NO.14 POOR FUEL ECONOMY [SKYACTIV-G 2.0, SKYACTIV-G 2.5]

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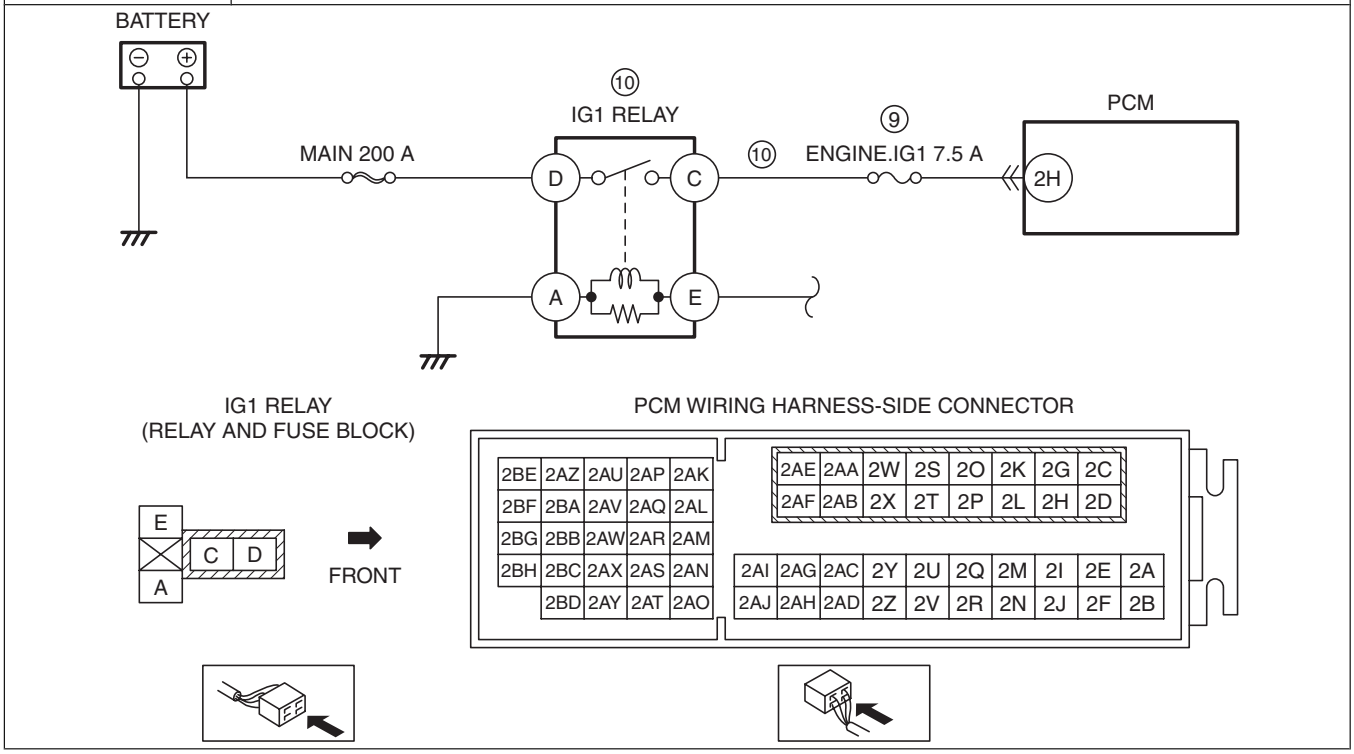
14	POOR FUEL ECONOMY
DESCRIPTION	• Fuel economy is unsatisfactory.

