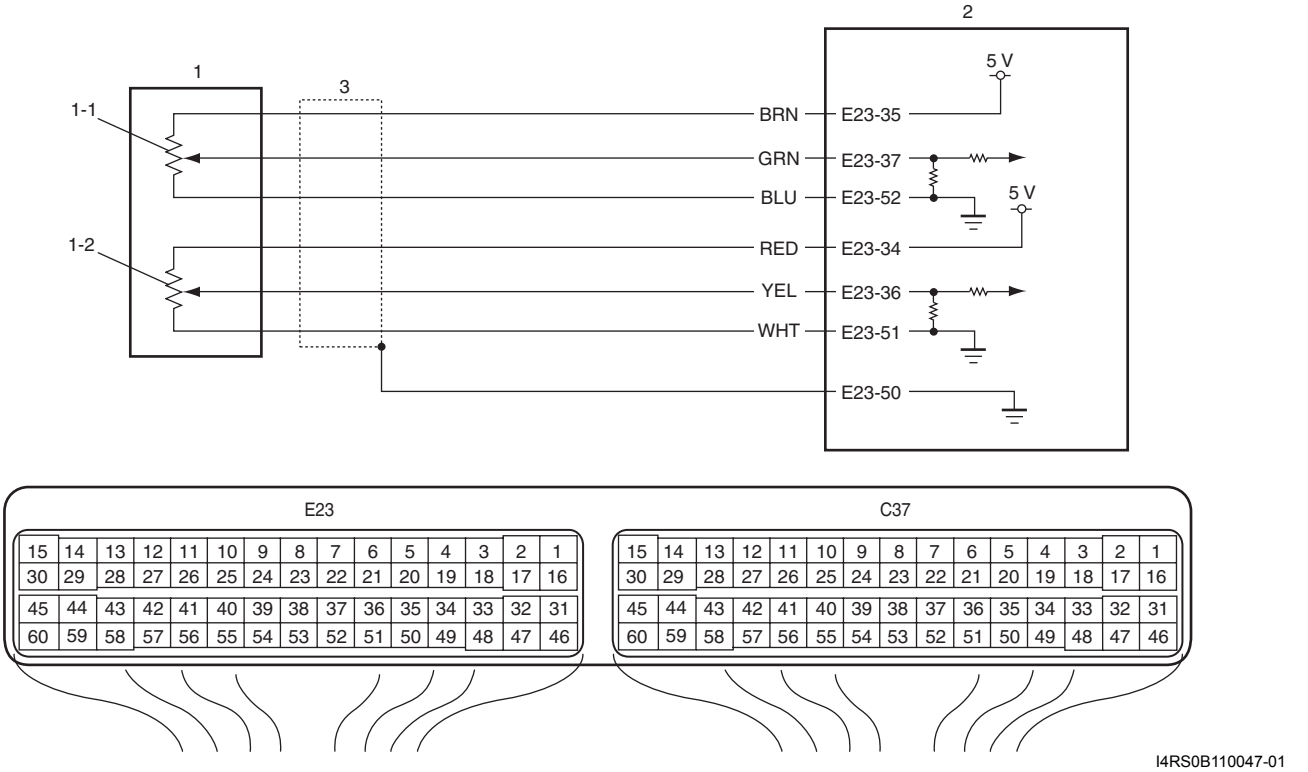
Step	Action	Yes	No
5	**ECM voltage check** 1) Turn OFF ignition switch. 2) Remove ECM from its bracket with ECM connectors connected. 3) Check for proper connection of ECM connector at "E23-35" terminal. 4) If OK, measure voltage between "E23-35" terminal of ECM connector and engine ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	"BRN" wire is open or high resistance circuit.	Go to Step 6.
6	**Wire harness check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between "E23-35" terminal of ECM connector and engine ground. *Is resistance infinity?*	Substitute a known-good ECM and recheck.	"BRN" wire is shorted to ground circuit.
7	**Wire harness check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection of ECM connector at "E23-37", "E23-52" and "E23-51" terminals. 3) If OK, measure resistance between "GRN" wire terminal of accelerator pedal position (APP) sensor assembly connector and vehicle body ground. *Is resistance infinity?*	Go to Step 8.	"GRN" wire is shorted to ground circuit.
8	**Wire harness check** 1) Measure resistance between "E23-37" and each "E23-52", "E23-51", "E23-50" terminals of ECM connector with ignition switch turned OFF. *Is each resistance infinity?*	Go to Step 9.	"GRN" wire is shorted to "BLU" wire and/or "WHT" wire and/or "E23-50" circuit.
9	**Wire harness check** 1) Measure resistance between "GRN" wire terminal of accelerator pedal position (APP) sensor assembly connector and "E23-37" terminal of ECM connector with ignition switch turned OFF. *Is resistance below 5 Ω?*	Go to Step 10.	"GRN" wire is open or high resistance circuit.
10	**Accelerator pedal position (APP) sensor assembly check** 1) Check accelerator pedal position sensor (main) referring to "Accelerator Pedal Position (APP) Sensor Assembly Inspection (For Automated Manual Transaxle Model): in Section 1C". *Is output voltage within specified value?*	Substitute a known-good ECM and recheck.	Replace accelerator pedal position (APP) sensor assembly.

DTC P2123: Pedal Position Sensor (Main) Circuit High Input (For Automated Manual Transaxle Model)

S4RS0B1104083

Wiring Diagram



I4RS0B110047-01

1. Accelerator pedal position (APP) sensor assembly	1-2. Accelerator pedal position (APP) sensor (sub)	3. Ground of accelerator pedal position (APP) sensor for shield wire
1-1. Accelerator pedal position (APP) sensor (main)	2. ECM	

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Output voltage of accelerator pedal position sensor (main) is more than specified value for 0.2 seconds continuously. (1 driving detection logic)	• Accelerator pedal position (APP) sensor (main) circuit • Accelerator pedal position (APP) sensor assembly • ECM • Incorrect mounting of accelerator pedal position (APP) sensor assembly

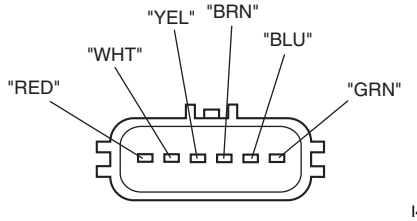
DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Keep the accelerator pedal at idle position for 2 seconds.
4) Keep the accelerator pedal at fully depressed position for 2 seconds.
5) Repeat Step 3) and 4) for 3 times.
6) Check DTC.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

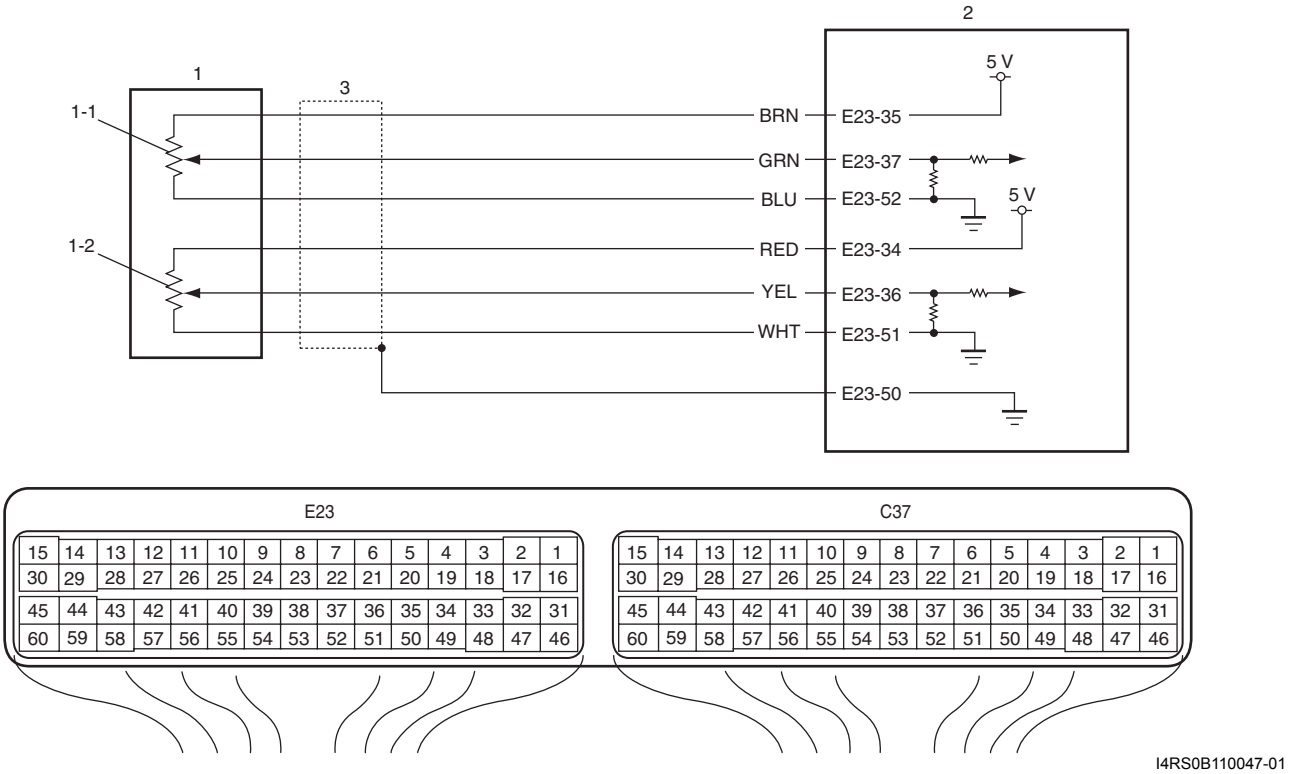
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**Accelerator pedal position (APP) sensor assembly mounting check** 1) Check that accelerator pedal position (APP) sensor assembly has been mounted to vehicle body properly (no pinched floor carpet, etc). *Is it OK?*	Go to Step 3.	Reinstall accelerator pedal position (APP) sensor assembly properly referring to "Accelerator Pedal Position (APP) Sensor Assembly Removal and Installation (For Automated Manual Transaxle Model): in Section 1C".
3	**Accelerator pedal position sensor (main) and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch, check "APP Sensor 1 Volt" displayed on scan tool. *Is displayed voltage 4.75 V or more?*	Go to Step 4.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection: in Section 00".
4	**ECM voltage check** 1) Disconnect connector from accelerator pedal position (APP) sensor assembly with ignition switch turned OFF. 2) Check for proper connection to accelerator pedal position (APP) sensor assembly at "BRN", "GRN" and "BLU" wire terminals.  I4RS0B110048-01 3) If OK, measure voltage between "BRN" wire terminal of accelerator pedal position (APP) sensor assembly connector and vehicle body ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	Go to Step 6.	Go to Step 5.

Step	Action	Yes	No
5	**Wire harness check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection of ECM connector at “E23-35” terminal. 3) If OK, measure voltage between “E23-35” terminal of ECM connector and engine ground with ignition switch turned ON. *Is voltage 0 V?*	Substitute a known-good ECM and recheck.	“BRN” wire is shorted to power circuit.
6	**Wire harness check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection of ECM connector at “E23-35”, “E23-37” and “E23-34” terminals. 3) If OK, measure resistance between “GRN” wire terminal and each “BRN”, “RED” wire terminals of accelerator pedal position (APP) sensor assembly connector. *Is each resistance infinity?*	Go to Step 7.	“GRN” wire is shorted to “BRN” wire and/or “RED” wire.
7	**Wire harness check** 1) Turn ON ignition switch. 2) Measure voltage between “E23-37” terminal of ECM connector and engine ground. *Is voltage 0 V?*	Go to Step 8.	“GRN” wire is shorted to power circuit.
8	**Ground circuit check** 1) Connect connectors to ECM with ignition switch turned OFF. 2) Measure resistance between “BLU” wire terminal of accelerator pedal position (APP) sensor assembly connector and vehicle body ground. *Is resistance below 5 Ω?*	Go to Step 10.	Go to Step 9.
9	**Ground circuit check** 1) Remove ECM from its bracket with ECM connectors connected. 2) Check for proper connection of ECM connector at “E23-52” terminal. 3) If OK, measure resistance between “E23-52” terminal of ECM connector and engine ground. *Is resistance below 5 Ω?*	“BLU” wire is open or high resistance circuit.	Faulty ECM ground circuit. If circuit is OK, substitute a known-good ECM and recheck.
10	**Accelerator pedal position (APP) sensor assembly check** 1) Check accelerator pedal position sensor (main) referring to “Accelerator Pedal Position (APP) Sensor Assembly Inspection (For Automated Manual Transaxle Model): in Section 1C”. *Is output voltage within specified value?*	Substitute a known-good ECM and recheck.	Replace accelerator pedal position (APP) sensor assembly.

DTC P2127: Pedal Position Sensor (Sub) Circuit Low Input (For Automated Manual Transaxle Model)

S4RS0B1104084

Wiring Diagram



1. Accelerator pedal position (APP) sensor assembly	1-2. Accelerator pedal position (APP) sensor (sub)	3. Ground of accelerator pedal position (APP) sensor for shield wire
1-1. Accelerator pedal position (APP) sensor (main)	2. ECM	

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Output voltage of accelerator pedal position sensor (sub) is less than specified value for 0.2 seconds continuously. (1 driving detection logic)	• Accelerator pedal position (APP) sensor (sub) circuit • Accelerator pedal position (APP) sensor assembly • ECM • Incorrect mounting of accelerator pedal (APP) sensor assembly

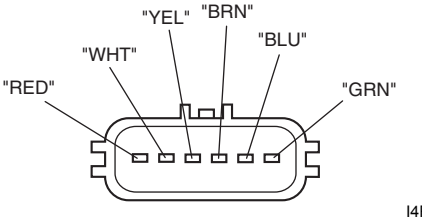
DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Keep the accelerator pedal at idle position for 2 seconds.
4) Keep the accelerator pedal at fully depressed position for 2 seconds.
5) Repeat Step 3) and 4) for 3 times.
6) Check DTC.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

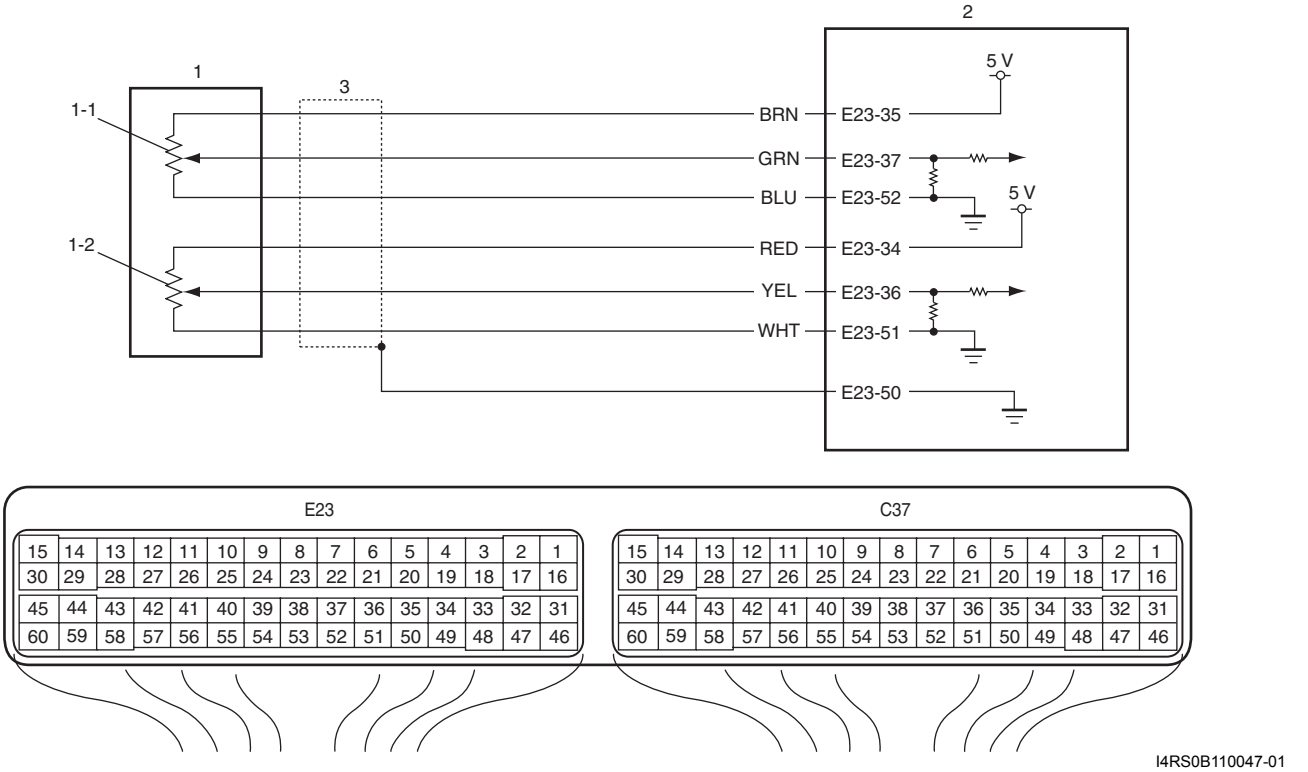
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**Accelerator pedal position (APP) sensor assembly mounting check** 1) Check that accelerator pedal position (APP) sensor assembly has been mounted to vehicle body properly (no pinched floor carpet, etc). *Is it OK?*	Go to Step 3.	Reinstall accelerator pedal position (APP) sensor assembly properly referring to "Accelerator Pedal Position (APP) Sensor Assembly Removal and Installation (For Automated Manual Transaxle Model): in Section 1C".
3	**Accelerator pedal position sensor (sub) and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch, check "APP Sensor 2 Volt" displayed on scan tool. *Is displayed voltage below 0.384 V?*	Go to Step 4.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection: in Section 00".
4	**ECM voltage check** 1) Disconnect connector from accelerator pedal position (APP) sensor assembly with ignition switch turned OFF. 2) Check for proper connection to accelerator pedal position (APP) sensor assembly at "RED", "YEL" and "WHT" wire terminals.  I4RS0B110048-01 3) If OK, measure voltage between "RED" wire terminal of accelerator pedal position (APP) sensor assembly connector and vehicle body ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	Go to Step 7.	Go to Step 5.

Step	Action	Yes	No
5	**ECM voltage check** 1) Turn OFF ignition switch. 2) Remove ECM from its bracket with ECM connectors connected. 3) Check for proper connection of ECM connector at "E23-34" terminal. 4) If OK, measure voltage between "E23-34" terminal of ECM connector and engine ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	"RED" wire is open or high resistance circuit.	Go to Step 6.
6	**Wire harness check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between "E23-34" terminal of ECM connector and engine ground. *Is resistance infinity?*	Substitute a known-good ECM and recheck.	"RED" wire is shorted to ground circuit.
7	**Wire harness check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection of ECM connector at "E23-36", "E23-52" and "E23-51" terminals. 3) If OK, measure resistance between "YEL" wire terminal of accelerator pedal position (APP) sensor assembly connector and vehicle body ground. *Is resistance infinity?*	Go to Step 8.	"YEL" wire is shorted to ground circuit.
8	**Wire harness check** 1) Measure resistance between "E23-36" and each "E23-52", "E23-51", "E23-50" terminals of ECM connector with ignition switch turned OFF. *Is each resistance infinity?*	Go to Step 9.	"YEL" wire is shorted to "BLU" wire and/or "WHT" wire and/or "E23-50" circuit.
9	**Wire harness check** 1) Measure resistance between "YEL" wire terminal of accelerator pedal position (APP) sensor assembly connector and "E23-36" terminal of ECM connector with ignition switch turned OFF. *Is resistance below 5 Ω?*	Go to Step 10.	"YEL" wire is open or high resistance circuit.
10	**Accelerator pedal position (APP) sensor assembly check** 1) Check accelerator pedal position sensor (sub) referring to "Accelerator Pedal Position (APP) Sensor Assembly Inspection (For Automated Manual Transaxle Model): in Section 1C". *Is output voltage within specified value?*	Substitute a known-good ECM and recheck.	Replace accelerator pedal position (APP) sensor assembly.

DTC P2128: Pedal Position Sensor (Sub) Circuit High Input (For Automated Manual Transaxle Model)

S4RS0B1104085

Wiring Diagram



I4RS0B110047-01

1. Accelerator pedal position (APP) sensor assembly	1-2. Accelerator pedal position (APP) sensor (sub)	3. Ground of accelerator pedal position (APP) sensor for shield wire
1-1. Accelerator pedal position (APP) sensor (main)	2. ECM	

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Output voltage of accelerator pedal position sensor (sub) is more than specified value for 0.2 seconds continuously. (1 driving detection logic)	• Accelerator pedal position (APP) sensor (sub) circuit • Accelerator pedal position (APP) sensor assembly • ECM • Incorrect mounting of accelerator (APP) sensor assembly

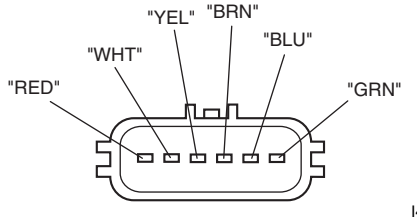
DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Keep the accelerator pedal at idle position for 2 seconds.
4) Keep the accelerator pedal at fully depressed position for 2 seconds.
5) Repeat Step 3) and 4) for 3 times.
6) Check DTC.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

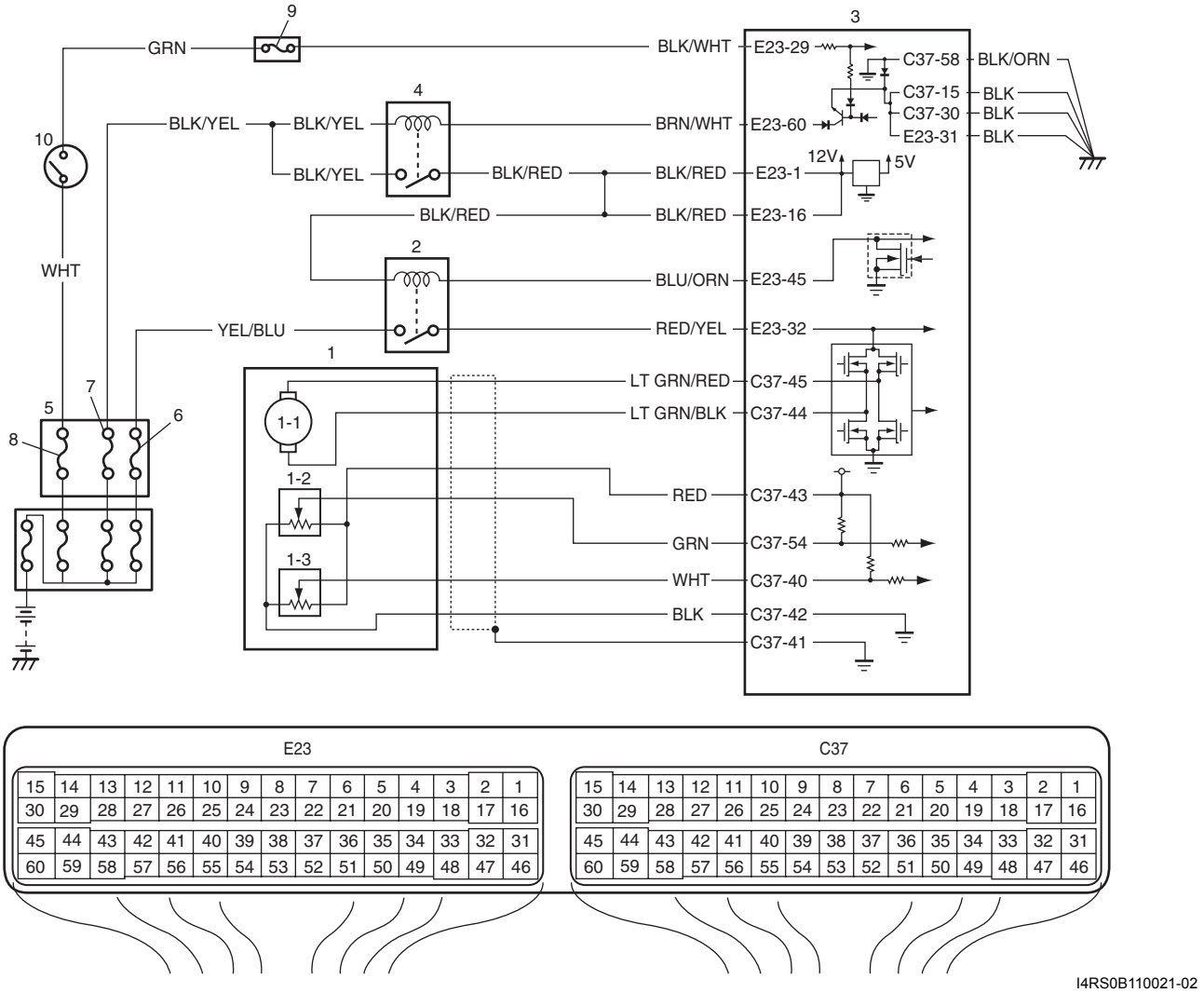
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**Accelerator pedal position (APP) sensor assembly mounting check** 1) Check that accelerator pedal position (APP) sensor assembly has been mounted to vehicle body properly (no pinched floor carpet, etc). *Is it OK?*	Go to Step 3.	Reinstall accelerator pedal position (APP) sensor assembly properly referring to "Accelerator Pedal Position (APP) Sensor Assembly Removal and Installation (For Automated Manual Transaxle Model): in Section 1C".
3	**Accelerator pedal position sensor (sub) and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch, check "APP Sensor 2 Volt" displayed on scan tool. *Is displayed voltage 4.75 V or more?*	Go to Step 4.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection: in Section 00".
4	**ECM voltage check** 1) Disconnect connector from accelerator pedal position (APP) sensor assembly with ignition switch turned OFF. 2) Check for proper connection to accelerator pedal position (APP) sensor assembly at "RED", "YEL" and "WHT" wire terminals.  I4RS0B110048-01 3) If OK, measure voltage between "RED" wire terminal of accelerator pedal position (APP) sensor assembly connector and vehicle body ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	Go to Step 6.	Go to Step 5.

