYSTEM OPERATION** • Perform the Spark Test. (See ENGINE CONTROL SYSTEM OPERATION INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is a strong blue spark visible at each cylinder?	Yes	Go to the next step.
		No	Repair or replace the malfunctioning part according to the inspection results.
13	**INSPECT ENGINE COMPRESSION** • Measure the compression pressure for each cylinder. (See COMPRESSION INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Are compression pressures within specification? **Specification:** • Compression [SKYACTIV-G 2.0, European (L.H.D. U.K.) specs.] — Standard: **978 kPa {9.97 kgf/cm^2, 142 psi} (300 rpm)** — Minimum: **783 kPa {7.98 kgf/cm^2, 114 psi} (300 rpm)** — Maximum difference between cylinders: **166 kPa {1.69 kgf/cm^2, 24.1 psi}** (**300 rpm**) • Compression [SKYACTIV-G 2.0, Except European (L.H.D. U.K.) specs.] — Standard: **885 kPa {9.02 kgf/cm^2, 128 psi} (300 rpm)** — Minimum: **708 kPa {7.22 kgf/cm^2, 103 psi} (300 rpm)** — Maximum difference between cylinders: **150 kPa {1.53 kgf/cm^2, 21.8 psi}** (**300 rpm**) • Compression [SKYACTIV-G 2.5] — Standard: **954 kPa {9.73 kgf/cm^2, 138 psi} (300 rpm)** — Minimum: **763 kPa {7.78 kgf/cm^2, 111 psi} (300 rpm)** — Maximum difference between cylinders: **161 kPa {1.64 kgf/cm^2, 23.4 psi}** (**300 rpm**) **Note** • Because the SKYACTIV-G 2.0 and SKYACTIV-G 2.5 retards the intake valve closing timing, compression pressure is low.	Yes	Go to the next step.
		No	Repair or replace the malfunctioning part according to the inspection results.

STEP	INSPECTION	RESULTS	ACTION
14	**INSPECT FUEL LINE PRESSURE** • Inspect the fuel line pressure. (See FUEL LINE PRESSURE INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is the low side fuel pressure within specification? **Specification:** • **405—485 kPa {4.13—4.94 kgf/cm^2, 58.8—70.3 psi}**	Yes	Visually inspect for deformed exhaust system parts. Repair or replace the malfunctioning part according to the inspection results.
		No	Zero or low: • Inspect the fuel pump relay and the fuel pump circuit. (See RELAY INSPECTION.) • Inspect the fuel line for restriction. — If there is any malfunction: • Repair or replace the malfunctioning part according to the inspection results. — If there is no malfunction: • Replace the fuel pump unit. (Pressure regulator or fuel pump malfunction) (See FUEL PUMP UNIT REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) High: • Replace the fuel pump unit. (Pressure regulator malfunction) (See FUEL PUMP UNIT REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
15	**VERIFY CURRENT INPUT SIGNAL STATUS** • Access the following PIDs using the M-MDS: (See ON-BOARD DIAGNOSTIC TEST [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) — ECT — MAF — O2S11 (When engine can be started) — O2S12 (When engine can be started) • Are the PIDs normal? (See PCM INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)	Yes	Go to the next step.
		No	ECT PID is not as specified: • Inspect for an intermittent open circuit of the ECT sensor and the related wiring harness. (See ENGINE COOLANT TEMPERATURE (ECT) SENSOR INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) MAF PID is not as specified: • Inspect for an intermittent open circuit of the MAF sensor and the related wiring harness. (See MASS AIR FLOW (MAF) SENSOR INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) O2S11 PID is not as specified: • Inspect for an intermittent open circuit of the A/F sensor and the related wiring harness. (See AIR FUEL RATIO (A/F) SENSOR INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) O2S12 PID is not as specified: • Inspect for an intermittent open circuit of the HO2S and the related wiring harness. (See HEATED OXYGEN SENSOR (HO2S) INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) Repair or replace the malfunctioning part according to the inspection results.
16	**INSPECT INTAKE-AIR SYSTEM FOR AIR SUCTION** • If the engine cannot be started: — Inspect the intake air system for air leakage. • If the engine can be started: — Perform the Intake Manifold Vacuum Inspection. (See ENGINE CONTROL SYSTEM OPERATION INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is air being sucked in from intake air system?	Yes	Repair or replace the malfunctioning part according to the inspection results.
		No	Go to the next step.

STEP	INSPECTION	RESULTS	ACTION
17	**INSPECT FUEL LINE PRESSURE** • Inspect the fuel line pressure. (See FUEL LINE PRESSURE INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is the low side fuel pressure within specification? **Specification:** **• 405—485 kPa {4.13—4.94 kgf/cm^2, 58.8—70.3 psi}**	Yes	Inspect the PCM ground condition. Repair or replace the malfunctioning part according to the inspection results.
		No	Zero or low: • Inspect the fuel pump relay and the fuel pump circuit. (See RELAY INSPECTION.) • Inspect the fuel line for restriction. — If there is any malfunction: • Repair or replace the malfunctioning part according to the inspection results. — If there is no malfunction: • Replace the fuel pump unit. (Pressure regulator or fuel pump malfunction) (See FUEL PUMP UNIT REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) High: • Replace the fuel pump unit. (Pressure regulator malfunction) (See FUEL PUMP UNIT REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
18	Verify the test results. • If normal, return to the diagnostic index to service any additional symptoms. (See SYMPTOM DIAGNOSTIC INDEX [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • If a malfunction remains, inspect the related Service Information and perform the repair or diagnosis. — If the vehicle is repaired, troubleshooting is completed. — If the vehicle is not repaired or additional diagnostic information is not available, replace the PCM. (See PCM REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)		