14	POOR FUEL ECONOMY
POSSIBLE CAUSE	• Engine cooling system malfunction • PCM DTC is stored • Erratic signal to PCM — APP sensor or related circuit malfunction — ECT sensor or related circuit malfunction — IAT sensor No.1 (integrated in MAF sensor/IAT sensor No.1) or related circuit malfunction — MAF sensor or related circuit malfunction — MAP sensor or related circuit malfunction — TP sensor or related circuit malfunction — Intermittent open or short circuit MAF sensor, APP sensor, TP sensor • Improper operation of cooling fan control system • Improper operation of A/C system • Incorrect fuel injection timing • Fuel injector malfunction • Short to power supply in wiring harness between IG1 relay terminal C and PCM terminal 2H • Contaminated air cleaner element • Air leakage or restriction in intake-air system • Poor fuel quality • Improper coolant level • Clutch slippage (MTX) • Improper ATF level (ATX) • Brake dragging • Tire air pressure malfunction • Vacuum leakage • Fuel leakage • Contamination in MAF sensor • Tires, wheels (large size) • Change of intake air system components and exhaust system components • Engine operation time is longer than traveled distance — Vehicle is driven in congested traffic frequently — Left idling for long periods • Amount of fuel injection increases — Overloaded — Frequent acceleration/deceleration — Frequently driving on ascending roads — Travel distance per one drive is short (amount of time for warm-up is long during engine operation) — Improper load signal input • Improper A/C request signal • Driver forgets to switch electronic device off • Electronic device is frequently used with engine stopped (no power generation) • Vehicle left undriven for long periods • Large amount of parasitic draw (especially after-market electronic devices) • Erratic or no signal from CMP sensor — Loose installation — Damaged trigger wheel (intake camshaft and/or exhaust camshaft) — Open or short circuit in related wiring harness • Erratic signal from CKP sensor — Loose installation — Damaged trigger wheel (crankshaft pulley) — Open or short circuit in related wiring harness • Inadequate fuel pressure (high-pressure side) — Fuel pressure sensor malfunction — High pressure fuel pump malfunction — Spill valve control solenoid valve control circuit malfunction (damage to driver in PCM caused by short circuit to ground system) — Spill valve control solenoid valve (built-into high pressure fuel pump) malfunction — Relief valve (built-into high pressure fuel pump) malfunction — Fuel line restricted — Fuel pump unit malfunction • Improper engine compression • Improper intake valve timing due to timing chain jumping • Improper exhaust valve timing due to timing chain jumping • Spark plug malfunction • Exhaust system and/or TWC restriction • PCV valve malfunction • Injector driver (built-into PCM) malfunction

14	POOR FUEL ECONOMY
POSSIBLE CAUSE	**Warning** **The following troubleshooting flow chart contains the fuel system diagnosis and repair procedures. Read the following warnings before performing the fuel system services:** **• 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 injury 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 possibly cause damage to the fuel pipe and 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 IF MALFUNCTION CAUSED BY ENGINE MALFUNCTION** • Verify the vehicle engine condition. • Can malfunction symptoms other than "NO.14 POOR FUEL ECONOMY" be verified?	Yes	Go to the applicable symptom troubleshooting. (See SYMPTOM DIAGNOSTIC INDEX [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	Go to the next step.
2	**INSPECT COOLING SYSTEM FOR MALFUNCTION** • Is any cooling system concern (overheating, runs cold) present?	Yes	Perform the applicable symptom troubleshooting. (See NO.17 COOLING SYSTEM CONCERNS-OVERHEATING [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) (See NO.18 COOLING SYSTEM CONCERNS-RUNS COLD [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	Go to the next step.
3	**VERIFY PCM DTC** • Retrieve any DTCs using the M-MDS. (See ON-BOARD DIAGNOSTIC TEST [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	Go to the next step.