Step	Action	Yes	No
5	**Wire harness check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection of ECM connector at “E23-34” terminal. 3) If OK, measure voltage between “E23-34” terminal of ECM connector and engine ground with ignition switch turned ON. *Is voltage 0 V?*	Substitute a known-good ECM and recheck.	“RED” wire is shorted to power circuit.
6	**Wire harness check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection of ECM connector at “E23-35”, “E23-36” and “E23-34” terminals. 3) If OK, measure resistance between “YEL” wire terminal and each “BRN”, “RED” wire terminals of accelerator pedal position (APP) sensor assembly connector. *Is each resistance infinity?*	Go to Step 7.	“YEL” wire is shorted to “BRN” wire and/or “RED” wire.
7	**Wire harness check** 1) Turn ON ignition switch. 2) Measure voltage between “E23-36” terminal of ECM connector and engine ground. *Is voltage 0 V?*	Go to Step 8.	“YEL” wire is shorted to power circuit.
8	**Ground circuit check** 1) Connect connectors to ECM with ignition switch turned OFF. 2) Measure resistance between “WHT” wire terminal of accelerator pedal position (APP) sensor assembly connector and vehicle body ground. *Is resistance below 5 Ω?*	Go to Step 10.	Go to Step 9.
9	**Ground circuit check** 1) Remove ECM from its bracket with ECM connectors connected. 2) Check for proper connection of ECM connector at “E23-51” terminal. 3) If OK, measure resistance between “E23-51” terminal of ECM connector and engine ground. *Is resistance below 5 Ω?*	“WHT” wire is open or high resistance circuit.	Faulty ECM ground circuit. If circuit is OK, substitute a known-good ECM and recheck.
10	**Accelerator pedal position (APP) sensor assembly check** 1) Check accelerator pedal position sensor (sub) referring to “Accelerator Pedal Position (APP) Sensor Assembly Inspection (For Automated Manual Transaxle Model): in Section 1C”. *Is output voltage within specified value?*	Substitute a known-good ECM and recheck.	Replace accelerator pedal position (APP) sensor assembly.

DTC P2135: Throttle Position Sensor (Main / Sub) Voltage Correlation (For Automated Manual Transaxle Model)

S4RS0B1104086

Wiring Diagram



I4RS0B110021-02

1. Electric throttle body assembly	3. ECM	8. "IG ACC" fuse
1-1. Throttle actuator	4. Main relay	9. "IG COIL" fuse
1-2. Throttle position sensor (main)	5. Individual circuit fuse box No.1	10. Ignition switch
1-3. Throttle position sensor (sub)	6. "TH MOT" fuse	
2. Throttle actuator control relay	7. "FI" fuse	

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Difference between the opening angle based on throttle position sensor (main) and the opening angle based on throttle position sensor (sub) is more than specification for specified time continuously. (1 driving detection logic)	• Throttle position sensor (main) and (sub) circuit • Electric throttle body assembly • ECM

DTC Confirmation Procedure

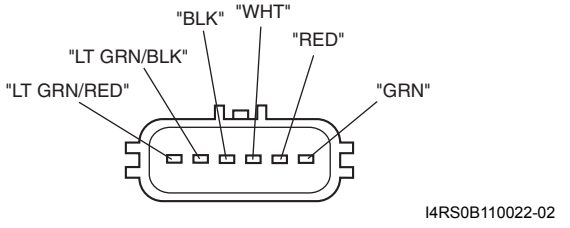
1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Keep the accelerator pedal at idle position for 2 seconds.
4) Keep the accelerator pedal at fully depressed position for 2 seconds.
5) Repeat Step 3) and 4) for 3 times.

6) Check DTC.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

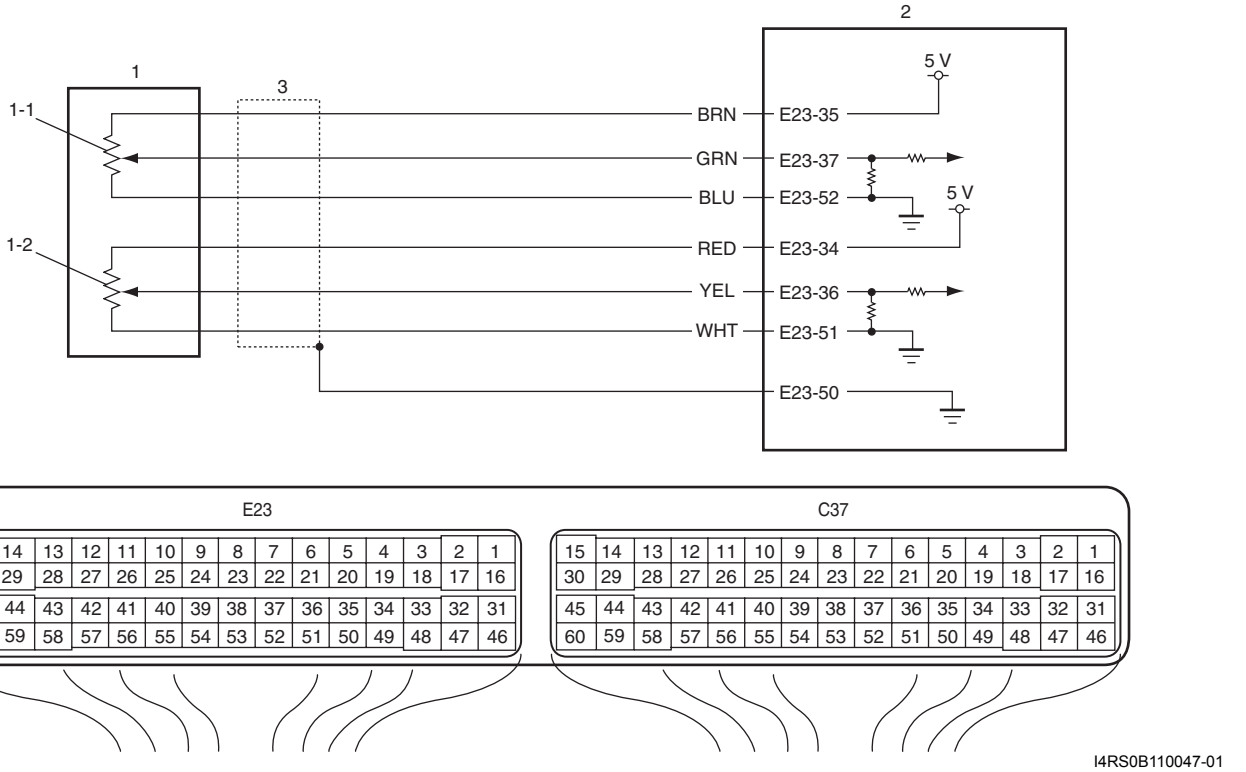
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**Throttle position sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch, check each voltage of "TP Sensor 1 Volt" and "TP Sensor 2 Volt" displayed on scan tool when accelerator pedal is idle position and fully depressed. *Is displayed each TP sensor value as described voltage in "Scan Tool Data: "?*	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection: in Section 00".	Go to Step 3.
3	**ECM voltage check** 1) Disconnect connector from electric throttle body assembly with ignition switch turned OFF. 2) Check for proper connection to electric throttle body assembly at "RED", "GRN", "WHT" and "BLK" wire terminals.  I4RS0B110022-02 3) If OK, measure voltage between "RED" wire terminal of electric throttle body assembly connector and engine ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	Go to Step 6.	Go to Step 4.
4	**Wire harness check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between "C37-43" terminal of ECM connector and engine ground. *Is resistance infinity?*	Go to Step 5.	"RED" wire is shorted to other circuit.
5	**Wire harness check** 1) Measure voltage between "C37-43" terminal of ECM connector and engine ground with ignition switch turned ON. *Is voltage 0 V?*	Substitute a known-good ECM and recheck.	"RED" wire is shorted to other circuit.

Step	Action	Yes	No
6	**Wire harness check** 1) Measure voltage between “GRN” wire terminal of electric throttle body assembly connector and engine ground, between “WHT” wire terminal of electric throttle body assembly connector and engine ground with ignition switch turned ON. *Is each voltage 4 – 6 V?*	Go to Step 9.	Go to Step 7.
7	**Wire harness check** 1) Turn OFF ignition switch. 2) Disconnect connectors from ECM. 3) Check for proper connection of ECM connector at “C37-54” and “C37-40” terminals. 4) If OK, measure voltage between “C37-54” terminal of ECM connector and engine ground, between “C37-40” terminal of ECM connector and engine ground. *Is each voltage 0 V?*	Go to Step 8.	“GRN” wire or “WHT” wire is shorted to other circuit.
8	**Wire harness check** 1) Measure resistance between “GRN” wire terminal of electric throttle body assembly connector and engine ground, between “WHT” wire terminal of electric throttle body assembly connector and engine ground with ignition switch turned OFF. *Is each resistance infinity?*	Substitute a known-good ECM and recheck.	“GRN” wire or “WHT” wire is shorted to other circuit.
9	**Electric throttle body assembly check** 1) Check throttle position sensor referring to “Throttle Position Sensor Performance Check” under “Electric Throttle Body Assembly On-Vehicle Inspection (For Automated Manual Transaxle Model): in Section 1C”. *Is each output voltage within specified value?*	Substitute a known-good ECM and recheck.	Replace electric throttle body assembly.

DTC P2138: Pedal Position Sensor (Main / Sub) Voltage Correlation (For Automated Manual Transaxle Model)

S4RS0B1104087

Wiring Diagram



I4RS0B110047-01

1. Accelerator pedal position (APP) sensor assembly	1-2. Accelerator pedal position (APP) sensor (sub)	3. Ground of accelerator pedal position (APP) sensor for shield wire
1-1. Accelerator pedal position (APP) sensor (main)	2. ECM	

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Difference between the opening angle based on accelerator pedal position sensor (main) and the opening angle based on accelerator pedal position sensor (sub) is more than specification for specified time continuously. (1 driving detection logic)	• Accelerator pedal position (APP) sensor (main) and (sub) circuit • Accelerator pedal position (APP) sensor assembly • ECM

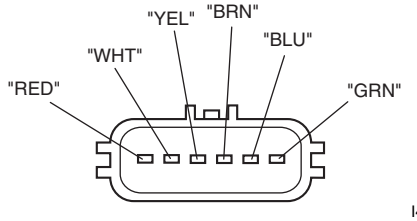
DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Keep the accelerator pedal at idle position for 2 seconds.
4) Keep the accelerator pedal at fully depressed position for 2 seconds.
5) Repeat Step 3) and 4) for 3 times.
6) Check DTC.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	**Accelerator pedal position sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check each voltage of "APP Sensor 1 Volt" and "APP Sensor 2 Volt" displayed on scan tool when accelerator pedal is idle position and fully depressed. *Is displayed each APP sensor value as described voltage in "Scan Tool Data: "?*	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection: in Section 00"	Go to Step 3.
3	**ECM voltage check** 1) Disconnect connector from accelerator pedal position (APP) sensor assembly with ignition switch turned OFF. 2) Check for proper connection to accelerator pedal position (APP) sensor assembly at "BRN", "GRN", "BLU", "RED", "YEL" and "WHT" wire terminals.  I4RS0B110048-01 3) If OK, measure voltage between "BRN" wire terminal of accelerator pedal position (APP) sensor assembly connector and vehicle body ground, between "RED" wire terminal of accelerator pedal position (APP) sensor assembly connector and vehicle body ground with ignition switch turned ON. *Is each voltage 4 – 6 V?*	Go to Step 6.	Go to Step 4.
4	**Wire harness check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection of ECM connector at "E23-35" and "E23-34" terminals 3) If OK, measure resistance between "E23-35" terminal of ECM connector and engine ground, between "E23-34" terminal of ECM connector and engine ground. *Is each resistance infinity?*	Go to Step 5.	"BRN" wire or "RED" wire is shorted to other circuit.

Step	Action	Yes	No
5	**Wire harness check** 1) Measure voltage between “E23-35” terminal of ECM connector and engine ground, between “E23-34” terminal of ECM connector and engine ground with ignition switch turned ON. *Is each voltage 0 V?*	Substitute a known-good ECM and recheck.	“BRN” wire or “RED” wire is shorted to other circuit.
6	**Wire harness check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection of ECM connector at “E23-37”, “E23-52”, “E23-36” and “E23-51” terminals. 3) If OK, measure resistance between “GRN” wire terminal of accelerator pedal position (APP) sensor assembly connector and vehicle body ground, between “YEL” wire terminal of accelerator pedal position (APP) sensor assembly connector and vehicle body ground. *Is each resistance infinity?*	Go to Step 7.	“GRN” wire or “YEL” wire is shorted to other circuit.
7	**Wire harness check** 1) Turn ON ignition switch. 2) Measure voltage between “E23-37” terminal of ECM connector and engine ground, between “E23-36” terminal of ECM connector and engine ground. *Is each voltage 0 V?*	Go to Step 8.	“GRN” wire or “YEL” wire is shorted to other circuit.
8	**Accelerator pedal position (APP) sensor assembly check** 1) 1)Check accelerator pedal position sensor referring to “Accelerator Pedal Position (APP) Sensor Assembly Inspection (For Automated Manual Transaxle Model): in Section 1C”. *Is output voltage within specified value?*	Substitute a known-good ECM and recheck.	Replace accelerator pedal position (APP) sensor assembly.

DTC P2227 / P2228 / P2229: Barometric Pressure Circuit Malfunction

S4RS0B1104062

DTC P2227: Barometric Pressure Circuit Range / Performance
DTC P2228: Barometric Pressure Circuit Low
DTC P2229: Barometric Pressure Circuit High

System Description

Barometric pressure sensor is installed in ECM.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
DTC P2227: Difference of barometric pressure value and intake manifold pressure value is higher than specified value while engine cranking. (2 driving cycle detection logic)	• Manifold absolute pressure sensor performance problem • Barometric pressure sensor in ECM
DTC P2228: Barometric pressure signal less than specified value is detected. (1 driving cycle detection logic)	• Barometric pressure sensor in ECM
DTC P2229: Barometric pressure signal more than specified value is detected. (1 driving cycle detection logic)	

DTC Confirmation Procedure

DTC P2227:

⚠ WARNING

- **When performing a road test, select a place where there is no traffic or possibility of a traffic accident and be very careful during testing to avoid occurrence of an accident.**
- **Road test should be carried out by 2 persons, a driver and a tester, on a level road.**

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch and clear DTC, pending DTC and freeze frame data by using scan tool and warm up engine to normal operating temperature.
3) Check DTC and pending DTC by using scan tool.

DTC P2228 / P2229:

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch, clear DTC by using scan tool and run engine for 1 min.
3) Check DTC and pending DTC by using scan tool.

DTC Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that the trouble has been corrected.**

Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check: ".
2	*Is DTC P2227 set?*	Go to Step 3.	Substitute a known-good ECM and recheck.
3	**MAP sensor check** 1) Check MAP sensor and its circuit referring to "DTC P0107: Manifold Absolute Pressure Circuit Low Input: "and/or "DTC P0108: Manifold Absolute Pressure Circuit High Input: ". *Is check result satisfactory?*	Substitute a known-good ECM and recheck.	MAP sensor or its circuit malfunction.

Inspection of ECM and Its Circuits

S4RS0B1104063

ECM and its circuits can be checked by measuring voltage, pulse signal and resistance with special tool connected.

⚠ CAUTION

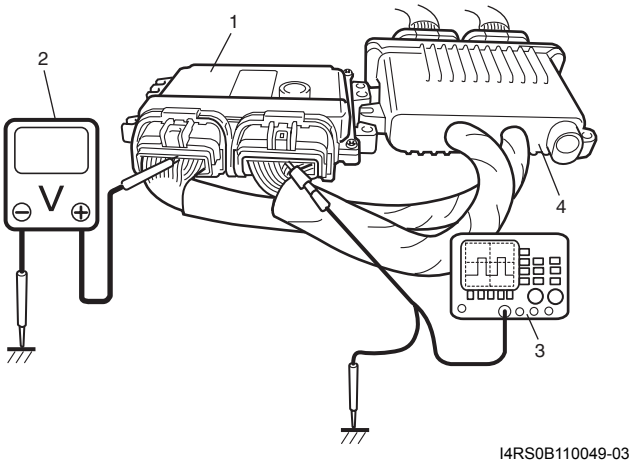
ECM cannot be checked by itself. It is strictly prohibited to connect voltmeter or ohmmeter to ECM with ECM connectors disconnected from it.

Voltage Check

1) Remove ECM (1) from its bracket referring to "Engine Control Module (ECM) Removal and Installation: in Section 1C".
2) Connect special tool (4) between ECM and ECM connectors securely.
3) Check voltage and/or pulse signal using voltmeter (2) and oscilloscope (3).

NOTE

- **As each terminal voltage is affected by battery voltage, confirm that it is 11 V or more when ignition switch is turned ON.**
- **Voltage with asterisk (*) cannot be measured with voltmeter because it is pulse signal. Use oscilloscope for its check if necessary.**



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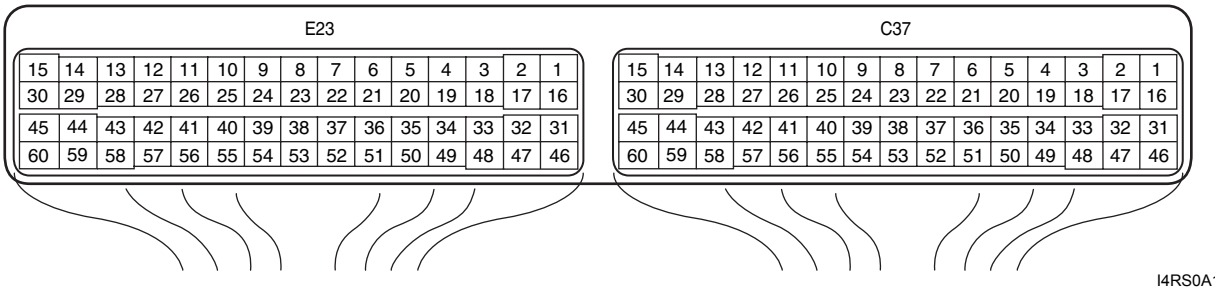
- **Before performed this inspection, be sure to read the "Precautions of ECM Circuit Inspection: ".**

Viewed from harness side



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Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
C37-1	BLU/YEL	Fuel injector No.1 output	10 – 14 V	Ignition switch turned ON.	—
			*0 – 0.6 V ↑↓ 10 – 14 V ("Reference waveform No.1: ", "Reference waveform No.2: " and "Reference waveform No.34: ")	Engine running at idle after warmed up engine.	Output signal is active low pulse. Pulse frequency varies depending on engine speed.
C37-2	BLU/WHT	Fuel injector No.2 output	10 – 14 V	Ignition switch turned ON.	—
			*0 – 0.6 V ↑↓ 10 – 14 V ("Reference waveform No.1: " and "Reference waveform No.3: ")	Engine running at idle after warmed up engine.	Output signal is active low pulse. Pulse frequency varies depending on engine speed.

Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
C37-3	GRN/ ORN	EGR valve (stepper motor coil 2) output	10 – 14 V	Ignition switch turned ON.	—
			*0 – 1 V ↑↓ 10 – 14 V (“Reference waveform No.4: ”)	Ignition switch is turned to ST (cranking) position.	Output signal is active low duty pulse. Number of pulse generated times varies depending on vehicle condition.
C37-4	GRN/ RED	EGR valve (stepper motor coil 1) output	10 – 14 V	Ignition switch turned ON.	—
			*0 – 1 V ↑↓ 10 – 14 V (“Reference waveform No.4: ”)	Ignition switch is turned to ST (cranking) position.	Output signal is active low duty pulse. Number of pulse generated times varies depending on vehicle condition.
C37-5	GRN/ WHT	Ignition coil No.2 and No.3 output	0 – 0.6 V	Ignition switch turned ON.	—
			*0 – 0.6 V ↑↓ 3 – 5 V (“Reference waveform No.5: ” and “Reference waveform No.6: ”)	Engine running at idle after warmed up engine.	Output signal is active high pulse. Pulse frequency varies depending on engine speed.
C37-6	GRN/ YEL	Ignition coil No.1 and No.4 output	0 – 0.6 V	Ignition switch turned ON.	—
			*0 – 0.6 V ↑↓ 3 – 5 V (“Reference waveform No.6: ”, “Reference waveform No.7: ” and “Reference waveform No.34: ”)	Engine running at idle after warmed up engine.	Output signal is active high pulse. Pulse frequency varies depending on engine speed.
C37-7	GRY/ BLU	Engine revolution signal output for TCM (for Automated Manual Transaxle model)	4 – 6 V	Ignition switch turned ON with engine stop.	—
			*0 – 1 V ↑↓ 4 – 5 V (“Reference waveform No.30: ”)	While engine running.	Output signal is pulse. Pulse frequency varies depending on engine speed. (12 pulses are generated per 1 crankshaft revolution.)
C37-8	—	—	—	—	—
C37-9	PPL	Vehicle speed sensor signal (for M/T and Automated Manual Transaxle models)	*0 – 1 V ↑↓ 4 – 5 V (“Reference waveform No.8: ” (M/T) or “Reference waveform No.31: ” (Automated Manual Transaxle))	Vehicle running.	Sensor signal is pulse. Pulse frequency varies depending on vehicle speed. (69 pulses (M/T) or 21 pulses (Automated Manual Transaxle) are generated per sec. at 30 km/h, 19 mph.) (8232 pulses/km (M/T)) (2561 pulses/km (Automated Manual Transaxle))

Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
C37-10	WHT	Oxygen signal of heated oxygen sensor-1	0 – 1 V	Ignition switch turned ON.	—
			*Deflects between over 0.5 V and under 0.45 V (“Reference waveform No.9: ” and “Reference waveform No.10: ”)	While engine running at 2,000 r/min. for 1 min. or longer after warmed up.	
C37-11	BRN	Oxygen signal of heated oxygen sensor-2	4 – 5 V	Ignition switch turned ON.	—
			*Deflects between over 0.5 V and under 0.45 V (“Reference waveform No.11: ”)	While engine running at 2,000 r/min. or more after vehicle running over 30 km/h, 19 mph for 5 min.	
C37-12	WHT	CAN (low) (communication line (active low signal) to TCM (for A/T or Automated Manual Transaxle model)	*0.5 – 2.5 V (“Reference waveform No.12: ”)	Ignition switch turned ON with engine stop.	CAN communication line signal is pulse. Pulse signal displayed with a regular frequency which varies depending on engine condition.
C37-13	RED	CAN (high) communication line (active high signal) to TCM (for A/T or Automated Manual Transaxle model)	*2.5 – 4.5 V (“Reference waveform No.12: ”)		
C37-14	GRY/ RED	Output of 5 V power source for TP sensor (for A/T and M/T models), MAP sensor, A/C refrigerant pressure sensor (if equipped with A/C)	4.5 – 5.5 V	Ignition switch turned ON.	—
C37-15	BLK	Ground for ECM	Below 0.3 V	Ignition switch turned ON.	—
C37-16	BLU/ RED	Fuel injector No.3 output	10 – 14 V	Ignition switch turned ON.	—
			*0 – 0.6 V ↑↓ 10 – 14 V (“Reference waveform No.1: ” and “Reference waveform No.13: ”)	Engine running at idle after warmed up engine.	Output signal is active low pulse. Pulse frequency varies depending on engine speed.
C37-17	BLU/ ORN	Fuel injector No.4 output	10 – 14 V	Ignition switch turned ON.	—
			*0 – 0.6 V ↑↓ 10 – 14 V (“Reference waveform No.1: ” and “Reference waveform No.14: ”)	Engine running at idle after warmed up engine.	Output signal is active low pulse. Pulse frequency varies depending on engine speed.
C37-18	BRN/ YEL	EGR valve (stepper motor coil 4) output	10 – 14 V	Ignition switch turned ON.	—
			*0 – 1 V ↑↓ 10 – 14 V (“Reference waveform No.4: ”)	Ignition switch is turned to ST (cranking) position.	Output signal is active low duty pulse. Number of pulse generated times varies depending on vehicle condition.

Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
C37-19	WHT/ RED	EGR valve (stepper motor coil 3) output	10 – 14 V	Ignition switch turned ON.	—
			*0 – 1 V ↑↓ 10 – 14 V (“Reference waveform No.4: ”)	Ignition switch is turned to ST (cranking) position.	Output signal is active low duty pulse. Number of pulse generated times varies depending on vehicle condition.
C37-20	RED/ YEL	CMP sensor signal	0 – 1 V or 4 – 5 V	Ignition switch turned ON.	—
			*0 – 0.6 V ↑↓ 4 – 5 V (“Reference waveform No.15: ” and “Reference waveform No.16: ”)	Engine running at idle after warmed up engine.	Sensor signal is pulse. Pulse frequency varies depending on engine speed. (6 pulses are generated per 1 camshaft revolution.)
C37-21	PNK	CKP sensor signal	0 – 1 V or 4 – 5 V	Ignition switch turned ON.	—
			*4 – 5 V ↑↓ 0 – 0.6 V (“Reference waveform No.15: ” and “Reference waveform No.16: ”)	Engine running at idle after warming up engine.	Sensor signal is pulse. Pulse frequency varies depending on engine speed. (30 (36 – 6) pulses are generated per 1 crankshaft revolution.)
C37-22	PPL/ WHT	Vehicle speed signal output for TCM (for Automated Manual Transaxle model)	*0 – 1 V ↑↓ 4 – 5 V (“Reference waveform No.31: ”)	Vehicle running.	Sensor signal is pulse. Pulse frequency varies depending on vehicle speed. (21 pulses are generated per sec. at 30 km/h, 19 mph.) (2561 pulses/km)
C37-23	—	—	—	—	—
C37-24	LT GRN	Engine coolant temp. (ECT) sensor signal	3.3 – 3.8 V	Ignition switch turned ON, ECT at 0 °C, 32 °F.	—
			1.38 – 1.72 V	Ignition switch turned ON, ECT at 50 °C, 122 °F.	
			0.40 – 0.53 V	Ignition switch turned ON, ECT at 100 °C, 212 °F.	
C37-25	BLK/ YEL	Intake air temp. (IAT) sensor signal	3.18 – 3.67 V	Ignition switch turned ON, IAT at 0 °C, 32 °F.	—
			1.32 – 1.65 V	Ignition switch turned ON, IAT at 40 °C, 104 °F.	
			0.46 – 0.60 V	Ignition switch turned ON, IAT at 80 °C, 176 °F.	
C37-26	GRN/ BLK	Mass air flow (MAF) sensor signal	0.5 – 1.5 V	Ignition switch turned ON with engine at stop.	—
			1.5 – 2.0 V (“Reference waveform No.17: ”)	When engine running at specified idle speed after warmed up.	
C37-27	GRY	Ground for MAF sensor	Below 0.3 V	Ignition switch turned ON.	—
C37-28	—	—	—	—	—
C37-29	BLU/ BLK	EVAP canister purge valve output	10 – 14 V	Ignition switch turned ON with engine at stop.	—
			*0 – 0.6 V ↑↓ 10 – 14 V (“Reference waveform No.18: ”)	Set EVAP canister purge valve at 52% by using “Misc Test” of scan tool.	Output signal is active low duty pulse. Duty ratio varies depending on vehicle condition.

Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
C37-30	BLK	Ground for ECM	Below 0.3 V	Ignition switch turned ON.	—
C37-31	—	—	—	—	—
C37-32	—	—	—	—	—
C37-33	—	—	—	—	—
C37-34	—	—	—	—	—
C37-35	—	—	—	—	—
C37-36	—	—	—	—	—
C37-37	—	—	—	—	—
C37-38	—	—	—	—	—
C37-39	—	—	—	—	—
C37-40	WHT	Throttle position sensor (sub) signal (for Automated Manual Transaxle model)	1.57 – 1.90 V	Ignition switch turned ON and accelerator pedal at idle position after warmed up engine.	—
			3.88 – 4.45 V	Ignition switch turned ON and accelerator pedal at full depressed position after warmed up engine.	
C37-41	—	Ground for shield wire of TP sensor circuit (for Automated Manual Transaxle model)	Below 0.3 V	Ignition switch turned ON.	—
C37-42	BLK	Ground for throttle position sensor (for Automated Manual Transaxle model)	Below 0.3 V	Ignition switch turned ON.	—
C37-43	RED	Output for 5 V power source of throttle position sensor (for Automated Manual Transaxle model)	4.5 – 5.5 V	Ignition switch turned ON.	—
C37-44	LT GRN/ BLK	Output of throttle actuator (for Automated Manual Transaxle model)	0 – 1 V	Ignition switch turned ON and accelerator pedal at idle position after warmed up engine.	Output signal is pulse. Duty ratio varies depending on throttle valve and accelerator pedal position.
			*0 – 1 V ↑↓ 10 – 14 V (“Reference waveform No.32: ” and “Reference waveform No.33: ”)	Ignition switch turned ON and accelerator pedal at full depressed position after warmed up engine.	
C37-45	LT GRN/ RED	Output of throttle actuator (for Automated Manual Transaxle model)	0 – 1 V	Ignition switch turned ON and accelerator pedal at full depressed position after warmed up engine.	Output signal is pulse. Duty ratio varies depending on throttle valve and accelerator pedal position.
			*0 – 1 V ↑↓ 10 – 14 V (“Reference waveform No.32: ” and “Reference waveform No.33: ”)	Ignition switch turned ON and accelerator pedal at idle position after warmed up engine.	

Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
C37-46	BLK/ RED	Heater output of heated oxygen sensor-1	10 – 14 V	Ignition switch turned ON.	—
			*0 – 2 V ↑↓ 10 – 14 V (“Reference waveform No.9: ” and “Reference waveform No.10: ”)	Engine running at idle after warmed up engine.	Output signal is active low duty pulse. Duty ratio varies depending on engine condition.
C37-47	RED/ BLU	Heater output of heated oxygen sensor-2	10 – 14 V	Ignition switch turned ON.	—
			0 – 1 V (“Reference waveform No.11: ”)	Engine running at idle after vehicle running over 30 km/h, 19 mph for 5 min.	
C37-48	YEL/ GRN	Starting motor signal	0 – 1 V	Ignition switch turned ON.	—
			6 – 14 V	While engine cranking.	
C37-49	RED/ WHT	IAC valve output (for A/T and M/T models)	*0 – 2 V ↑↓ 8 – 14 V (“Reference waveform No.19: ”)	Ignition switch turned ON.	Ignition switch turned ON.
			*0 – 2 V ↑↓ 8 – 14 V (“Reference waveform No.20: ”)	Engine running at idle after warmed up engine.	Output signal is active low duty pulse. Number of pulse generated times varies depending on vehicle condition.
C37-50	—	Ground of ECM for shield wire	Below 0.3 V	Ignition switch turned ON.	—
C37-51	—	Ground of ECM for shield wire	Below 0.3 V	Ignition switch turned ON.	—
C37-52	—	Ground of ECM for shield wire	Below 0.3 V	Ignition switch turned ON.	—
C37-53	RED/ BLK	Manifold absolute pressure (MAP) sensor signal	Approx. 4 V (“Reference waveform No.21: ”)	Ignition switch turned ON with barometric pressure at 100 kPa, 760 mmHg.	—
			0.4 – 2.0 V (“Reference waveform No.22: ”)	While engine running at specified idle speed after warmed up with barometric pressure at 100 kPa, 760 mmHg.	
C37-54	GRY/ BLU	Throttle position (TP) sensor signal (for A/T and M/T models)	0.5 – 1.0 V	Ignition switch turned ON and throttle valve at idle position after warmed up engine.	—
			3.4 – 4.7 V	Ignition switch turned ON and throttle valve at full open position after warmed up engine.	
	GRN	Throttle position sensor (main) signal (for Automated Manual Transaxle model)	0.75 – 1.08 V	Ignition switch turned ON and accelerator pedal at idle position after warmed up engine.	
			3.67 – 4.24 V	Ignition switch turned ON and accelerator pedal at full depressed position after warmed up engine.	
C37-55	ORN	Ground for sensors	Below 0.3 V	Ignition switch turned ON.	—

Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
C37-56	RED	Knock sensor signal	2 – 3 V (“Reference waveform No.23: ” and “Reference waveform No.24: ”)	Ignition switch turned ON.	—
				Engine running at 4000 r/min. after warmed up.	
C37-57	YEL	Ground for sensors	Below 0.3 V	Ignition switch turned ON.	—
C37-58	BLK/ORN	Ground for ECM	Below 0.3 V	Ignition switch turned ON.	—
C37-59	YEL/BLK	Oil control valve ground (for M15 engine model)	Below 1.3 V	Ignition switch turned ON.	—
C37-60	YEL/RED	Oil control valve output (for M15 engine model)	*0 – 0.6 V ↑↓ 10 – 14 V (“Reference waveform No.25: ” and “Reference waveform No.26: ”)	At the moment of ignition switch turned ON.	Output signal is active high pulse. Duty ratio varies depending on vehicle condition.

Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
E23-1	BLK/RED	Main power supply	10 – 14 V	Ignition switch turned ON.	—
E23-2	WHT/RED	Power source for ECM internal memory	10 – 14 V	Ignition switch turned ON.	—
E23-3	RED	CAN (high) communication line (active high signal) for BCM, combination meter	*2.5 – 4.5 V (“Reference waveform No.27: ”)	Ignition switch turned ON with engine at stop.	CAN communication line signal is pulse. Pulse signal displayed with a regular frequency with varies depending on engine condition.
E23-4	BRN	Engine revolution signal output for EPS control module	0 – 0.8 V	Ignition switch turned ON with engine at stop.	—
			*0 – 1 V ↑↓ 8 – 14 V (“Reference waveform No.28: ” and “Reference waveform No.29: ”)	While engine running.	Output signal is pulse. Pulse frequency varies depending on engine speed. (2 pulses are generated per 1 crankshaft revolution.) (3000 r/min. = 100 Hz)
E23-5	PPL/WHT	Serial communication line of data link connector 12 V	8 – 14 V	Ignition switch turned ON.	—
E23-6	—	—	—	—	—
E23-7	—	—	—	—	—
E23-8	—	—	—	—	—
E23-9	—	—	—	—	—
E23-10	—	—	—	—	—
E23-11	—	—	—	—	—
E23-12	—	—	—	—	—
E23-13	YEL/RED	Clock signal for immobilizer coil antenna	10 – 14 V	Ignition switch turned ON.	—
E23-14	—	—	—	—	—

Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
E23-15	GRN/ WHT	Fuel pump relay output	0 – 2.5 V	For 2 sec. from the time ignition switch is turned ON or while engine is running.	—
			10 – 14 V	On and after 2 sec. from the time ignition switch is turned ON or while engine is at stop.	
E23-16	BLK/ RED	Main power supply	10 – 14 V	Ignition switch turned ON.	—
E23-17	—	—	—	—	—
E23-18	WHT	CAN (low) communication line (active low signal) for BCM, combination meter	*0.5 – 2.5 V (“Reference waveform No.27: ”)	Ignition switch turned ON with engine at stop.	CAN communication line signal is pulse. Pulse signal displayed with a regular frequency which varies depending on engine condition.
E23-19	BLU/ WHT	Electric load signal for heater blower motor	10 – 14 V	Ignition switch turned ON, blower fan selector at OFF position.	—
			0 – 1 V	Ignition switch turned ON, blower fan selector at 2nd speed position or more.	
E23-20	GRN/ WHT	Stop lamp switch signal	0 – 1 V	Ignition switch turned ON, stop lamp not lit up.	—
			10 – 14 V	Ignition switch turned ON, stop lamp lit up.	
E23-21	—	—	—	—	—
E23-22	—	—	—	—	—
E23-23	—	—	—	—	—
E23-24	YEL/ RED	Fuel level sensor signal	0 – 6 V	Ignition switch turned ON. Voltage varies depends on fuel level.	—
E23-25	PPL	Vehicle speed signal output for EPS control module	*0 – 1 V ↑↓ 10 – 14 V (“Reference waveform No.8: ”)	Vehicle running.	Sensor signal is pulse. Pulse frequency varies depending on vehicle speed. (21 pulses are generated per sec. at 30 km/h, 19 mph.) (2561 pulses/km)
E23-26	RED/ BLU	EPS signal	10 – 14 V	Ignition switch turned ON.	—
			0 – 1 V	With engine running at idle speed, and steering wheel turned to the right or left as far as it stops.	
E23-27	—	—	—	—	—
E23-28	YEL/ BLK	Serial communication line for immobilizer coil antenna	10 – 14 V	Ignition switch turned ON.	—
E23-29	BLK/ WHT	Ignition switch signal	0 – 1 V	Ignition switch turned OFF.	—
			10 – 14 V	Ignition switch turned ON.	
E23-30	WHT	Starting motor control relay output	0 – 1 V	Ignition switch turned ON.	—
			0 – 1 V	Ignition switch is turned to ST (engine cranking) position.	
E23-31	BLK	Ground for ECM (for A/T model)	Below 0.3 V	Ignition switch turned ON.	—

Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
E23-32	RED/ YEL	Power supply of throttle actuator drive circuit (for Automated Manual Transaxle model)	10 – 14 V	Ignition switch turned ON.	—
E23-33	—	—	—	—	—
E23-34	RED	Output for 5 V power source of accelerator pedal position (APP) sensor (sub) (for Automated Manual Transaxle model)	4.5 – 5.5 V	Ignition switch turned ON.	—
E23-35	BRN	Output for 5 V power source of accelerator pedal position (APP) sensor (main) (for Automated Manual Transaxle model)	4.5 – 5.5 V	Ignition switch turned ON.	—
E23-36	YEL	Accelerator pedal position (APP) sensor (sub) signal (for Automated Manual Transaxle model)	1.55 – 1.65 V	Ignition switch turned ON and accelerator pedal at idle position after warmed up engine.	—
			4.18 – 5.12 V	Ignition switch turned ON and accelerator pedal at full depressed position after warmed up engine.	
E23-37	GRN	Accelerator pedal position (APP) sensor (main) signal (for Automated Manual Transaxle model)	0.75 – 0.85 V	Ignition switch turned ON and accelerator pedal at idle position after warmed up engine.	—
			3.46 – 4.24 V	Ignition switch turned ON and accelerator pedal at full depressed position after warmed up engine.	
E23-38	—	—	—	—	—
E23-39	—	—	—	—	—
E23-40	—	—	—	—	—
E23-41	—	—	—	—	—
E23-42	—	—	—	—	—
E23-43	—	—	—	—	—
E23-44	—	—	—	—	—
E23-45	BLU/ ORN	Throttle actuator control relay output (for Automated Manual Transaxle model)	0 – 1 V	Ignition switch turned ON.	—

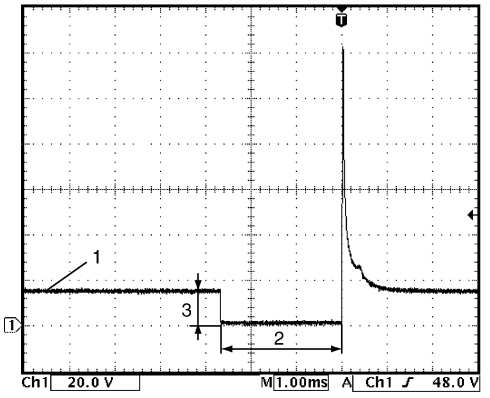
Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
E23-46	LT GRN	Radiator cooling fan relay No.1 output	10 – 14 V	Ignition switch turned ON, engine coolant temp.: below 95 °C (203 °F), or A/C refrigerant pressure (if equipped with A/C): below 600 kPa (87 psi) with A/C switch turned ON while engine is running.	—
			0 – 2 V	Ignition switch turned ON, engine coolant temp.: 97.5 °C (207.5 °F) or higher, or A/C refrigerant pressure (if equipped with A/C): 1100 kPa (159.5 psi) or higher with A/C switch turned ON while engine is running.	
E23-47	GRY	A/C compressor relay output (if equipped with A/C)	10 – 14 V	Engine running, A/C switch OFF and blower selector at OFF position.	—
			0 – 1 V	Engine running, A/C switch ON and blower selector at 1st position or more.	
E23-48	GRN	Radiator cooling fan relay No.2 and No.3 output	10 – 14 V	Ignition switch turned ON, engine coolant temp.: below 100 °C (212 °F), or A/C refrigerant pressure (if equipped with A/C): below 1200 kPa (174 psi) with A/C switch turned ON while engine is running.	—
			0 – 2 V	Ignition switch turned ON, engine coolant temp.: 102.5 °C (216.5 °F) or higher, or A/C refrigerant pressure (if equipped with A/C): 1500 kPa (217.5 psi) or higher with A/C switch turned ON while engine is running.	
E23-49	—	—	—	—	—
E23-50	—	Ground for shield wire of accelerator pedal position (APP) sensor (for Automated Manual Transaxle model)	Below 0.3 V	Ignition switch turned ON.	—
E23-51	WHT	Ground for accelerator pedal position (APP) sensor (sub) (for Automated Manual Transaxle model)	Below 0.3 V	Ignition switch turned ON.	—

Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
E23-52	BLU	Ground for accelerator pedal position (APP) sensor (main) (for Automated Manual Transaxle model)	Below 0.3 V	Ignition switch turned ON.	—
E23-53	—	—	—	—	—
E23-54	ORN	Ground for sensors	Below 0.3 V	Ignition switch turned ON.	—
E23-55	RED	A/C refrigerant pressure sensor signal (if equipped with A/C)	1.38 – 1.52 V	Engine running, A/C switch OFF and blower selector at OFF position, A/C refrigerant pressure: 800 kPa (116 psi)	—
			2.15 – 2.38 V	Engine running, A/C switch ON and blower selector at 1st position or more, A/C refrigerant pressure: 1400 kPa (203 psi)	
			2.67 – 2.95 V	Engine running, A/C switch ON and blower selector at 1st position or more, A/C refrigerant pressure: 1800 kPa (261 psi)	
E23-56	—	—	—	—	—
E23-57	WHT/ BLK	A/C evaporator outlet air temp. sensor signal (if equipped with A/C)	3.4 – 3.7 V	Ignition switch turned ON at A/C evaporator outlet temperature 0 °C (32 °F).	—
			2.5 – 2.8 V	Ignition switch turned ON at A/C evaporator outlet temperature 15 °C (59 °F).	
			1.7 – 2.0 V	Ignition switch turned ON at A/C evaporator outlet temperature 30 °C (86 °F).	
E23-58	—	—	—	—	—
E23-59	—	—	—	—	—
E23-60	BRN/ WHT	Main power supply relay output	10 – 14 V	Ignition switch turned OFF.	—
			0 – 2 V	Ignition switch turned ON.	

Reference waveform No.1

Fuel injector signal (1) with engine idling

Measurement terminal	CH1: “C37-2” to “C37-58”
Oscilloscope setting	CH1: 20 V/DIV TIME: 1 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed



I4RS0B110050-01

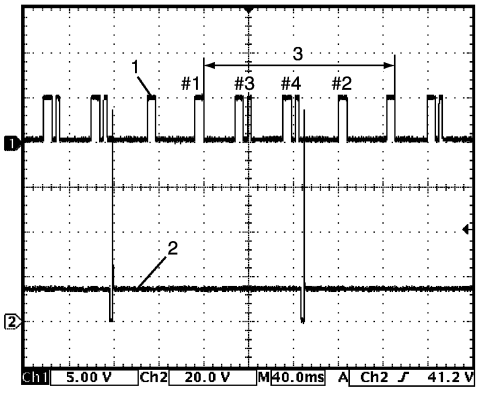
2. Fuel injection pulse width: 2-4 msec.
3. 10 – 14 V

Reference waveform No.2

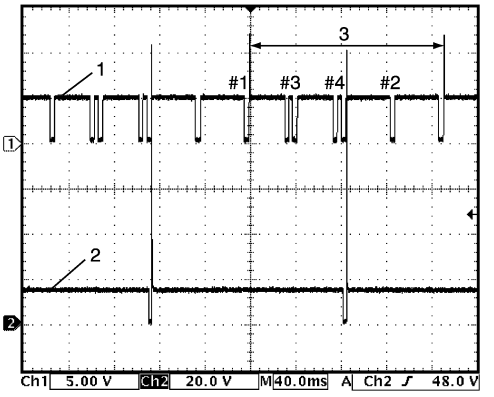
No.1 fuel injector signal (2) with engine idling

Measurement terminal	CH1: “C37-20” to “C37-58” CH2: “C37-1” to “C37-58”
Oscilloscope setting	CH1: 5 V/DIV, CH2: 20 V/DIV TIME: 40 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

[A]



[B]



I4RS0B110051-01

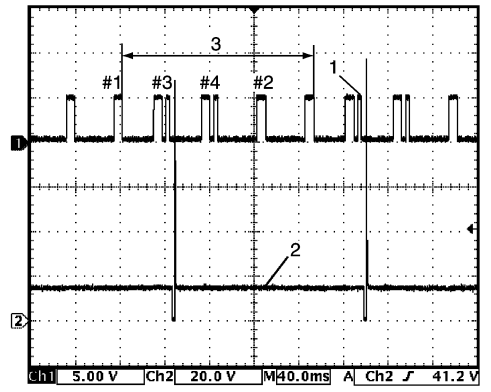
[A]: For M15 engine model
[B]: For M13 engine model
1. Cylinder reference signal (CMP reference signal)
3. 720° crank angle

Reference waveform No.3

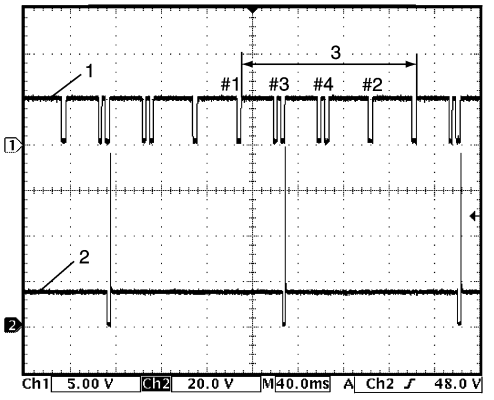
No.2 fuel injector signal (2) with engine idling

Measurement terminal	CH1: “C37-20” to “C37-58” CH2: “C37-2” to “C37-58”
Oscilloscope setting	CH1: 5 V/DIV, CH2: 20 V/DIV TIME: 40 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

[A]



[B]



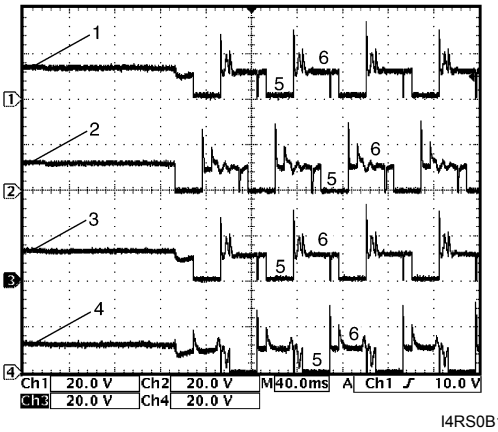
I4RS0B110052-01

[A]: For M15 engine model
[B]: For M13 engine model
1. Cylinder reference signal (CMP reference signal)
3. 720° crank angle

Reference waveform No.4

EGR valve signal

Measurement terminal	CH1: “C37-4” to “C37-58” CH2: “C37-3” to “C37-58” CH3: “C37-19” to “C37-58” CH4: “C37-18” to “C37-58”
Oscilloscope setting	CH1: 20 V/DIV, CH2: 20 V/DIV CH3: 20 V/DIV, CH4: 20 V/DIV TIME: 40 ms/DIV
Measurement condition	Engine at cranking



I4RS0B110053-01

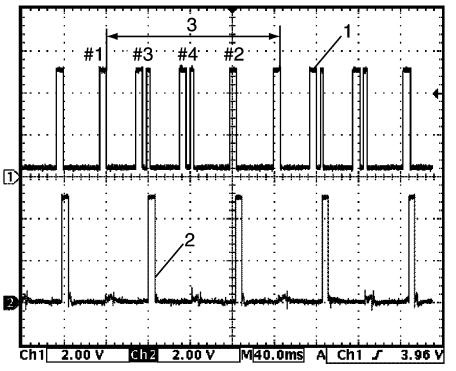
1. EGR valve stepper motor coil 1 signal
2. EGR valve stepper motor coil 2 signal
3. EGR valve stepper motor coil 3 signal
4. EGR valve stepper motor coil 4 signal
5. ON signal
6. OFF signal

Reference waveform No.5

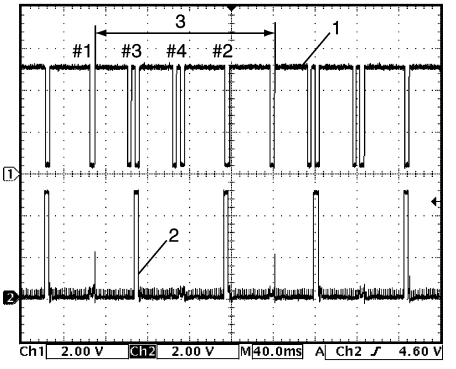
Ignition coil No.2 and No.3 signal (2) with engine idling

Measurement terminal	CH1: “C37-20” to “C37-58” CH2: “C37-5” to “C37-58”
Oscilloscope setting	CH1: 2 V/DIV, CH2: 2 V/DIV TIME: 40 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

[A]



[B]



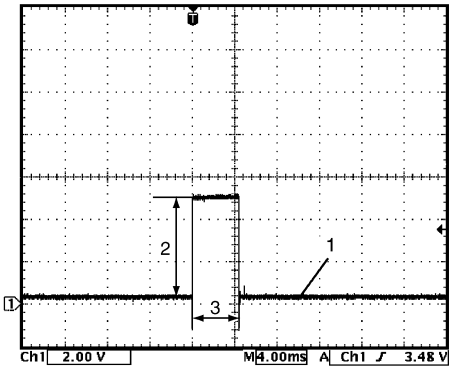
I4RS0B110054-01

1. Cylinder reference signal (CMP reference signal)
3. 720° crank angle

Reference waveform No.6

Ignition coil signal (1) with engine idling

Measurement terminal	CH1: “C37-6” to “C37-58”
Oscilloscope setting	CH1: 2 V/DIV TIME: 4 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed



I4RS0B110055-02

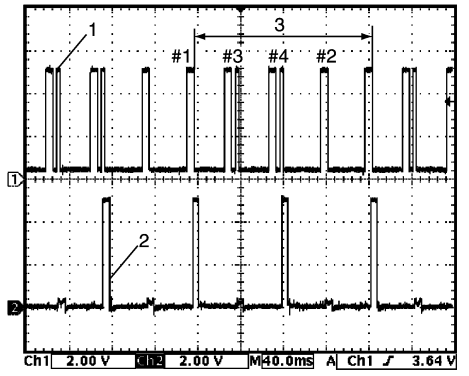
2. 4 – 6 V
3. Ignition coil pulse width: 4 – 5 msec.

Reference waveform No.7

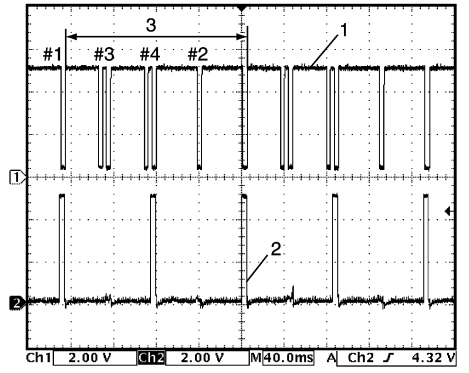
Ignition coil No.1 and No.4 signal (2) with engine idling

Measurement terminal	CH1: “C37-20” to “C37-58” CH2: “C37-6” to “C37-58”
Oscilloscope setting	CH1: 2 V/DIV, CH2: 2 V/DIV TIME: 40 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

[A]



[B]



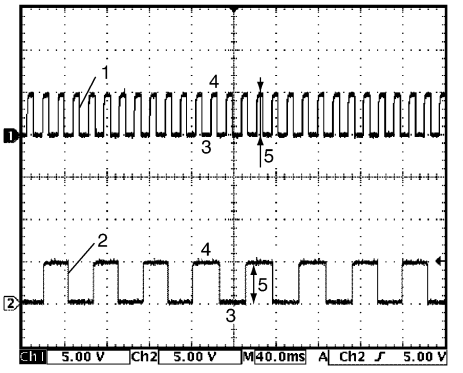
I4RS0B110056-01

[A]: For M15 engine model
[B]: For M13 engine model
1. Cylinder reference signal (CMP reference signal)
3. 720° crank angle

Reference waveform No.8

VSS signal at 30 km/h (19 mph) (for M/T model)

Measurement terminal	CH1: “C37-9” to “C37-58” CH2: “E23-25” to “C37-58”
Oscilloscope setting	CH1: 5 V/DIV, CH2: 5 V/DIV TIME: 40 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Drive vehicle at 30 km/h (19 mph)



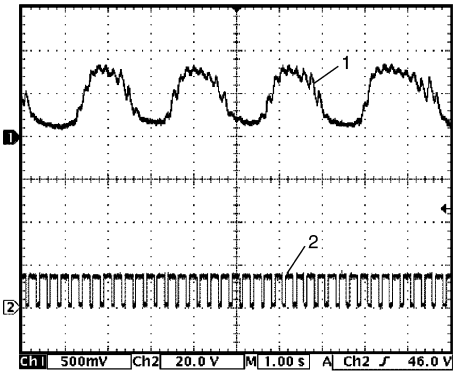
I4RS0B110057-02

1. VSS signal (M/T)
2. VSS signal for EPS control module
3. ON
4. OFF
5. 4 – 5 V

Reference waveform No.9

Heated oxygen sensor-1 signal (1) with engine idling

Measurement terminal	CH1: “C37-10” to “C37-57” CH2: “C37-46” to “C37-58”
Oscilloscope setting	CH1: 500 mV/DIV, CH2: 20 V/DIV TIME: 1 s/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed



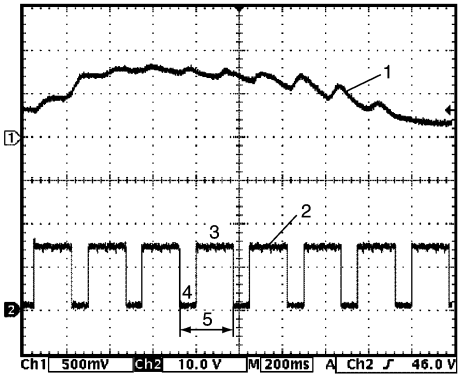
I4RS0B110058-01

2. Heated oxygen sensor-1 heater signal

Reference waveform No.10

Heated oxygen sensor-1 heater signal (2) with engine idling

Measurement terminal	CH1: “C37-10” to “C37-57” CH2: “C37-46” to “C37-58”
Oscilloscope setting	CH1: 500 mV/DIV, CH2: 10 V/DIV TIME: 200 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed



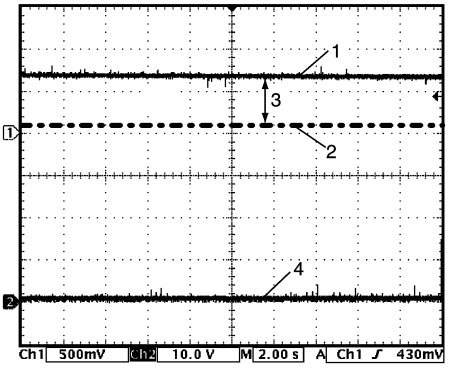
I4RS0B110059-01

1. Heated oxygen sensor-1 signal
3. OFF signal
4. ON signal
5. One duty cycle

Reference waveform No.11

Heated oxygen sensor-2 heater signal (4) with engine idling

Measurement terminal	CH1: “C37-11” to “C37-57” CH2: “C37-47” to “C37-58”
Oscilloscope setting	CH1: 500 mV/DIV, CH2: 10 V/DIV TIME: 2 s/DIV
Measurement condition	• After warmed up to normal operating temperature • Drive vehicle at 60 km/h (37 mph) for 10 min. • Engine at specified idle speed



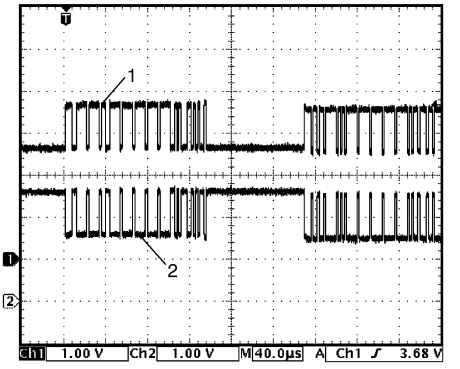
I4RS0B110060-01

1. Heated oxygen sensor-2 signal upper limit
2. Heated oxygen sensor-2 signal lower limit
3. Normal waveform range

Reference waveform No.12

CAN communication line signal from TCM (for A/T or Automated Manual Transaxle model) with ignition switch turned ON

Measurement terminal	CH1: “C37-13” to “C37-58” CH2: “C37-12” to “C37-58”
Oscilloscope setting	CH1: 1 V/DIV, CH2: 1 V/DIV TIME: 40 μs/DIV
Measurement condition	Ignition switch turned ON (Signal pattern is depending on engine condition)



I4RS0B110061-01

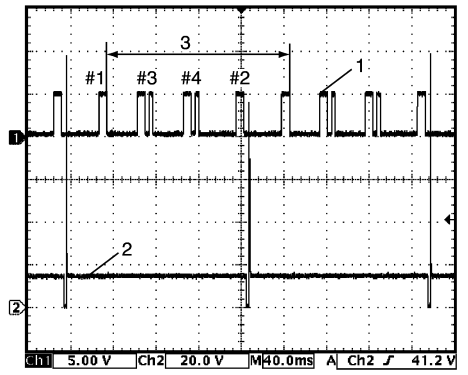
1. CAN communication line signal (High)
2. CAN communication line signal (Low)

Reference waveform No.13

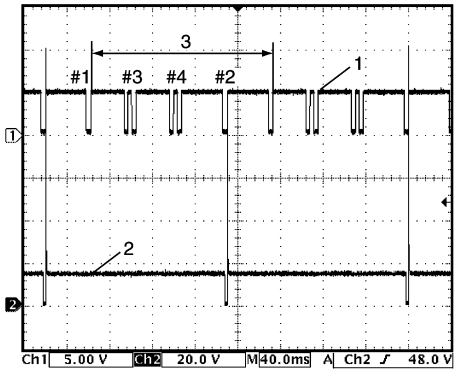
No.3 fuel injector signal (2) with engine idling

Measurement terminal	CH1: “C37-20” to “C37-58” CH2: “C37-16” to “C37-58”
Oscilloscope setting	CH1: 5 V/DIV, CH2: 20 V/DIV TIME: 40 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

[A]



[B]



I4RS0B110062-01

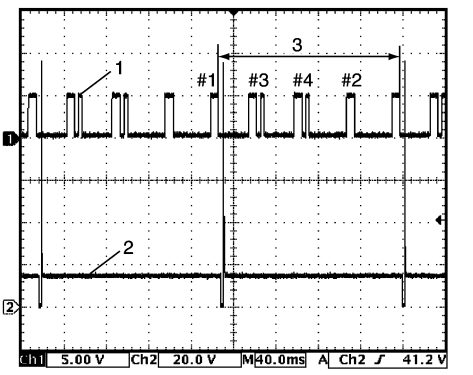
[A]: For M15 engine model
[B]: For M13 engine model
1. Cylinder reference signal (CMP reference signal)
3. 720° crank angle

Reference waveform No.14

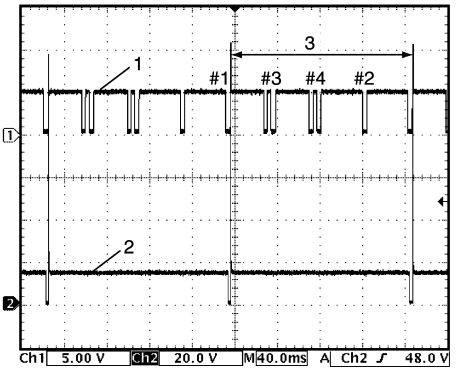
No.4 fuel injector signal (2) with engine idling

Measurement terminal	CH1: “C37-20” to “C37-58” CH2: “C37-17” to “C37-58”
Oscilloscope setting	CH1: 5 V/DIV, CH2: 20 V/DIV TIME: 40 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

[A]



[B]



I4RS0B110063-01

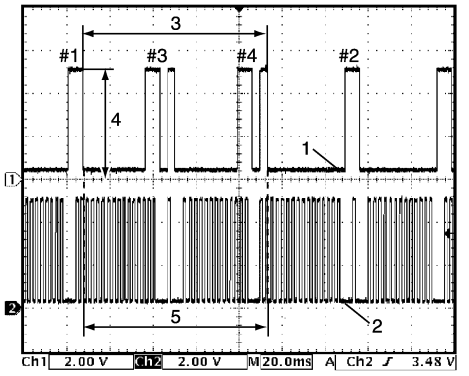
[A]: For M15 engine model
[B]: For M13 engine model
1. Cylinder reference signal (CMP reference signal)
3. 720° crank angle

Reference waveform No.15

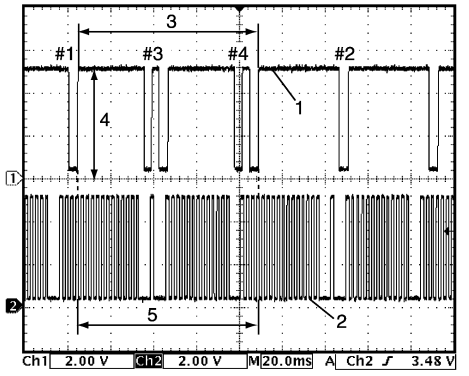
CMP sensor signal with engine idling

Measurement terminal	CH1: “C37-20” to “C37-58” CH2: “C37-21” to “C37-58”
Oscilloscope setting	CH1: 2 V/DIV, CH2: 2 V/DIV TIME: 20 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

[A]



[B]



I4RS0B110064-01

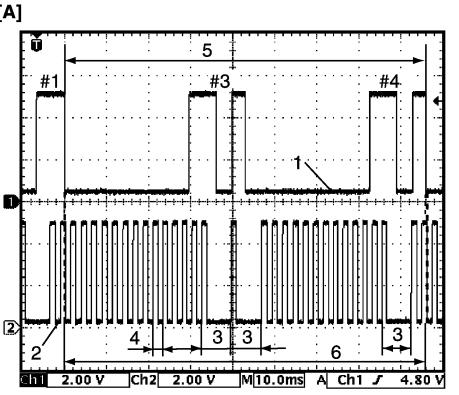
[A]: For M15 engine model
[B]: For M13 engine model
1. Cylinder reference signal (CMP reference signal)
2. CKP signal
3. 360° crank angle
4. 4 – 5 V
5. 36 – 6 = 30 CKP pulse

Reference waveform No.16

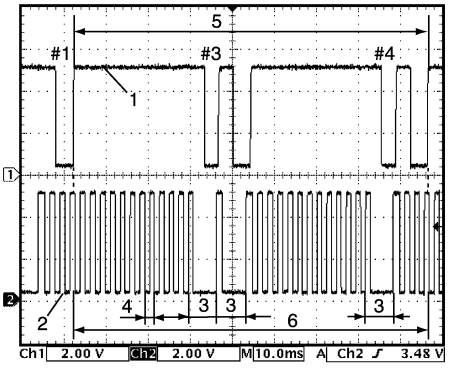
CMP sensor signal with engine idling

Measurement terminal	CH1: “C37-20” to “C37-58” CH2: “C37-21” to “C37-58”
Oscilloscope setting	CH1: 2 V/DIV, CH2: 2 V/DIV TIME: 10 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

[A]



[B]



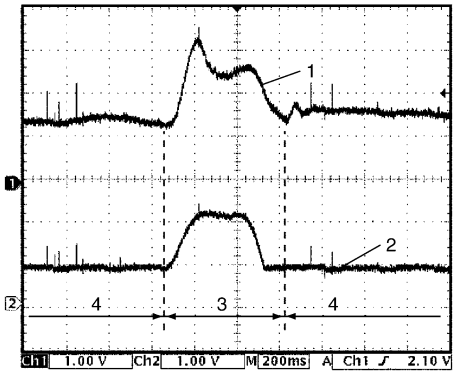
I4RS0B110065-01

[A]: For M15 engine model
[B]: For M13 engine model
1. Cylinder reference signal (CMP reference signal)
2. CKP signal
3. 30° crank angle
4. 10° crank angle
5. 360° crank angle
6. 36 – 6 = 30 CKP pulse

Reference waveform No.17

Mass air flow sensor signal (1) with engine racing

Measurement terminal	CH1: “C37-26” to “C37-27” CH2: “C37-54” to “C37-55”
Oscilloscope setting	CH1: 1 V/DIV, CH2: 1 V/DIV TIME: 200 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine racing



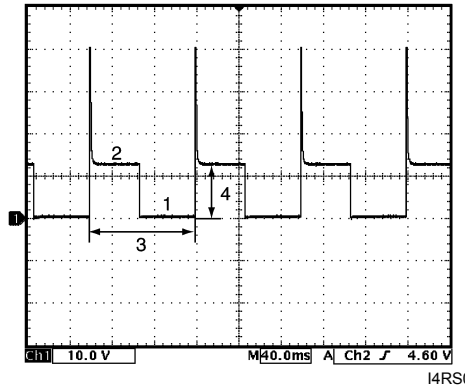
I4RS0B110066-01

2. Throttle position sensor signal
3. Racing
4. Idle

Reference waveform No.18

EVAP canister purge valve signal

Measurement terminal	CH1: “C37-29” to “C37-58”
Oscilloscope setting	CH1: 10 V/DIV TIME: 40 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Set EVAP canister purge valve at 52% by using “Misc Test” of scan tool



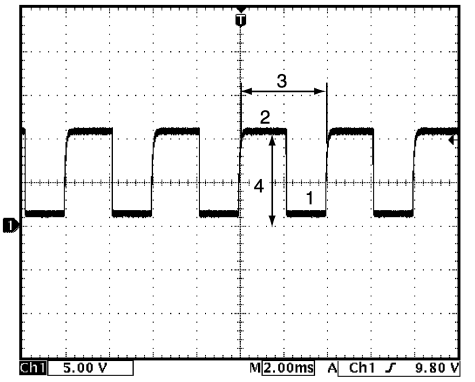
I4RS0B110067-01

1. ON signal
2. OFF signal
3. One duty cycle
4. 10 – 14 V

Reference waveform No.19

IAC valve signal with ignition switch turned ON

Measurement terminal	CH1: “C37-49” to “C37-58”
Oscilloscope setting	CH1: 5 V/DIV TIME: 2 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Ignition switch turned ON



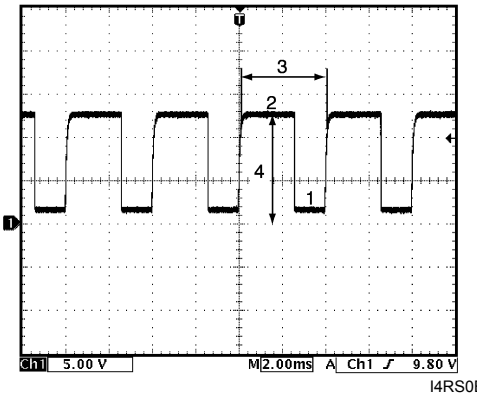
I4RS0B110068-01

1. ON signal
2. OFF signal
3. One duty cycle (Approx. 4 msec.)
4. 8 – 14 V

Reference waveform No.20

IAC valve signal

Measurement terminal	CH1: “C37-49” to “C37-58”
Oscilloscope setting	CH1: 5 V/DIV TIME: 2 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed



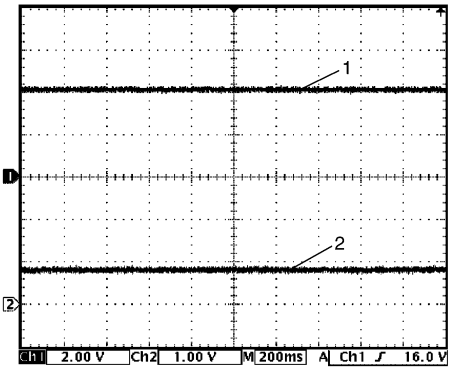
I4RS0B110069-01

1. ON signal
2. OFF signal
3. One duty cycle (Approx. 4 msec.)
4. 8 – 14 V

Reference waveform No.21

Manifold absolute pressure sensor signal (1) with ignition switch turned ON

Measurement terminal	CH1: “C37-53” to “C37-55” CH2: “C37-54” to “C37-55”
Oscilloscope setting	CH1: 2 V/DIV, CH2: 1 V/DIV TIME: 200 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Ignition switch turned ON



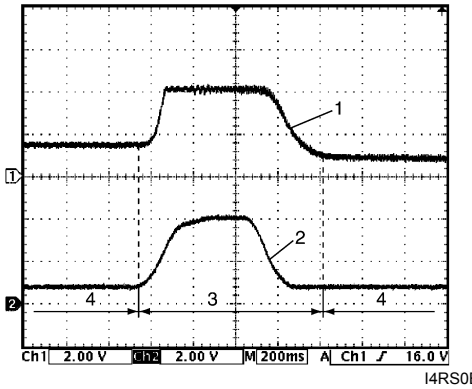
I4RS0B110070-01

2. Throttle position sensor signal

Reference waveform No.22

Manifold absolute pressure sensor signal (1) with engine racing

Measurement terminal	CH1: “C37-53” to “C37-55” CH2: “C37-54” to “C37-55”
Oscilloscope setting	CH1: 2 V/DIV, CH2: 2 V/DIV TIME: 200 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine racing



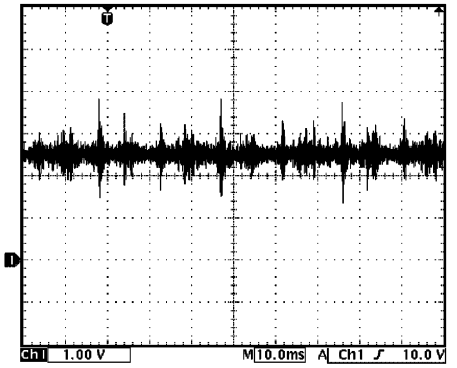
I4RS0B110071-01

2. Throttle position sensor signal
3. Racing
4. Idle

Reference waveform No.23

Knock sensor signal at engine speed 4000 r/min.