STEP	INSPECTION	RESULTS	ACTION
4	**VERIFY CURRENT INPUT SIGNAL STATUS** **Caution** **• While performing this step, always operate the vehicle in a safe and lawful manner.** **• 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.** • Access the following PIDs using the M-MDS: (See ON-BOARD DIAGNOSTIC TEST [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) — APP1 — APP2 — ECT — IAT — MAF — MAP — TP REL • Do the PIDs indicate the correct values under the malfunction condition? (See PCM INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)	Yes	Go to the next step.
		No	APP1, APP2 PIDs are not as specified: • Inspect the APP sensor. (See ACCELERATOR PEDAL POSITION (APP) SENSOR INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) ECT PID is not as specified: • Inspect the ECT sensor. (See ENGINE COOLANT TEMPERATURE (ECT) SENSOR INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) IAT PID is not as specified: • Inspect the IAT sensor No.1. (See INTAKE AIR TEMPERATURE (IAT) SENSOR INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) MAF PID is not as specified: • Inspect the MAF sensor. (See MASS AIR FLOW (MAF) SENSOR INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) MAP PID is not as specified: • Inspect the MAP sensor. (See MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) TP REL PID is not as specified: • Inspect the TP sensor. (See THROTTLE POSITION (TP) SENSOR INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) Repair or replace the malfunctioning part according to the inspection results. • If the malfunction remains: — Perform the “INTERMITTENT CONCERN TROUBLESHOOTING” procedure. (See INTERMITTENT CONCERN TROUBLESHOOTING [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
5	**DETERMINE IF MALFUNCTION CAUSE IS A/C REQUEST SIGNAL OR OTHER** • Access the AC_REQ PID using the M-MDS. (See ON-BOARD DIAGNOSTIC TEST [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Monitor the AC_REQ PID while turning on and off the air conditioner using the switch on the control panel. • Does the AC_REQ PID value change from on to off according to switch control panel?	Yes	Go to the next step.
		No	If the AC_REQ PID is always ON: • Perform the symptom troubleshooting “NO.24 A/C IS ALWAYS ON OR A/C COMPRESSOR RUNS CONTINUOUSLY”. (See NO.24 A/C IS ALWAYS ON OR A/C COMPRESSOR RUNS CONTINUOUSLY [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) If the AC_REQ PID is always OFF: • Perform the symptom troubleshooting “NO.23 A/C DOES NOT WORK SUFFICIENTLY”. (See NO.23 A/C DOES NOT WORK SUFFICIENTLY [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
6	**INSPECT COOLING FAN CONTROL SYSTEM OPERATION** • Perform the Cooling Fan Control System Inspection. (See ENGINE CONTROL SYSTEM OPERATION INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Does the cooling fan control system operate properly?	Yes	Go to the next step.
		No	Repair or replace the malfunctioning part according to the inspection results.

STEP	INSPECTION	RESULTS	ACTION
7	**INSPECT A/C CUT-OFF CONTROL SYSTEM OPERATION** • Perform the A/C Cut-off Control System Inspection. (See ENGINE CONTROL SYSTEM OPERATION INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Does the A/C cut-off operation work properly?	Yes	Go to the next step.
		No	Repair or replace the malfunctioning part according to the inspection results.
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 ENGINE.IG1 7.5 A FUSE** • Switch the ignition off. • Remove the ENGINE.IG1 7.5 A fuse. • Inspect the ENGINE.IG1 7.5 A fuse. • Is there any malfunction?	Yes	If the fuse is blown: • Repair or replace the wiring harness for a possible short to ground. • Replace the fuse. If the fuse is deteriorated: • Replace the fuse. Go to the next step.
		No	Reinstall the ENGINE.IG1 7.5 A fuse, then go to the next step.
10	**INSPECT IG1 RELAY CIRCUIT FOR SHORT TO POWER SUPPLY** • Remove the IG1 relay. • Disconnect the PCM connector. • Measure the voltage at the IG1 relay terminal C (wiring harness-side). • Is the voltage **0 V**?	Yes	Inspect the IG1 relay. (See RELAY INSPECTION.) • If there is any malfunction: — Replace the IG1 relay. • If there is no malfunction: — Reconnect all disconnected connectors. — Go to the next step.
		No	Repair or replace the wiring harness for a possible short to power supply.

STEP	INSPECTION	RESULTS	ACTION
11	**INSPECT RELATED PART CONDITION** • Inspect the following: — Air cleaner element for contamination — Intake-air system restriction — Fuel quality (proper octane, contamination, winter/summer blend) — Coolant level — Clutch slippage (MTX) — ATF level (ATX) — Brake dragging — Tire air pressure — Vacuum leakage — Fuel leakage — MAF sensor contaminated — Tires, wheels (large size) — Change of intake air system components and exhaust system components — Engine operation time is longer than traveled distance • Vehicle is driven in congested traffic frequently • Left idling for long periods — Amount of fuel injection increases • Overloaded • Frequent acceleration/deceleration • Frequently driving on ascending roads • Travel distance per one drive is short — Driver forgets to switch electronic device off — Electronic device is frequently used with engine stopped (no power generation) — Vehicle left undriven for long periods — Large amount of parasitic draw — CKP sensor, intake CMP sensor and exhaust CMP sensor • Installation condition (See CRANKSHAFT POSITION (CKP) SENSOR REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) (See CAMSHAFT POSITION (CMP) SENSOR REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Damaged trigger wheel, intake camshaft and exhaust camshaft • Is there any malfunction?	Yes	Service if necessary. • Repeat this step.
		No	Go to the next step.