Measurement terminal	CH1: “C37-56” to “C37-58”
Oscilloscope setting	CH1: 1 V/DIV TIME: 10 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Run engine at 4000 r/min.

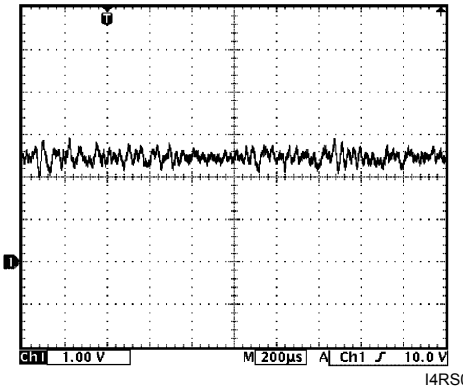


I4RS0B110072-01

Reference waveform No.24

Knock sensor signal at engine speed 4000 r/min.

Measurement terminal	CH1: “C37-56” to “C37-58”
Oscilloscope setting	CH1: 1 V/DIV TIME: 200 μs/DIV
Measurement condition	• After warmed up to normal operating temperature • Run engine at 4000 r/min.

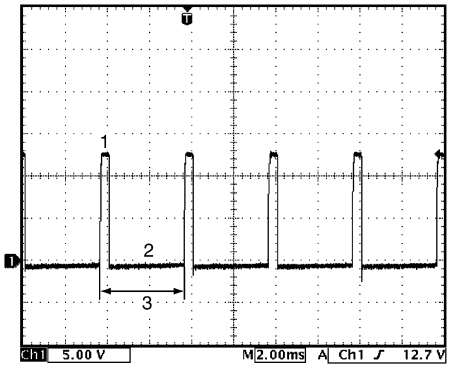


I4RS0B110073-01

Reference waveform No.25

Oil control valve signal with engine idling (for M15 engine model)

Measurement terminal	CH1: “C37-60” to “C37-59”
Oscilloscope setting	CH1: 5 V/DIV TIME: 2 ms/DIV
Measurement condition	At the moment of the ignition switch turned on



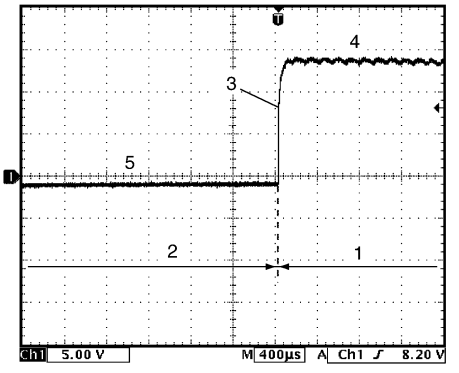
I4RS0B110074-01

1. ON signal
2. OFF signal
3. Only duty cycle

Reference waveform No.26

Oil control valve signal with engine racing (for M15 engine model)

Measurement terminal	CH1: “C37-60” to “C37-59”
Oscilloscope setting	CH1: 5 V/DIV TIME: 400 μs/DIV
Measurement condition	• After warmed up to normal operating temperature • Drive vehicle at 20 km/h (12 mph) and depress accelerator pedal fully



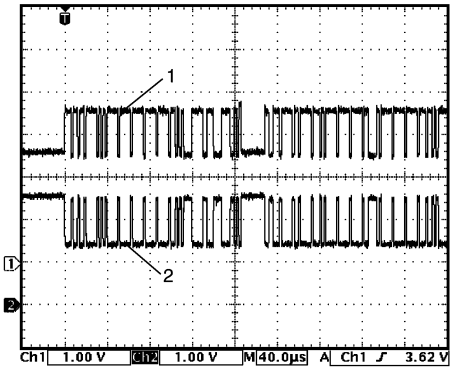
I4RS0B110075-01

1. Accelerator pedal depressed fully
2. Accelerator pedal depressed partially
3. Oil control valve signal
4. ON signal
5. OFF signal

Reference waveform No.27

CAN communication line signal from BCM with ignition switch turned ON

Measurement terminal	CH1: “E23-3” to “C37-58” CH2: “E23-18” to “C37-58”
Oscilloscope setting	CH1: 1 V/DIV, CH2: 1 V/DIV TIME: 40 μs/DIV
Measurement condition	Ignition switch turned ON (Signal pattern is depending on engine condition)



I4RS0B110076-01

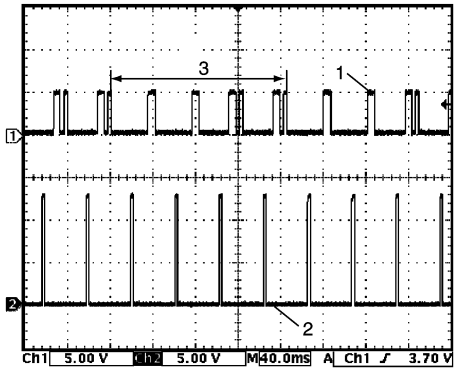
1. CAN communication line signal (High)
2. CAN communication line signal (Low)

Reference waveform No.28

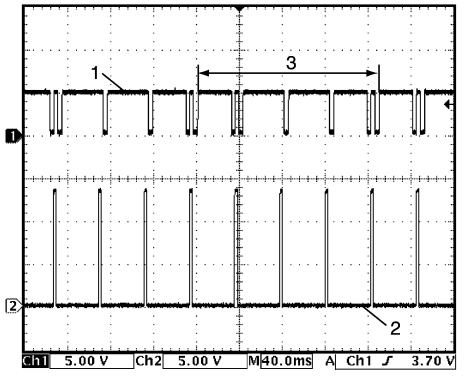
Ignition pulse (engine revolution) signal (2) with engine idling

Measurement terminal	CH1: “C37-20” to “C37-58” CH2: “E23-4” to “C37-58”
Oscilloscope setting	CH1: 5 V/DIV, CH2: 5 V/DIV TIME: 40 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

[A]



[B]



I4RS0B110077-01

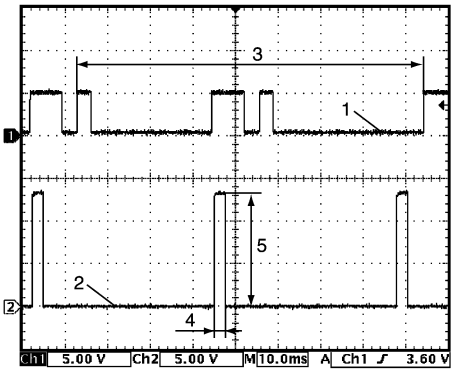
[A]:	For M15 engine model
[B]:	For M13 engine model
1.	Cylinder reference signal (CMP reference signal)
3.	720° crank angle

Reference waveform No.29

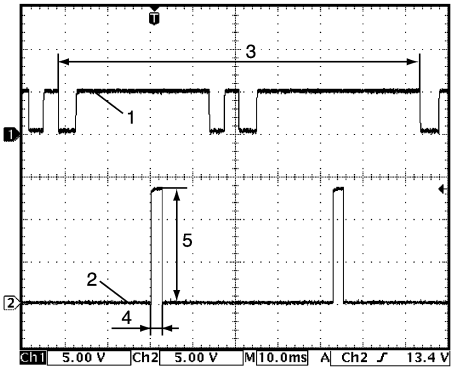
Ignition pulse (engine revolution) signal (2) with engine idling

Measurement terminal	CH1: “C37-20” to “C37-58” CH2: “E23-4” to “C37-58”
Oscilloscope setting	CH1: 5 V/DIV, CH2: 5 V/DIV TIME: 10 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed

[A]



[B]



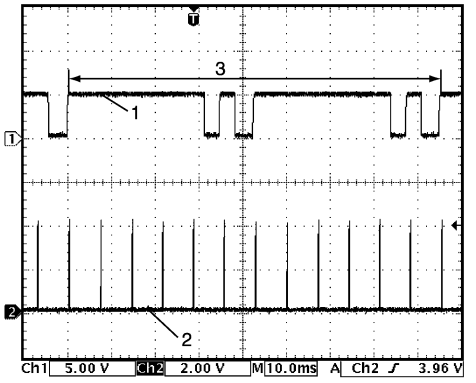
I4RS0B110078-01

[A]:	For M15 engine model
[B]:	For M13 engine model
1.	Cylinder reference signal (CMP reference signal)
3.	360° crank angle
4.	2 to 4 msec.
5.	10 – 14 V

Reference waveform No.30

Engine revolution signal for TCM (for Automated Manual Transaxle model) (2) with engine idling

Measurement terminal	CH1: “C37-20” to “C37-58” CH2: “C37-7” to “C37-58”
Oscilloscope setting	CH1: 5 V/DIV, CH2: 2 V/DIV TIME: 10 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed



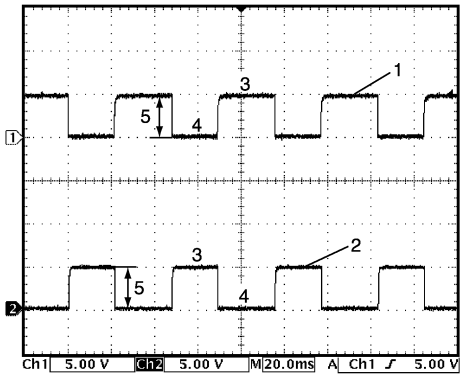
I4RS0B110079-01

1. Cylinder reference signal (CMP reference signal)
3. 360° crank angle

Reference waveform No.31

VSS signal at 30 km/h (19 mph) (for Automated Manual Transaxle model)

Measurement terminal	CH1: “C37-9” to “C37-58” CH2: “C37-22” to “C37-58”
Oscilloscope setting	CH1: 5 V/DIV, CH2: 5 V/DIV TIME: 20 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Drive vehicle at 30 km/h (19 mph)



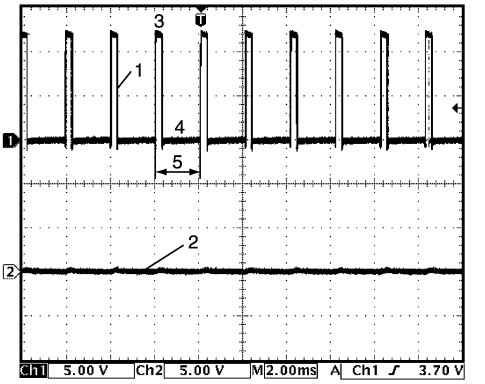
I4RS0B110080-02

1. VSS signal (Automated Manual Transaxle)
2. VSS signal for TCM (Automated Manual Transaxle)
3. OFF
4. ON
5. 4 – 5 V

Reference waveform No.32

Throttle actuator output signal with ignition switch turned ON

Measurement terminal	CH1: “C37-45” to “C37-58” CH2: “C37-44” to “C37-58”
Oscilloscope setting	CH1: 5 V/DIV, CH2: 5 V/DIV TIME: 2 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Ignition switch turned ON and accelerator pedal at idle position



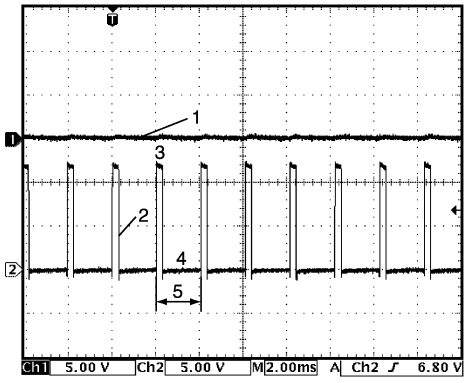
I4RS0B110081-02

1. Throttle actuator drive signal (“C37-45” terminal)
2. Throttle actuator drive signal (“C37-44” terminal)
3. ON signal
4. OFF signal
5. One duty cycle

Reference waveform No.33

Throttle actuator output signal with ignition switch turned ON

Measurement terminal	CH1: “C37-45” to “C37-58” CH2: “C37-44” to “C37-58”
Oscilloscope setting	CH1: 5 V/DIV, CH2: 5 V/DIV TIME: 2 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Ignition switch turned ON and accelerator pedal at full depressed position



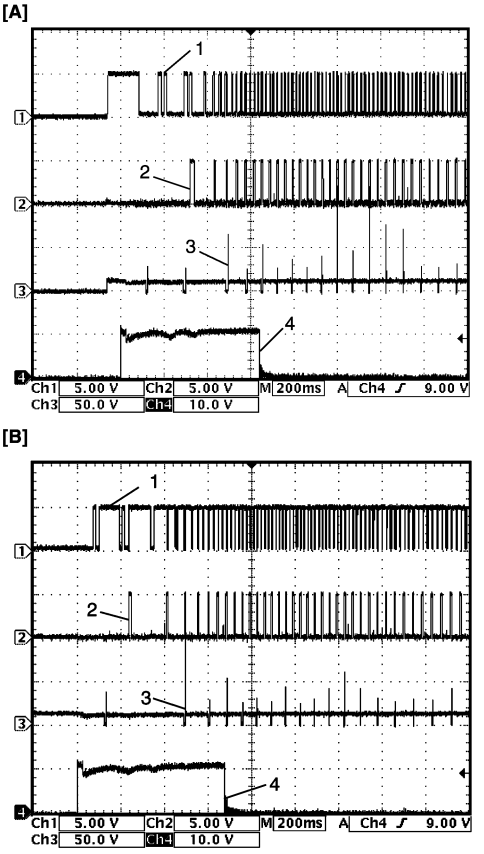
I4RS0B110082-02

1.	Throttle actuator drive signal (“C37-45” terminal)
2.	Throttle actuator drive signal (“C37-44” terminal)
3.	ON signal
4.	OFF signal
5.	One duty cycle

Reference waveform No.34

Ignition coil signal and fuel injector signal with engine cranking

Measurement terminal	CH1: “C37-20” to “C37-58” CH2: “C37-6” to “C37-58” CH3: “C37-1” to “C37-58” CH4: “C37-48” to “C37-58”
Oscilloscope setting	CH1: 5 V/DIV, CH2: 5 V/DIV CH3: 50 V/DIV, CH4: 10 V/DIV TIME: 200 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at cranking



I4RS0B110083-01

[A]:	For M15 engine model
[B]:	For M13 engine model
1.	Cylinder reference signal (CMP reference signal)
2.	Ignition coil No.1 and No.4 signal
3.	No.1 fuel injector signal
4.	Engine start signal

Resistance Check

1) Remove ECM from its bracket referring to “Engine Control Module (ECM) Removal and Installation: in Section 1C”.

⚠ CAUTION

Never touch terminals of ECM itself or connect voltmeter or ohmmeter (2).

2) Connect special tool to ECM connectors securely.

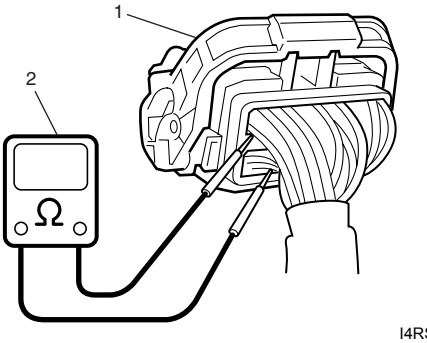
NOTE

Do not connect the other connector of special tool to ECM.

3) Check resistance between each pair of terminals of disconnected connectors (1) as listed in the following table.

⚠ CAUTION

- **Be sure to connect ohmmeter probe from wire harness side of coupler.**
- **Be sure to turn OFF ignition switch for this check.**
- **Resistance in the following table represents that measured when parts temperature is 20 °C (68 °F).**



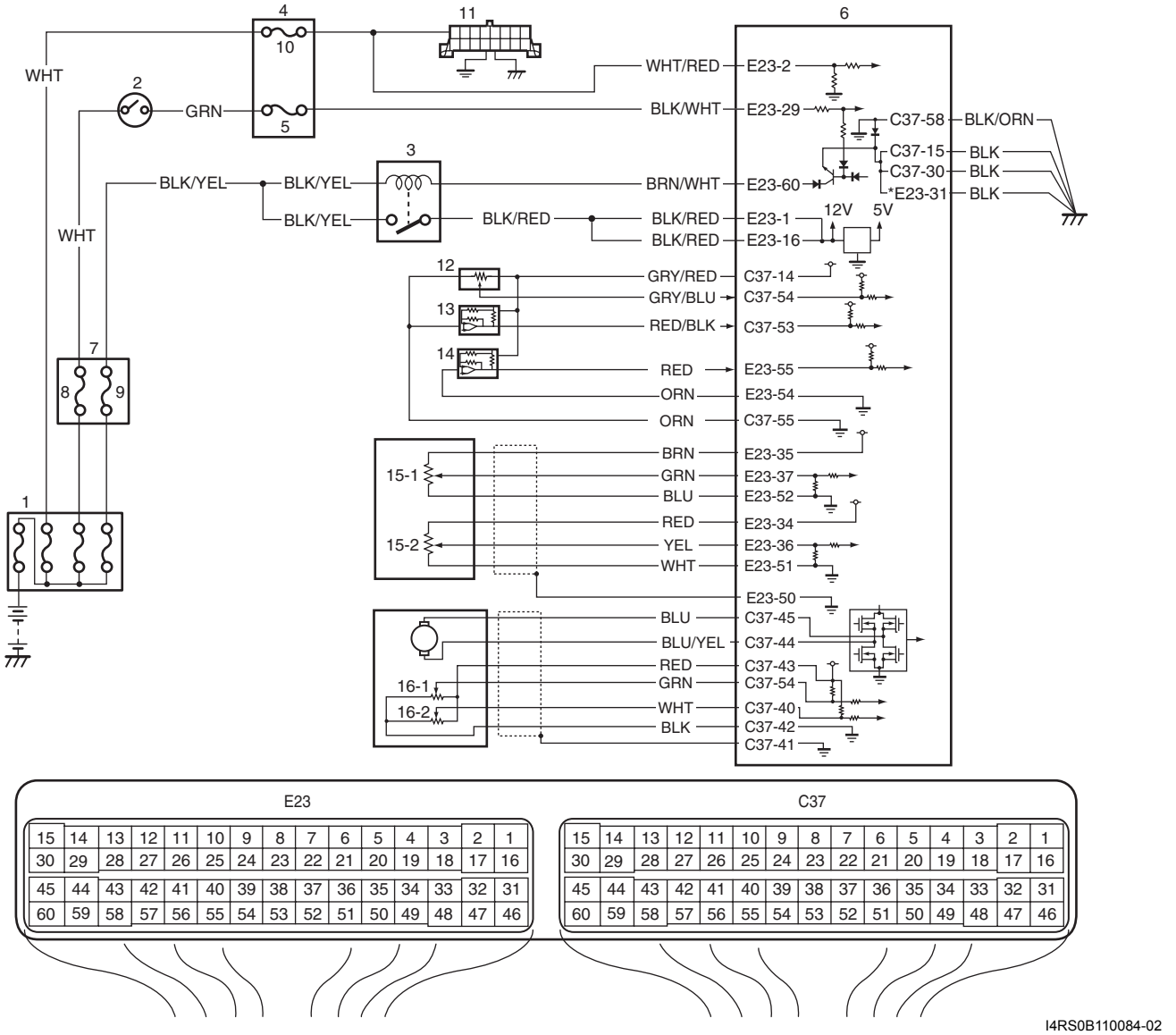
I4RS0A110086-02

Terminals	Circuit	Standard resistance	Condition
C37-47 to E23-29	Heater of HO2S-2	4 – 15 Ω	—
E23-46 to E23-1/16	Radiator cooling fan relay No.1	160 – 240 Ω	—
E23-60 to E23-29	Main relay	160 – 240 Ω	Battery disconnected and ignition switch turned ON
E23-15 to E23-29	Fuel pump relay	160 – 240 Ω	—
C37-16 to E23-1/16	No.3 fuel injector	10.8 – 18.2 Ω	—
C37-17 to E23-1/16	No.4 fuel injector		
C37-4 to E23-1/16	EGR valve (stepping motor No.1 coil)	20 – 31 Ω	—
C37-29 to E23-1/16	EVAP canister purge valve	28 – 35 Ω	—
C37-2 to E23-1/16	No.2 fuel injector	10.8 – 18.2 Ω	—
C37-3 to E23-1/16	EGR valve (stepping motor No.2 coil)	20 – 31 Ω	—
C37-18 to E23-1/16	EGR valve (stepping motor No.4 coil)		
C37-19 to E23-1/16	EGR valve (stepping motor No.3 coil)		
C37-46 to E23-29	Heater of HO2S-1	2 – 11 Ω	—
C37-1 to E23-1/16	No.1 fuel injector	10.8 – 18.2 Ω	—
E23-47 to E23-1/16	A/C compressor relay (if equipped with A/C)	160 – 240 Ω	—
C37-60 to C37-59	Oil control valve (for M15 engine model)	6 – 15 Ω	—
E23-45 to E23-1/16	Throttle actuator control relay (for Automated Manual Transaxle model)	160 – 240 Ω	—

ECM Power and Ground Circuit Check

S4RS0B1104064

Wiring Diagram



I4RS0B110084-02

1. Main fuse box	8. "IG ACC" fuse	15-1. Accelerator pedal position (APP) sensor (main) (for Automated Manual Transaxle model)
2. Ignition switch	9. "FI" fuse	15-2. Accelerator pedal position (APP) sensor (sub) (for Automated Manual Transaxle model)
3. Main relay	10. "RADIO" fuse	16-1. TP sensor (main) (for Automated Manual Transaxle model)
4. BCM (included in junction block assembly)	11. DLC	16-2. TP sensor (sub) (for Automated Manual Transaxle model)
5. "IG COIL" fuse	12. TP sensor (for A/T and M/T models)	*: For Automated Manual Transaxle model
6. ECM	13. MAP sensor	
7. Individual circuit fuse box No.1	14. A/C refrigerant pressure sensor (if equipped with A/C)	

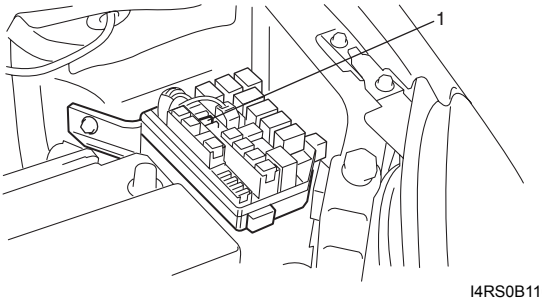
Circuit Description

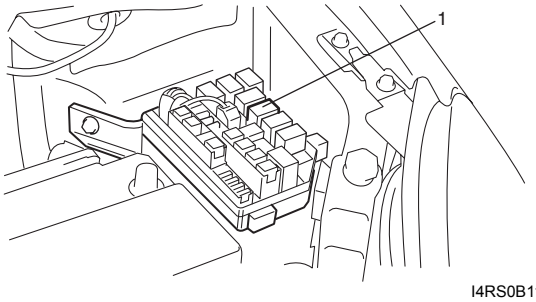
When the ignition switch is turned ON, the main relay turns ON (the contact point closes) and the main power is supplied to ECM.

Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the “Precautions of ECM Circuit Inspection: ”.**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to “Inspection of ECM and Its Circuits: ”.**

Step	Action	Yes	No
1	**Circuit fuse check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection to ECM connector at “E23-2”, “E23-29”, “E23-60”, “E23-1”, “E23-16”, “E23-31”, “C37-58”, “C37-15” and “C37-30” terminals. 3) If OK, check “RADIO” fuse and “IG COIL” fuse for blowing. *Are “RADIO” fuse and “IG COIL” fuse in good condition?*	Go to Step 2.	Replace fuse (s) and check for short in circuits connected to fuse(s).
2	**Power supply circuit check** 1) Measure voltage between “E23-2” terminal of ECM connector and body ground. *Is voltage 10 – 14 V?*	Go to Step 3.	“WHT/RED” or “WHT” wire is open circuit.
3	**Ignition signal check** 1) Turn ignition switch to ON position. 2) Measure voltage between “E23-29” terminal of ECM connector and body ground. *Is voltage 10 – 14 V?*	Go to Step 4.	“BLK/WHT” or “GRN” wire is open circuit.
4	**Main relay circuit check** 1) Turn ignition switch to OFF position. 2) Check “FI” fuse (1) (15 A) in individual circuit fuse box No.1 for blowing.  I4RS0B110085-01 3) If OK, measure voltage between “E23-60” terminal of ECM connector and body ground. *Is voltage 10 – 14 V?*	Go to Step 5.	Go to Step 9.
5	**Main relay circuit check** 1) Connect connectors to ECM with ignition switch turned OFF. 2) Turn ignition switch to ON position. 3) Measure voltage between “E23-60” terminal of ECM connector and body ground. *Is voltage 0 – 1 V?*	Go to Step 7.	Go to Step 6.

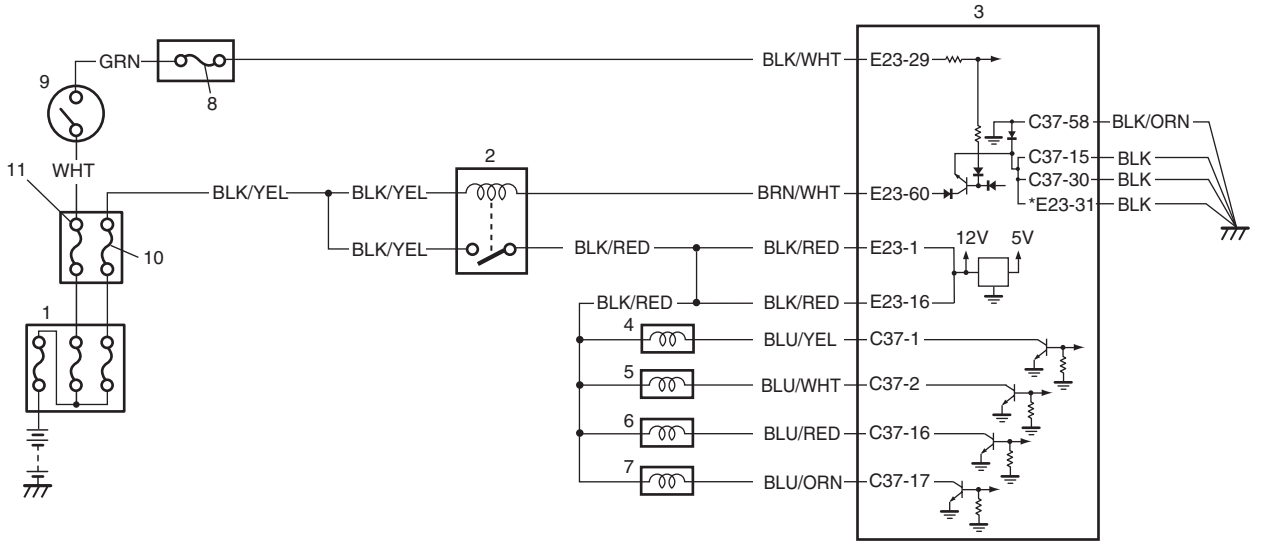
Step	Action	Yes	No
6	**ECM ground circuit check** 1) Turn ignition switch to OFF position. 2) Disconnect connectors from ECM. 3) Measure resistance between each “E23-31”, “C37-58”, “C37-15” and “C37-30” terminals of ECM connector and body ground. *Is resistance 1 Ω or less?*	Substitute a known-good ECM and recheck.	“BLK/ORN” or “BLK” wire is open or high resistance circuit.
7	**Main relay circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Using service wire, ground “E23-60” terminal of ECM connector and measure voltage between each “E23-1” and “E23-16” terminals of ECM connector and body ground. *Is voltage 10 – 14 V?*	Go to Step 11.	Go to Step 8.
8	**Main relay circuit check** 1) Remove main relay (1) from individual circuit fuse box No.1.  I4RS0B110086-01 2) Check for proper connection to main relay connector at “BLK/YEL” and “BLK/RED” wire terminals. 3) If OK, measure resistance between each “E23-1” and “E23-16” wire terminals of ECM connector and “BLK/RED” wire terminal of main relay connector. *Is resistance 1 Ω or less?*	Go to Step 9.	“BLK/RED” wire is open circuit or high resistance circuit.
9	**Main relay circuit check** 1) Remove main relay from individual circuit fuse box No.1 with ignition switch turned OFF. 2) Measure voltage between “BLK/YEL” wire terminal of main relay connector and body ground. *Is voltage 10 – 14 V?*	Go to Step 10.	“BLK/YEL” wire is open circuit.
10	**Main relay check** 1) Check main relay referring to “Main Relay, Fuel Pump Relay, Starting Motor Control Relay and Throttle Actuator Control Relay Inspection: in Section 1C”. *Is main relay in good condition?*	“BRN/WHT” wire is open or high resistance circuit.	Replace main relay.

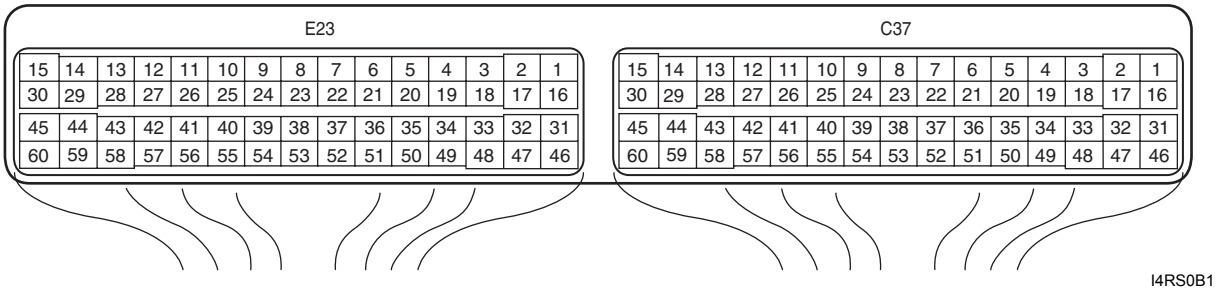
Step	Action	Yes	No
11	**Sensor power source circuit check** 1) Connect connectors to ECM with ignition switch turned OFF. 2) Turn ON ignition switch, measure each voltage between “C37-14”, “E23-35”, “E23-34” and “C37-43” terminal of ECM connector and vehicle body ground. *Is each voltage 4 – 6 V?*	ECM power and ground circuit is in good condition.	Go to Step 12.
12	**Sensor power source circuit check** 1) Disconnect connectors from ECM, TP sensor, MAP sensor, A/C refrigerant pressure sensor (if equipped with A/C) and accelerator pedal position (APP) sensor with ignition switch turned OFF. 2) Measure each resistance between “C37-14”, “E23-35”, “E23-34” and “C37-43” terminal of ECM connector and vehicle body ground. *Is each resistance infinity?*	Check internal short circuit of TP sensor, MAP sensor, A/C refrigerant pressure sensor (if equipped with A/C) and/or accelerator pedal position (APP) sensor.	“GRY/RED”, “BRN” and/or “RED” wire is shorted to ground circuit.

Fuel Injector Circuit Check

S4RS0B1104065

Wiring Diagram





I4RS0B110087-02

1. Main fuse box	4. No.1 injector	7. No.4 injector	10. “FI” fuse
2. Main relay	5. No.2 injector	8. “IG COIL” fuse	11. “IG ACC” fuse
3. ECM	6. No.3 injector	9. Ignition switch	*: For Automated Manual Transaxle model

Troubleshooting

NOTE

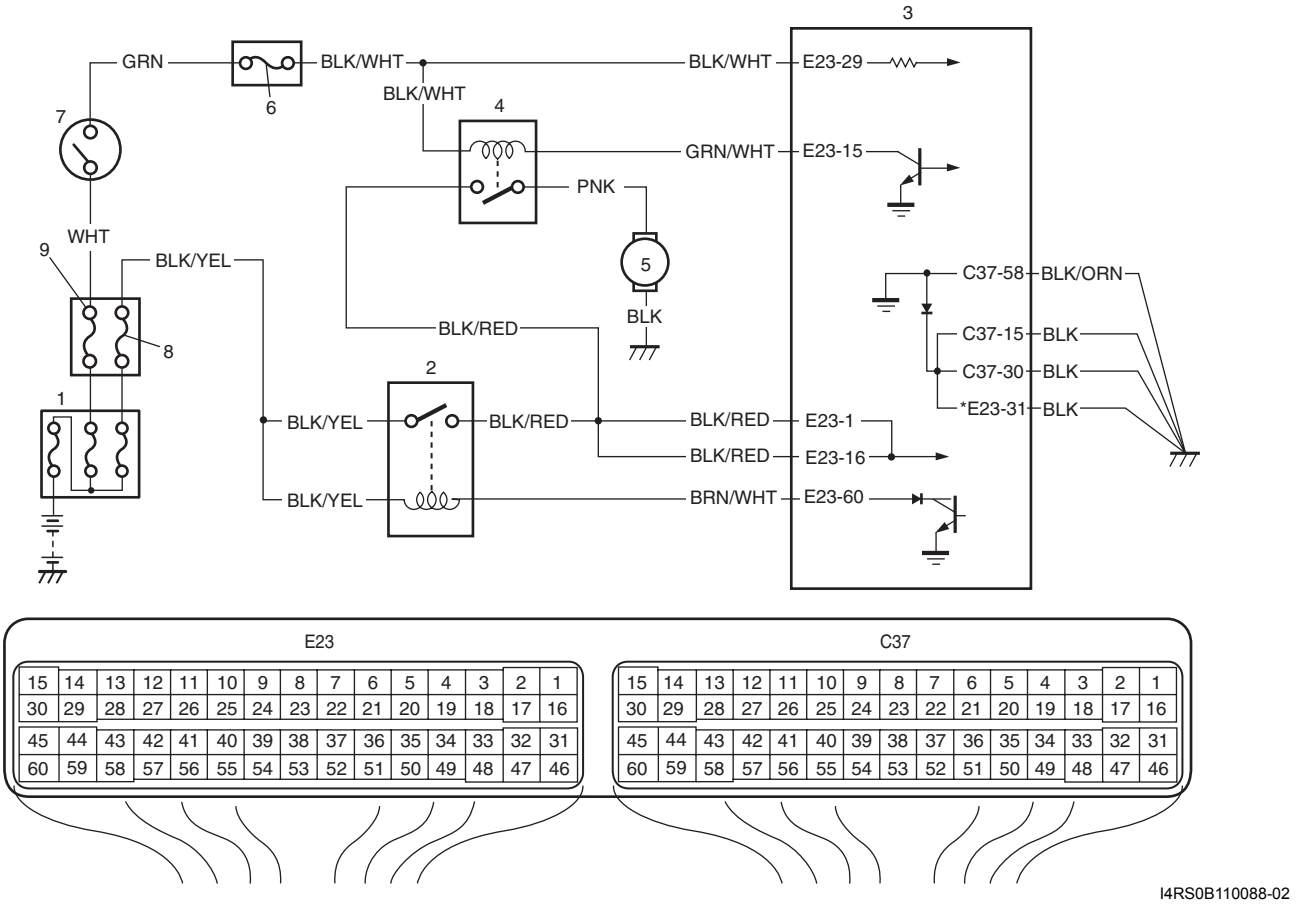
- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**

Step	Action	Yes	No
1	**Fuel injector check for operating sound** 1) Using sound scope, check each injector for operating sound at engine cranking. *Do all 4 injector make operating sound?*	Fuel injectors circuit is in good condition.	Go to Step 2.
2	**Fuel injector resistance check** 1) Disconnect connectors from fuel injectors with ignition switch turned OFF. 2) Check for proper connection to fuel injector at each terminals. 3) If OK, check all 4 fuel injectors for resistance referring to "Fuel Injector On-Vehicle Inspection: in Section 1G". *Are all injectors in good condition?*	Go to Step 3.	Faulty fuel injector.
3	**Fuel injector insulation resistance check** 1) Check that there is insulation between each fuel injector terminal and engine ground. *Is there insulation?*	Go to Step 4.	Faulty fuel injector.
4	**Fuel injector power supply check** 1) Measure voltage between each "BLK/RED" wire terminal of fuel injector connector and engine ground with ignition switch turned ON. *Is voltage 10 – 14 V?*	Go to Step 5.	"BLK/RED" wire is open or shorted to ground circuit. If it is in good condition, go to "ECM Power and Ground Circuit Check: ".
5	**Wire circuit check** 1) Turn OFF ignition switch. 2) Disconnect connectors from ECM. 3) Measure resistance between each "BLU/YEL", "BLU/WHT", "BLU/RED", "BLU/ORN" wire terminal of fuel injector connector and vehicle body ground. *Is resistance infinity?*	Go to Step 6.	"BLU/YEL", "BLU/WHT", "BLU/RED" and/or "BLU/ORN" wire(s) are shorted to ground.
6	**Wire circuit check** 1) Measure voltage between each "BLU/YEL", "BLU/WHT", "BLU/RED", "BLU/ORN" wire terminal of fuel injector connector and vehicle body ground with ignition switch turned ON. *Is voltage 0 V?*	Go to Step 7.	"BLU/YEL", "BLU/WHT", "BLU/RED" and/or "BLU/ORN" wire(s) are shorted to power supply circuit.
7	**Fuel injector drive signal check** 1) Connect connectors to each fuel injector and ECM with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Measure voltage between each "C37-1", "C37-2", "C37-16", "C37-17" terminal of ECM connector and vehicle body ground. *Is voltage 10 – 14 V?*	Check fuel injector referring to "Fuel Injector Inspection: in Section 1G". If check result is satisfactory, substitute a known-good ECM and recheck.	"BLU/YEL", "BLU/WHT", "BLU/RED" and/or "BLU/ORN" wire(s) are open circuit.

Fuel Pump and Its Circuit Check

S4RS0B1104066

Wiring Diagram



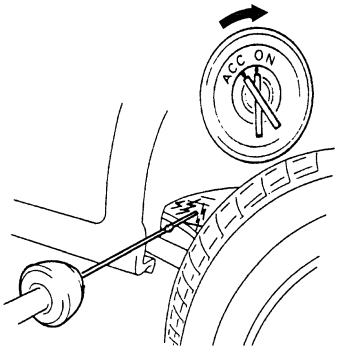
I4RS0B110088-02

1. Main fuse box	4. Fuel pump relay	7. Ignition switch	*: For Automated Manual Transaxle model
2. Main relay	5. Fuel pump	8. "FI" fuse	
3. ECM	6. "IG COIL" fuse	9. "IG ACC" fuse	

Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**

Step	Action	Yes	No
1	**Fuel pump control system check for operation** *Is fuel pump heard to operate 2 sec. after ignition switch is turned ON?*  I2RH01110132-01	Fuel pump circuit is in good condition.	Go to Step 2.
2	**Fuel pump relay power supply check** 1) Disconnect fuel pump relay from individual circuit fuse box No.1 with ignition switch turned OFF. 2) Check for proper connection to fuel pump relay at each terminal. 3) If OK, turn ON ignition switch, measure voltage between "BLK/WHT" wire terminal of fuel pump relay connector and engine ground. *Is voltage 10 – 14 V?*	Go to Step 3.	"BLK/WHT" wire is open or shorted to ground circuit.
3	**Fuel pump relay power supply check** 1) Turn ON ignition switch, measure voltage between "BLK/RED" wire terminal of fuel pump relay connector and engine ground. *Is voltage 10 – 14 V?*	Go to Step 4.	"BLK/RED" wire is open circuit.
4	**Fuel pump relay check** 1) Check fuel pump relay referring to "Main Relay, Fuel Pump Relay, Starting Motor Control Relay and Throttle Actuator Control Relay Inspection: in Section 1C". *Is relay in good condition?*	Go to Step 5.	Faulty relay.
5	**Fuel pump relay drive signal check** 1) Connect fuel pump relay to individual circuit fuse box No.1. 2) Connect voltmeter between "E23-15" terminal of ECM connector and vehicle body ground. 3) Measure voltage 2 second after ignition switch is turned ON. *Is voltage 10 – 14 V?*	Go to Step 6.	"GRN/WHT" wire is open circuit or shorted to ground circuit.
6	**Fuel pump relay drive signal check** 1) Measure voltage within 2 second after ignition switch is turned ON. *Is voltage 0 – 1 V?*	Go to Step 7.	Substitute a known-good ECM and recheck.

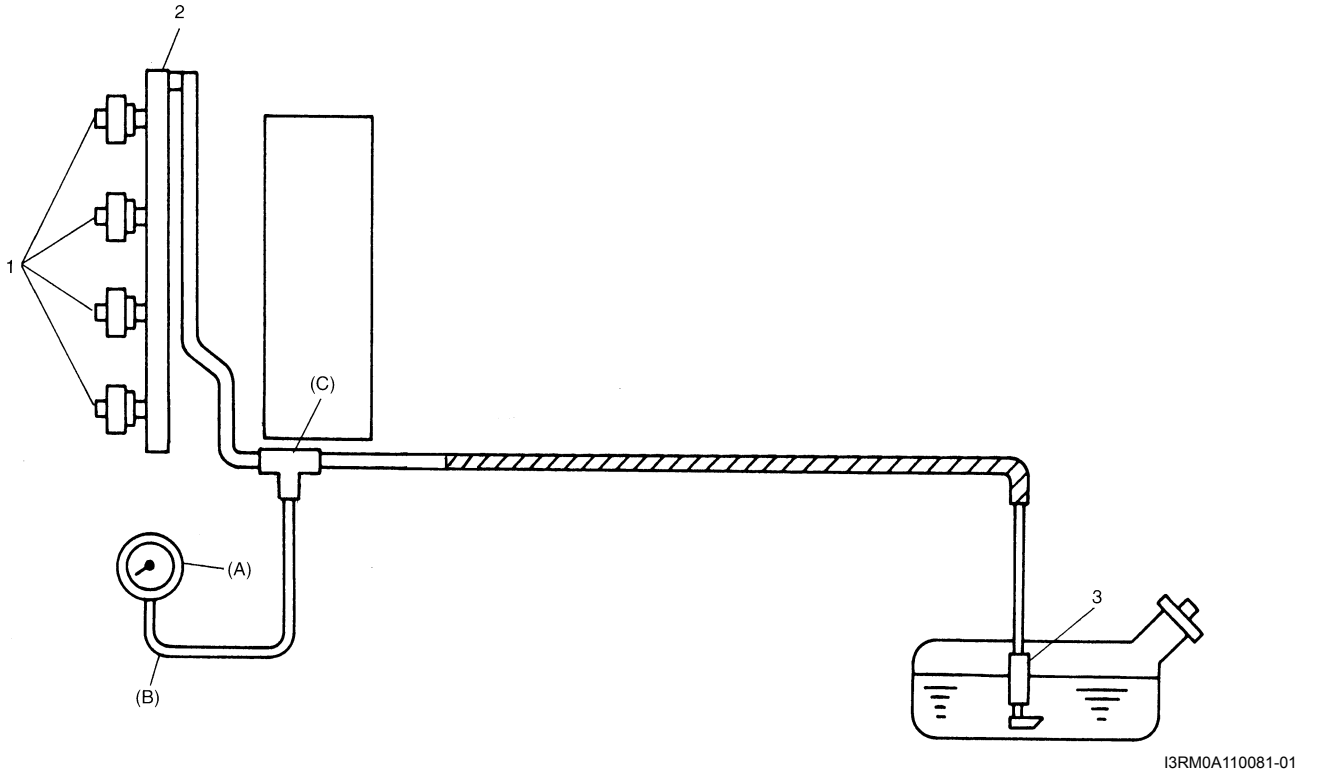
Step	Action	Yes	No
7	**Wire circuit check** 1) Turn OFF ignition switch. 2) Detach fuel tank referring to “Fuel Tank Removal and Installation: in Section 1G”. 3) Disconnect connector from fuel pump. 4) Measure resistance between “PNK” wire terminal of fuel pump connector and vehicle body ground. *Is resistance infinity?*	Go to Step 8.	“PNK” wire is shorted to ground.
8	**Fuel pump circuit check** 1) Connect service wire between “E23-15” terminal of ECM connector and vehicle body ground. 2) Turn ON ignition switch, measure voltage between “PNK” terminal at fuel pump connector and vehicle body ground. *Is voltage 10 – 14 V?*	Go to Step 9.	“PNK” wire is open circuit.
9	**Fuel pump circuit check** 1) Turn OFF ignition switch. 2) Measure resistance between “BLK” wire terminal at fuel pump connector and vehicle body ground. *Is resistance less than 5 Ω?*	Faulty fuel pump.	“BLK” wire is open circuit.