STEP	INSPECTION	RESULTS	ACTION
12	**INSPECT FUEL PRESSURE (HIGH-SIDE)** • Start the engine and warm it up completely. • Access the FUEL_PRES PID using the M-MDS at idle. (See ON-BOARD DIAGNOSTIC TEST [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is the FUEL_PRES PID value **approx. 3 MPa {31 kgf/cm^2, 435 psi}**?	Yes	Go to Step 16.
		No	Lower than **3 MPa {31 kgf/cm2, 435 psi}**: • Inspect the following: — Fuel leakage at the fuel line and fuel injector — Fuel pump • Perform the Fuel Pump (Low-pressure Side) Operation Inspection. (See ENGINE CONTROL SYSTEM OPERATION INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) — Fuel pressure sensor (See FUEL PRESSURE SENSOR INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) — High pressure fuel pump (See HIGH PRESSURE FUEL PUMP INSPECTION [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: — Go to Step 15. Higher than **3 MPa {31 kgf/cm2, 435 psi}**: • Go to the next step.
13	**DETERMINE IF MALFUNCTION CAUSE IS FUEL PRESSURE SENSOR OR HIGH PRESSURE FUEL PUMP** • Is the vehicle acceleration performance normal?	Yes	Go to the next step.
		No	Go to Step 15.
14	**INSPECT FUEL PRESSURE SENSOR** • Inspect the fuel pressure sensor. (See FUEL PRESSURE SENSOR INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is there any malfunction?	Yes	Replace the fuel distributor. (See FUEL INJECTOR REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	Go to Step 16.
15	**INSPECT SPILL VALVE CONTROL SOLENOID VALVE CONTROL CIRCUIT FOR SHORT TO GROUND** • Switch the ignition off. • Disconnect the high pressure fuel pump and PCM connectors. • Inspect for continuity between high pressure fuel pump terminal A (wiring harness-side) and body ground. • Is there continuity?	Yes	Repair or replace the wiring harness for a possible short to ground. • If the malfunction remains: — Replace the PCM. (damage to driver in PCM) (See PCM REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	Replace the high pressure fuel pump. (See HIGH PRESSURE FUEL PUMP REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
16	**INSPECT FUEL PRESSURE (LOW-SIDE)** • Connect the fuel pressure gauge between fuel pump and high pressure fuel pump. • Measure the low side fuel 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	Go to the next step.
		No	Inspect the following: • Fuel line restriction • Fuel filter clogged — 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. (See FUEL PUMP UNIT REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)

STEP	INSPECTION	RESULTS	ACTION
17	**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	Inspect the following: • Damaged valve seat • Worn valve stem and valve guide • Worn or stuck piston ring • Worn piston, piston ring or cylinder • Improper intake valve timing • Improper exhaust valve timing Service if necessary.
18	**INSPECT IGNITION SYSTEM OPERATION** • Perform the Spark Test. (See ENGINE CONTROL SYSTEM OPERATION INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is the 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.
19	**INSPECT EXHAUST SYSTEM FOR RESTRICTION** • Inspect for restriction in the exhaust system and the TWC. • Is there any restriction?	Yes	Repair or replace the malfunctioning part according to the inspection results.
		No	Go to the next step.
20	**INSPECT IF MALFUNCTION CAUSE IS PCV VALVE OR INJECTOR DRIVER (PCM INTEGRATED)** • Inspect the PCV valve. (See POSITIVE CRANKCASE VENTILATION (PCV) VALVE INSPECTION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) • Is there any malfunction?	Yes	Replace the PCV valve. (See POSITIVE CRANKCASE VENTILATION (PCV) VALVE REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].)
		No	Injector driver malfunction. • Replace the PCM. (See PCM REMOVAL/INSTALLATION [SKYACTIV-G 2.0, SKYACTIV-G 2.5].) If the problem remains, overhaul the engine.

STEP	INSPECTION	RESULTS	ACTION
21	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].)		