Fuel Pressure Check

S4RS0B1104067

System Diagram

Special tool
(A): 09912–58442
(B): 09912–58432
(C): 09912–58490



I3RM0A110081-01

1.	Injector
2.	Delivery pipe
3.	Fuel filter and fuel pump

Troubleshooting

NOTE

Before using following flow, check to make sure that battery voltage is higher than 11 V. If battery voltage is low, pressure becomes lower than specification even if fuel pump and line are in good condition.

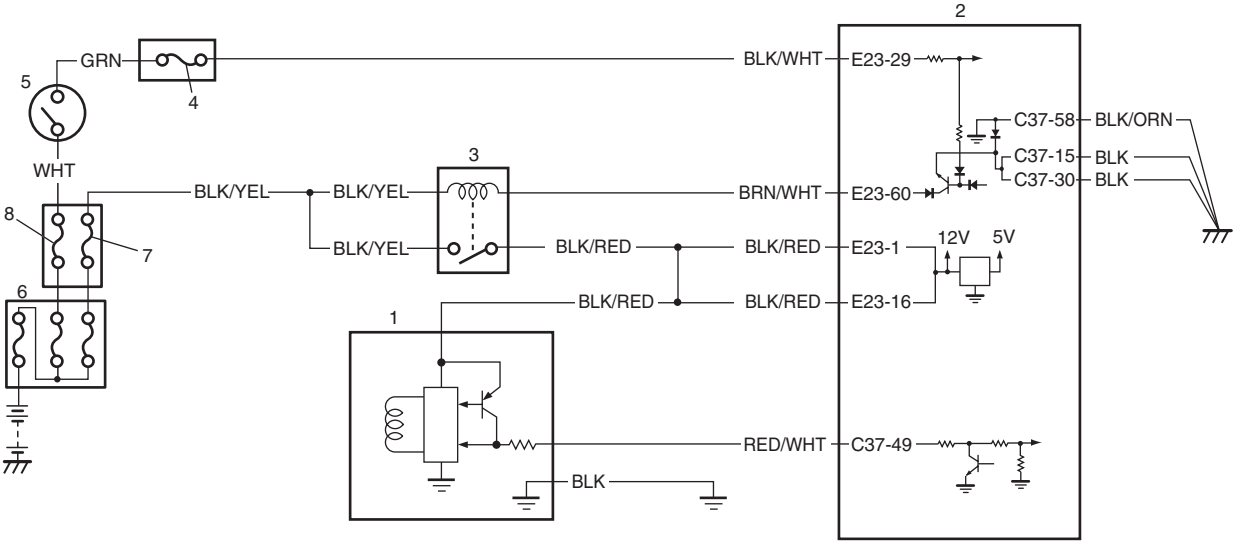
Step	Action	Yes	No
1	**Fuel pressure check** 1) Check fuel pressure referring to “Fuel Pressure Inspection: in Section 1G”. *Is check result satisfactory?*	Go to Step 2.	Go to Step 5.
2	**Fuel pressure check** 1) Start engine and warm it up to normal operating temperature. 2) Keep engine speed at 4000 rpm. *Does fuel pressure show about the same value as Step 1?*	Go to Step 3.	Go to Step 8.
3	**Fuel line check** 1) Check fuel pipe, fuel hose and joint for fuel leakage. *Are they in good condition?*	Go to Step 4.	Repair or replace defective part.

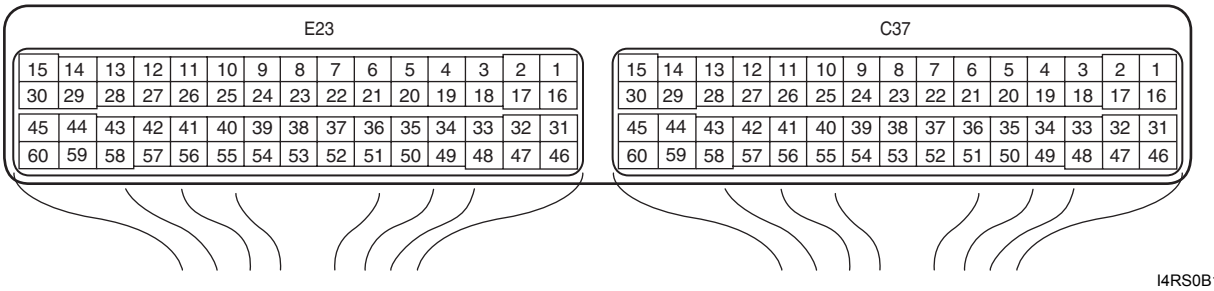
Step	Action	Yes	No
4	**Fuel line check** 1) Check fuel pipe, fuel hose and joint for damage or deform. *Are they in good condition?*	Faulty fuel pressure regulator.	Repair or replace damaged or damaged part.
5	*Was fuel pressure higher than specification in Step 1?*	Go to Step 6.	Go to Step 7.
6	**Fuel line check** 1) Check fuel pipe, fuel hose and joint for damage or deform. *Are they in good condition?*	Faulty fuel pressure regulator.	Repair or replace damaged or damaged part.
7	**Fuel pump operating sound check** 1) Remove fuel filler cap and then turn ON ignition switch. *Can you hear operating sound?*	Go to Step 8.	Faulty fuel pump.
8	**Fuel line check** 1) Check fuel pipe, fuel hose and joint for damage or deform. *Are they in good condition?*	Clogged fuel filter, faulty fuel pump, faulty fuel pressure regulator or fuel leakage from hose connection in fuel tank.	Repair or replace defective part.

Idle Air Control System Check (For A/T and M/T models)

S4RS0B1104068

Wiring Diagram





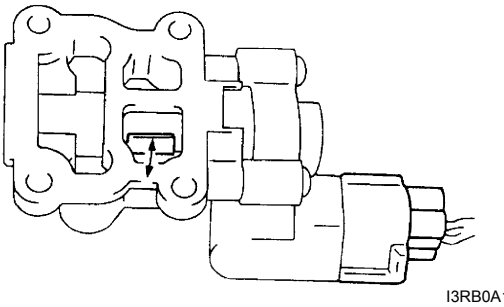
I4RS0B110041-02

1. IAC valve	4. "IG COIL" fuse	7. "FI" fuse
2. ECM	5. Ignition switch	8. "IG ACC" fuse
3. Main relay	6. Main fuse box	

Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**

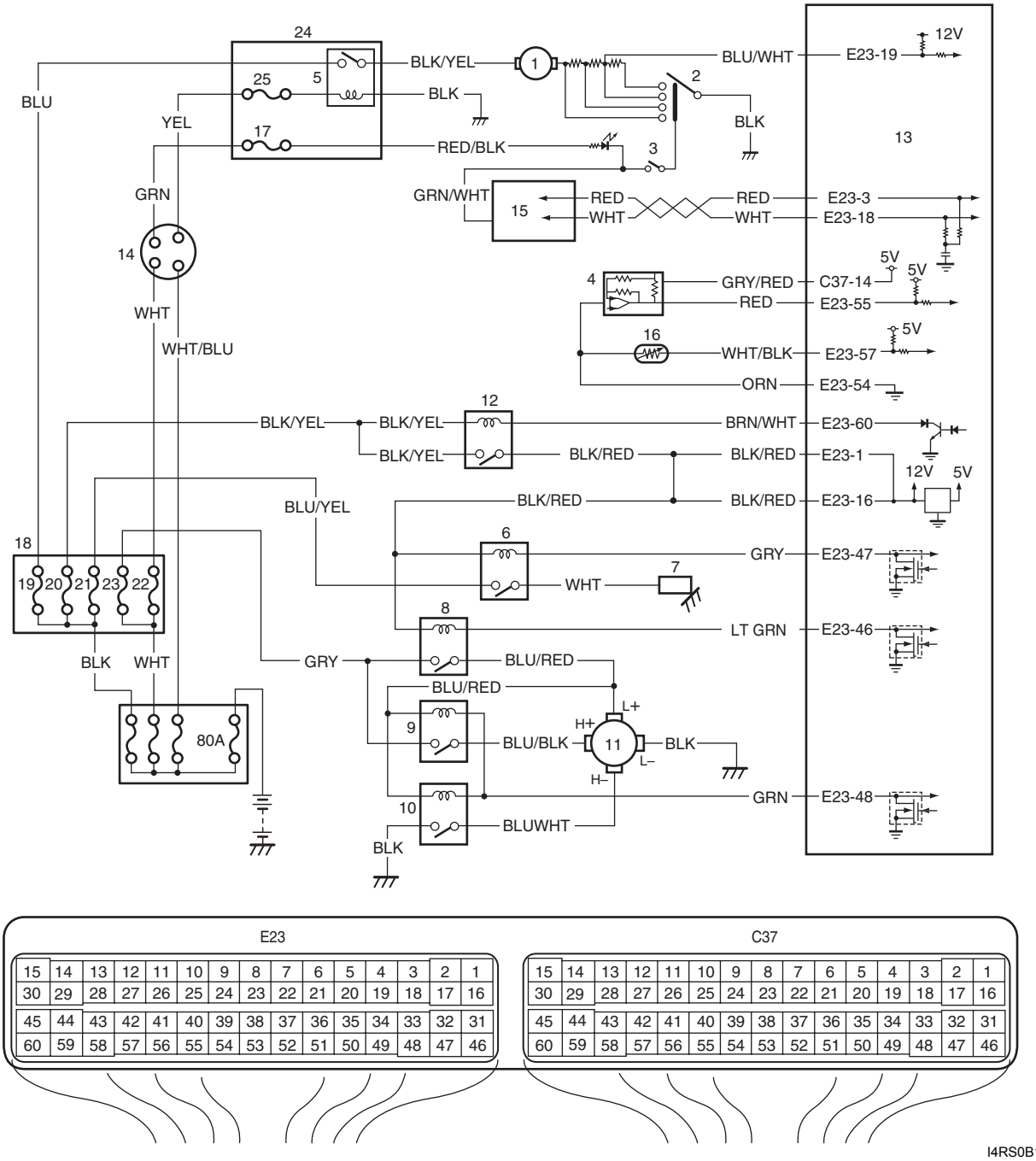
Step	Action	Yes	No
1	1) Check engine idle speed and IAC duty referring to "Idle Speed / Idle Air Control (IAC) Duty Inspection (For A/T and M/T Models): ". *Is idle speed within specification?*	Go to Step 2.	Go to Step 4.
2	*Is IAC duty within specification in Step 1?*	Go to Step 3.	Check for: Vacuum leak, EVAP canister purge control system, Clog of IAC air passage, Accessory engine load, "Electric Load Signal Circuit Check: ", Closed throttle position (TP sensor), Stuck of PCV valve.
3	*Is engine idle speed kept at specified speed even with headlight turned ON?*	System is in good condition.	Go to Step 7.
4	*Was idle speed higher than specification in Step 1?*	Go to Step 5.	Go to Step 7.
5	**A/C system circuit check (if equipped with A/C)** 1) Check A/C system circuit referring to Step 1 of "A/C System Circuits Check: ". *Is it in good condition?*	Go to Step 6.	Repair or replace A/C system circuit or A/C system.
6	**ECT sensor check** 1) Check ECT sensor performance referring to "Engine Coolant Temperature (ECT) Sensor Inspection: in Section 1C". *Is it in good condition?*	Go to Step 7.	Replace ECT sensor and recheck.
7	**Idle air control system check** 1) Remove IAC valve from throttle body referring to "Idle Air Control (IAC) Valve Removal and Installation (For A/T and M/T Models): in Section 1C". 2) Check IAC valve for operation referring to "Idle Air Control (IAC) Valve On-Vehicle Inspection (For A/T and M/T Models): in Section 1C".  I3RB0A110051-01 *Is check result satisfactory?*	Intermittent trouble or faulty ECM. Check for intermittent referring to "Intermittent and Poor Connection Inspection: in Section 00".	Go to Step 8.

Step	Action	Yes	No
8	**Idle air control valve circuit check** 1) Check idle air control valve circuit referring to Step 4 to 10 of “DTC P0505: Idle Air Control System (For A/T and M/T models): ”. *Is circuit in good condition?*	Replace IAC valve and recheck.	Repair or replace IAC valve circuit.

A/C System Circuits Check

S4RS0B1104069

Wiring Diagram



I4RS0B110090-01

1. Blower fan motor	8. Radiator cooling fan motor relay No.1	15. BCM	22. “IG ACC” fuse
2. Blower fan switch	9. Radiator cooling fan motor relay No.2	16. Evaporator outlet air temp. sensor	23. “RDTR FAN” fuse
3. A/C switch	10. Radiator cooling fan motor relay No.3	17. “BACK” fuse	24. Junction block assembly
4. A/C refrigerant pressure sensor	11. Radiator cooling fan motor	18. Individual circuit fuse box No.1	25. “IG2 SIG” fuse
5. Blower motor relay	12. Main relay	19. “HTR FAN” fuse	
6. Compressor relay	13. ECM	20. “FI” fuse	

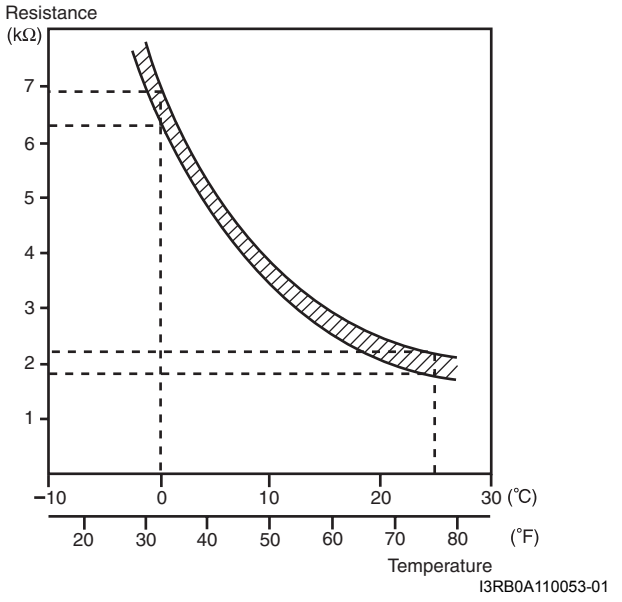
7. A/C compressor	14. Ignition switch	21. "A/C COMP" fuse	

Troubleshooting

NOTE

- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**
- **When A/C evaporator outlet air temp. is below 2.5 °C (36.5 °F), A/C remains OFF ("E23-47" terminal voltage becomes 10 – 14 V). This condition is not abnormal.**

Step	Action	Yes	No
1	**Reception data check from BCM** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check DTC for reception data from BCM. *Is there DTC P1678?*	Go to applicable DTC diag. flow.	Go to Step 2.
2	**A/C switch signal circuit check** 1) Start engine and select "DATA LIST" mode on scan tool. 2) Check A/C switch signal under following conditions respectively. **A/C switch signal** **Engine running, A/C switch OFF: OFF** **Engine running, A/C switch ON and blower speed selector turned 1st position or more: ON** *Is check result satisfactory?*	Go to Step 3.	Check A/C switch circuit.
3	**DTC check of ECT sensor circuit** 1) Check ECM for DTC of ECT sensor circuit. *Is there DTC P0116, DTC P0117 or DTC P0118?*	Go to applicable DTC diag. flow.	Go to Step 4.
4	**Radiator cooling fan control system check** *Is radiator cooling fan started when A/C and blower speed selector switch are turned ON with engine running?*	Go to Step 10.	Go to Step 5.
5	**Radiator cooling fan control circuit check** 1) Check DTC with scan tool. *Is DTC P0480 displayed?*	Go to "DTC P0480: Fan 1 (Radiator Cooling Fan) Control Circuit: ".	Go to Step 6.

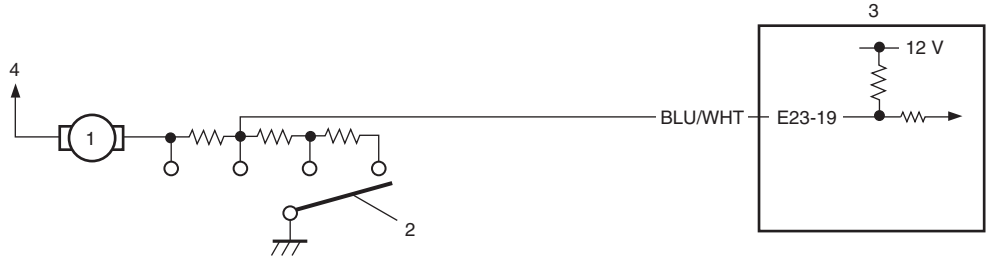
Step	Action	Yes	No
6	**A/C evaporator outlet air temp. sensor check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection to “E23-57” and “E23-54” wire terminals of ECM connector. 3) If OK, measure resistance between “E23-57” and “E23-54” wire terminals of ECM connector. **Evaporator temp. sensor resistance** **At 0 °C: 6.3 – 6.9 kΩ** **At 25 °C: 1.8 – 2.2 kΩ**  *Is resistance within specification?*	Go to Step 7.	Faulty A/C evaporator outlet air temp. sensor or its circuit.
7	**DTC check of A/C refrigerant pressure sensor circuit** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check ECM for DTC of A/C refrigerant pressure sensor circuit. *Is there DTC P0532 or DTC P0533?*	Go to applicable DTC diag. flow.	Go to Step 8.
8	**A/C refrigerant pressure sensor voltage check** 1) Check A/C refrigerant pressure sensor voltage referring to “Inspection of ECM and Its Circuits: ”. *Is voltage within specified value?*	Go to Step 9.	Check amount of refrigerant. If OK, replace A/C refrigerant pressure sensor.
9	**Radiator cooling fan check** 1) Check radiator cooling fan referring to “Radiator Cooling Fan Motor On-Vehicle Inspection: in Section 1F”. *Is check result satisfactory?*	Radiator cooling fan drive circuit malfunction. If circuit is OK, go to Step 6.	Replace radiator cooling fan motor.
10	**A/C compressor control system check** *Is A/C compressor started when A/C and blower speed selector switch are turned ON with engine running?*	A/C system is in good condition.	Go to Step 11.

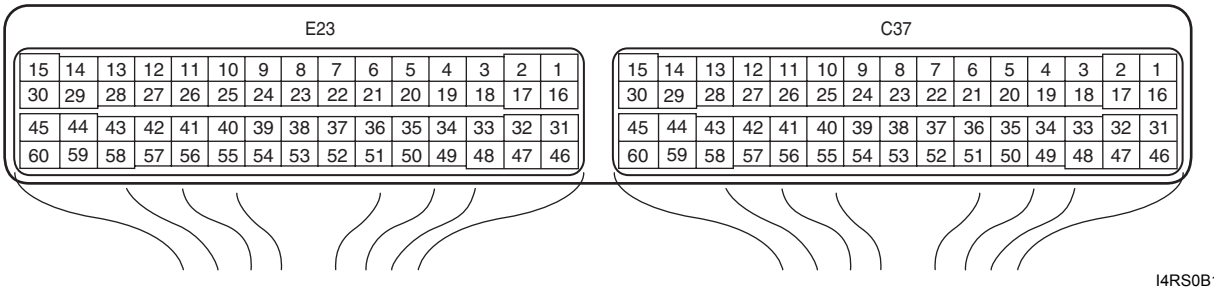
Step	Action	Yes	No
11	**A/C compressor relay circuit check** 1) Measure voltage between “E23-47” wire terminal of ECM connector and vehicle body ground under following conditions respectively. **Voltage between “E23-47” terminal of ECM connector and ground** **While engine running and A/C switch turned OFF: 10 – 14 V** **While engine running, A/C and blower speed selector switch turned ON: 0 – 1 V** *Is check result satisfactory?*	Go to Step 12.	Go to Step 13.
12	**A/C compressor relay check** 1) Check A/C compressor relay referring to “Compressor Relay Inspection: in Section 7B”. *Is it in good condition?*	A/C compressor drive circuit malfunction.	Replace A/C compressor relay.
13	**A/C compressor relay circuit check** 1) Remove A/C compressor relay with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between “BLK/RED” wire terminal of A/C compressor relay connector and vehicle body ground. *Is voltage 10 –14 V?*	Go to Step 14.	“BLK/RED” wire is open circuit.
14	**A/C compressor relay check** 1) Check A/C compressor relay referring to “Compressor Relay Inspection: in Section 7B”. *Is it in good condition?*	“GRY” wire is open circuit. If OK, substitute a known-good ECM and recheck.	Replace A/C compressor relay.

Electric Load Signal Circuit Check

S4RS0B1104070

Wiring Diagram





I4RS0B110091-01

1. Blower fan motor	3. ECM
2. Blower fan switch	4. To blower motor relay

Troubleshooting

NOTE

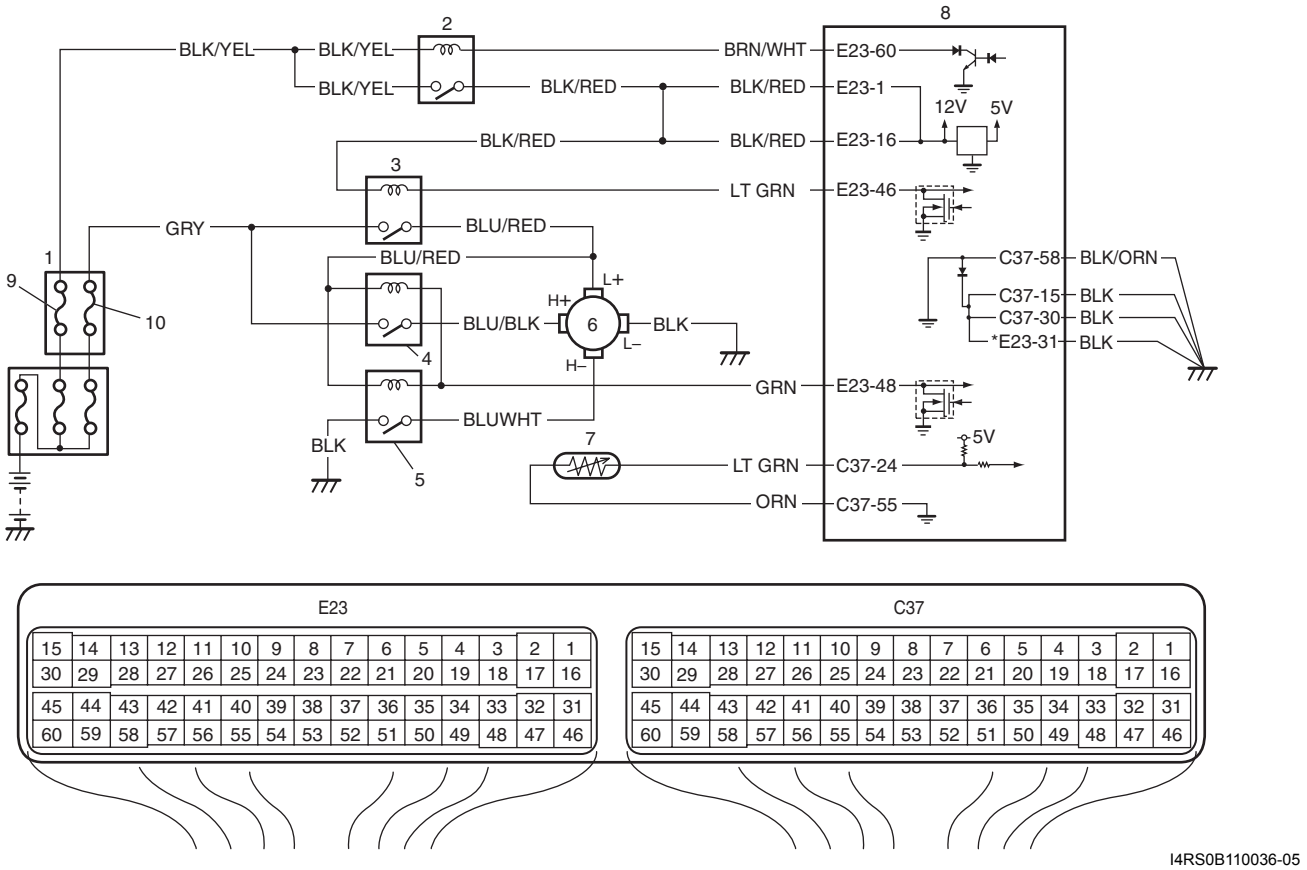
- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**

Step	Action	Yes	No
1	*Do you have SUZUKI scan tool?*	Go to Step 2.	Go to Step 3.
2	**Electric load signal circuit check** 1) Connect SUZUKI scan tool to DLC with ignition switch turned OFF. 2) Start engine and select "DATA LIST" mode on scan tool. 3) Check electric load signal under following conditions respectively. **Electric load signal** **Ignition switch turned ON, blower speed selector turned OFF or 1st position: OFF** **Ignition switch turned ON, blower speed selector turned to 3rd position or more: ON** *Is check result satisfactory?*	Electric load signal circuit is in good condition.	"BLU/WHT" wire is open or short circuit, or blower circuit malfunction.
3	**Electric load signal circuit check** 1) Turn ON ignition switch. 2) Check voltage at terminal "E23-19" of ECM connector connected, under following conditions respectively. **Voltage at "E23-19"** **Ignition switch turned ON, blower speed selector turned OFF or 1st position: 10 – 14 V** **Ignition switch turned ON, blower speed selector turned to 3rd position or more: 0 V** *Is each voltage as specified?*	Electric load signal circuit is in good condition.	"BLU/WHT" wire is open or short circuit, or electric load circuit malfunction.

Radiator cooling fan Low Speed Control System Check

S4RS0B1104071

Wiring Diagram



I4RS0B110036-05

1. Individual circuit fuse box No.1	5. Radiator cooling fan relay No. 3	9. “FI” fuse
2. Main relay	6. Radiator cooling fan motor	10. “RDTR FAN” fuse
3. Radiator cooling fan relay No. 1	7. ECT sensor	*: For Automated Manual Transaxle model
4. Radiator cooling fan relay No. 2	8. ECM	

Troubleshooting

⚠ WARNING

Keep hands, tools, and clothing away from engine cooling fan to help prevent personal injury. This fan is electric and can come on whether or not the engine is running. The fan can start automatically in response to the ECT sensor with the ignition switch at the "ON" position.

NOTE

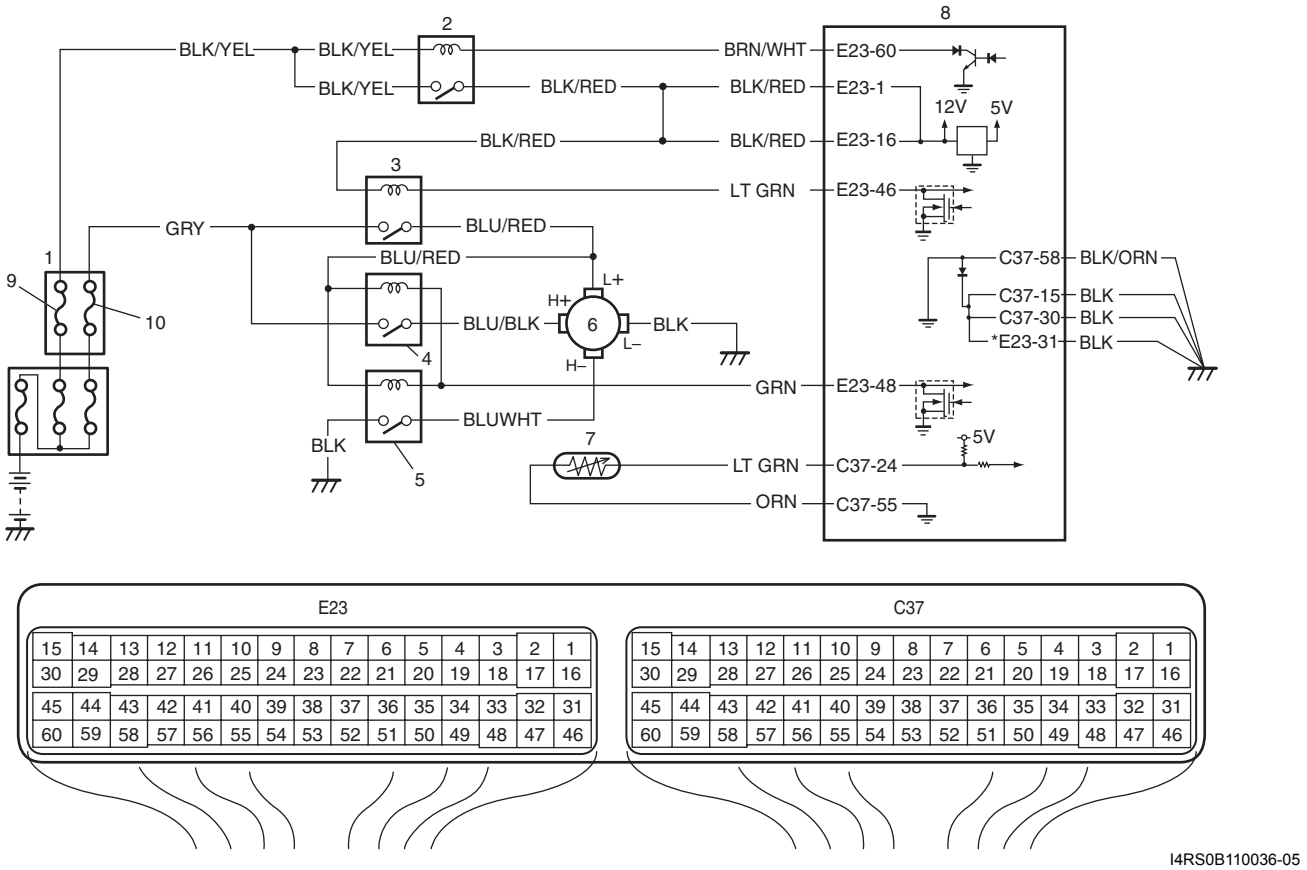
- **Before performed trouble shooting, be sure to read the "Precautions of ECM Circuit Inspection: ".**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits: ".**

Step	Action	Yes	No
1	*Is there DTC(s) of ECT sensor circuit (DTC P0116 / P0117 / P0118) and/or radiator cooling fan circuit (DTC P0480)?*	Go to corresponding DTC flow.	Go to Step 2.
2	**Low speed radiator cooling fan control circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Start engine and select "DATA LIST" mode on scan tool. 3) Warm up engine until coolant temp. is 97.5 °C, 207.5 °F or higher and A/C switch turns OFF (if equipped with A/C). (If engine coolant temp. dose not rise, check engine cooling system or ECT sensor.) *Is radiator cooling fan started at low speed when engine coolant temp. reached above temp.?*	Radiator cooling fan low speed control system is in good condition.	Perform from Step 2 to Step 8 in DTC P0480 diag. flow. If OK, Go to Step 3.
3	**Radiator cooling fan control check** 1) Disconnect radiator cooling fan control relays No. 2, and No. 3 from individual circuit fuse box No.1 with ignition switch turned OFF. 2) Run engine when ECT is over 97.5 °C, 207.5 °F. 3) Measure voltage between vehicle body ground and "BLU/RED" wire terminal of disconnected radiator cooling fan motor connector. *Is voltage 10 – 14 V?*	Go to Step 4.	"BLU/RED" wire is open or high resistance circuit.
4	**Check radiator cooling fan wire circuit check** 1) Turn ignition switch to OFF position. 2) Measure resistance between "BLK" wire terminal of disconnected radiator cooling fan motor connector and vehicle body ground. *Is resistance below 1 Ω?*	Go to Step 5.	"BLK" wire is open or high resistance circuit.
5	**Radiator cooling fan check** 1) Check radiator cooling fan referring to "Radiator Cooling Fan Motor On-Vehicle Inspection: in Section 1F". *Is it in good condition?*	Substitute a known-good ECM and recheck.	Faulty radiator cooling fan.

Radiator cooling fan High Speed Control System Check

S4RS0B1104072

Wiring Diagram



I4RS0B110036-05

1. Individual circuit fuse box No.1	5. Radiator cooling fan relay No. 3	9. “FI” fuse
2. Main relay	6. Radiator cooling fan motor	10. “RDTR FAN” fuse
3. Radiator cooling fan relay No. 1	7. ECT sensor	*: For Automated Manual Transaxle model
4. Radiator cooling fan relay No. 2	8. ECM	

Troubleshooting

⚠ WARNING

Keep hands, tools, and clothing away from engine cooling fan to help prevent personal injury. This fan is electric and can come on whether or not the engine is running. The fan can start automatically in response to the ECT sensor with the ignition switch at the “ON” position.

NOTE

- **Before performed trouble shooting, be sure to read the “Precautions of ECM Circuit Inspection: ”.**
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to “Inspection of ECM and Its Circuits: ”.**

Step	Action	Yes	No
1	*Is there DTC(s) of ECT sensor circuit (DTC P0116 / P0117 / P0118) and/or radiator cooling fan circuit (DTC P0480)?*	Go to corresponding DTC flow.	Go to Step 2.
2	**Low speed radiator cooling fan control circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Start engine and select “DATA LIST” mode on scan tool. 3) Warm up engine until coolant temp. is 97.5 °C, 207.5 °F or higher and A/C switch turns OFF (if equipped with A/C). (If engine coolant temp. dose not rise, check engine cooling system or ECT sensor.) *Is radiator cooling fan started at low speed when engine coolant temp. reached above temp.?*	Go to Step 3.	Perform from Step 2 to Step 5 in “Radiator cooling fan Low Speed Control System Check: ”.
3	**High speed radiator cooling fan control circuit check** 1) Start engine and select “DATA LIST” mode on scan tool. 2) Warm up engine until coolant temp. is 102.5 °C, 216.5 °F or higher and A/C switch turns OFF (if equipped with A/C). (If engine coolant temp. dose not rise, check engine cooling system or ECT sensor.) *Is radiator cooling fan started at high speed when engine coolant temp. reached above temp?*	Radiator cooling fan control system is in good condition.	Perform from Step 9 to Step 14 in DTC P0480 diag. flow. If OK, Go to Step 4.
4	**Radiator cooling fan control No. 2 and No. 3 check** 1) Run engine when ECT is over 102.5 °C, 216.5 °F. 2) Measure voltage between vehicle body ground and “E23-48” terminal of ECM connector. *Is voltage lower than 1.5 V?*	Go to Step 5.	Faulty ECM.
5	**Radiator cooling fan No. 2 wire circuit check** 1) Remove radiator cooling fan control relay No.2 with ignition switch turned OFF. 2) Measure voltage between “GRY” wire terminal of disconnected radiator cooling fan control relay No. 2 connector and vehicle body ground. *Is voltage 10 – 14 V?*	Go to Step 6.	“GRY” wire is open or high resistance circuit.
6	**Radiator cooling fan No. 2 wire circuit check** 1) Disconnect connector from radiator cooling fan motor with ignition switch turned OFF. 2) Measure resistance between “BLU/BLK” wire terminal of disconnected radiator cooling fan control relay No. 2 connector and vehicle body ground. *Is resistance infinity?*	Go to Step 7.	“BLU/BLK” wire is shorted to ground circuit.
7	**Radiator cooling fan No. 2 wire circuit check** 1) Turn ON ignition switch. 2) Measure voltage between “BLU/BLK” wire terminal of disconnected radiator cooling fan control relay No. 2 connector and vehicle body ground. *Is voltage 0 V?*	Go to Step 8.	“BLU/BLK” wire is shorted to power supply circuit.

Step	Action	Yes	No
8	**Radiator cooling fan control No. 2 check** 1) Connect radiator cooling fan control relay No. 2 to individual circuit fuse box No.1 with ignition switch turned OFF. 2) Run engine when ECT is over 102.5 °C, 216.5 °F. 3) Measure voltage between vehicle body ground and "BLU/BLK" wire terminal of disconnected radiator cooling fan motor connector. *Is voltage 10 – 14 V?*	Go to Step 10.	Go to Step 9.
9	**Radiator cooling fan control relay No.2 check** 1) Remove radiator cooling fan control relay No.2 with ignition switch turned OFF. 2) Check radiator cooling fan control relay No.2 referring to "Radiator Cooling Fan Relay Inspection: in Section 1F". *Is it in good condition?*	"BLU/BLK" wire is open or high resistance circuit.	Faulty radiator cooling fan control relay No.2.
10	**Radiator cooling fan No. 3 wire circuit check** 1) Remove radiator cooling fan control relay No.3 with ignition switch turned OFF. 2) Measure resistance between vehicle body ground and "BLK" wire terminal of disconnected radiator cooling fan control relay No. 3 connector in individual circuit fuse box No.1. *Is resistance below 1 Ω?*	Go to Step 11.	"BLK" wire is open or high resistance circuit.
11	**Radiator cooling fan control No. 3 check** 1) Connect radiator cooling fan control relay No. 3 to individual circuit fuse box No.1 with ignition switch turned OFF. 2) Run engine when ECT is over 102.5 °C, 216.5 °F. 3) Measure resistance between vehicle body ground and "BLU/WHT" wire terminal of disconnected radiator cooling fan motor connector. *Is resistance below 2 Ω?*	Go to Step 13.	Go to Step 12.
12	**Radiator cooling fan control relay No. 3 check** 1) Remove radiator cooling fan control relay No.3 with ignition switch turned OFF. 2) Check radiator cooling fan control relay No.3 referring to "Radiator Cooling Fan Relay Inspection: in Section 1F". *Is it in good condition?*	"BLU/WHT" wire is open or high resistance circuit.	Faulty radiator cooling fan control relay No.3.
13	**Radiator cooling fan check** 1) Check radiator cooling fan referring to "Radiator Cooling Fan Motor On-Vehicle Inspection: in Section 1F". *Is it in good condition?*	Substitute a known-good ECM and recheck.	Faulty radiator cooling fan.

Repair Instructions

Idle Speed / Idle Air Control (IAC) Duty Inspection (For A/T and M/T Models)

S4RS0B1106001

Before idle speed / IAC duty check, make sure of the following.

- Lead wires and hoses of electronic fuel injection and engine and emission control systems are connected securely.
- Accelerator cable has some play, that is, it is not tight.
- Valve lash is checked according to maintenance schedule.
- Ignition timing is within specification.
- All accessories (wipers, heater, lights, A/C, etc.) are out of service.
- Air cleaner has been properly installed and is in good condition.
- No abnormal air drawn in from air intake system.

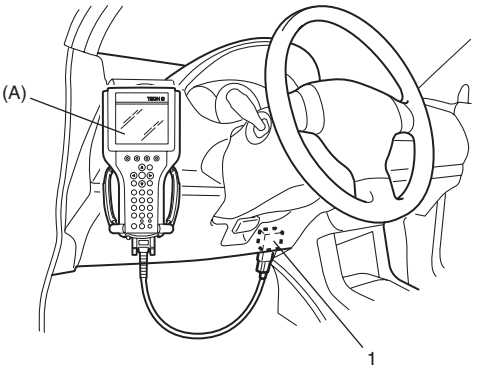
After all items are confirmed, check idle speed and IAC duty as follows.

NOTE

Before starting engine, place transmission gear shift lever in "Neutral" (shift selector lever to "P" range for A/T vehicle), and set parking brake and block drive wheels.

1) Connect SUZUKI scan tool to DLC (1) with ignition switch turned OFF.

Special tool
(A): SUZUKI scan tool



I4RS0B110093-01

2) Warm up engine to normal operating temperature.
3) Check engine idle speed and "IAC duty" by using "Data List" mode on scan tool to check "IAC duty".
4) If duty and/or idle speed is out of specification, inspect idle air control system referring to "Idle Air Control System Check (For A/T and M/T models): ".

Engine idle speed and IAC duty

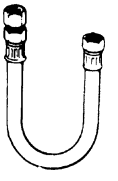
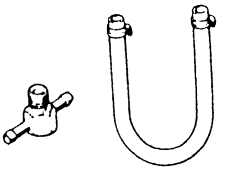
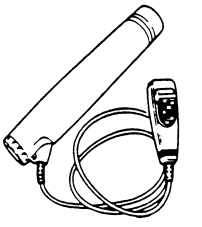
	A/C OFF	A/C ON
M/T vehicle	**700 ± 50 rpm 10 – 55%**	**850 ± 50 rpm**
A/T vehicle at P/N range	**750 ± 50 rpm 10 – 55%**	**850 ± 50 rpm**

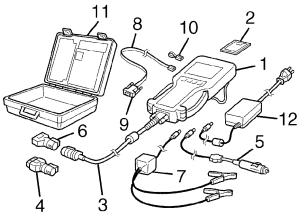
5) Check that specified engine idle speed is obtained with A/C turned ON if vehicle is equipped with A/C. If not, check A/C system circuit and idle air control system.

Special Tools and Equipment

Special Tool

S4RS0B1108001

09912–58432 Fuel pressure gauge hose This tool is included in fuel pressure gauge set (09912-58413). ☞		09912–58442 Fuel pressure gauge This tool is included in fuel pressure gauge set (09912-58413). ☞	
09912–58490 3-way joint & hose ☞		09930–76420 Timing-light (dry cell type) ☞	

SUZUKI scan tool — This kit includes following items. 1. Tech 2, 2. PCMCIA card, 3. DLC cable, 4. SAE 16/19 adapter, 5. Cigarette cable, 6. DLC loopback adapter, 7. Battery power cable, 8. RS232 cable, 9. RS232 adapter, 10. RS232 loop back connector, 11. Storage case, 12. Power supply ☞ / ☞		

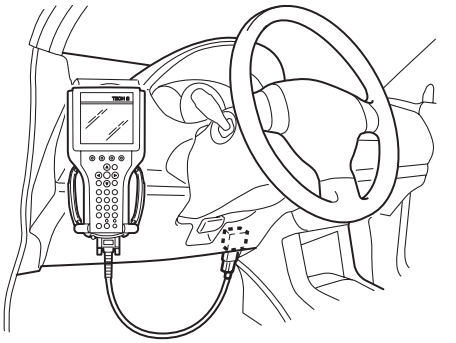
Aux. Emission Control Devices

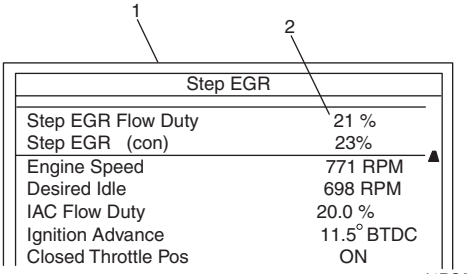
Diagnostic Information and Procedures

EGR System Inspection

S4RS0B1204001

1) Connect SUZUKI scan tool to data link connector (DLC) with ignition switch turned OFF.
2) Turn ON ignition switch and erase DTC using “CLEAR DTC” in “TROUBLE CODES” menu.
3) Start engine and warm it up to normal operating temperature, then select “DATA LIST” mode on scan tool.
4) Make sure that vehicle condition is as follows.
   - Vehicle speed = 0 km/h (0 KPH)
   - Engine speed ≤ 900 rpm
   - Engine coolant temp. ≥ 90 °C, 164 °F
5) With engine idling (without depressing accelerator pedal), open EGR valve by using “STEP EGR” mode in “MISC TEST” menu. In this state, as EGR valve opening increases engine idle speed drops. If not, possible cause is clogged EGR gas passage, stuck or faulty EGR valve.





I4RS0B120001-01

1.	SUZUKI scan tool display
2.	EGR valve opening (0: Close, 100: Full open)

Repair Instructions

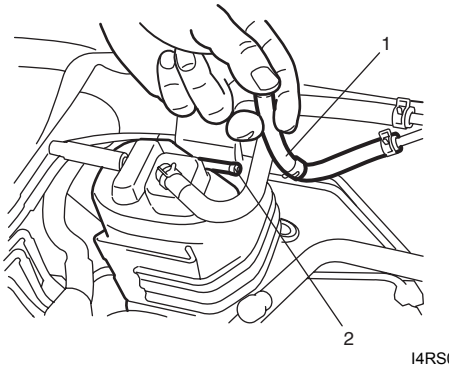
EVAP Canister Purge Inspection

S4RS0B1206001

NOTE

Before inspection, check to make sure that gear shift lever is in neutral position (with A/T model, selector lever in “P” range) and that parking brake lever is pulled all the way up.

1) Disconnect purge hose (1) from EVAP canister (2).
2) Place finger against the end of disconnected hose and check that vacuum is not felt there when engine is cool and running at idle speed. If check result is not satisfactory, check EVAP canister purge valve, wire harness and ECM.



I4RS0B120002-01

EVAP Canister Purge Valve and Its Circuit Inspection

S4RS0B1206002

⚠ WARNING

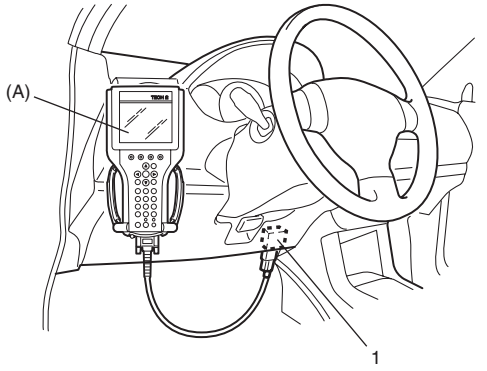
Do not apply vacuum by mouth; otherwise harmful fuel vapor can be breathed in.

⚠ CAUTION

Do not apply vacuum more than –86 kPa (–12.47 psi); otherwise EVAP canister purge valve could be damaged.

1) Prepare to operate EVAP canister purge valve as follows.
   a) When using SUZUKI scan tool:
      i) Connect SUZUKI scan tool to DLC (1) with ignition switch turned OFF and disconnect purge valve vacuum hoses from intake manifold and EVAP canister.
      ii) Turn ON ignition switch, clear DTC and select “MISC TEST” mode on SUZUKI scan tool.

      Special tool
      (A): SUZUKI scan tool



I4RS0B120003-03

b) When not using SUZUKI scan tool:

NOTE

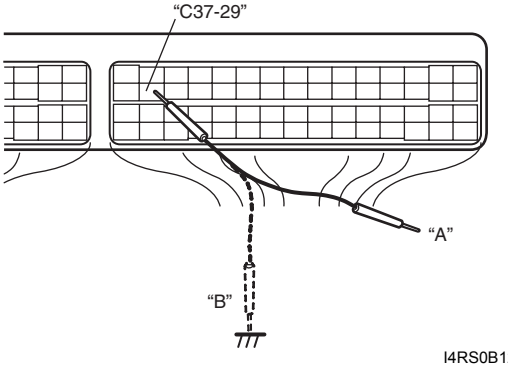
Before performed this check, be sure to read the "Precautions of ECM Circuit Inspection: in Section 1A".

i) Disconnect purge valve vacuum hoses from intake manifold and EVAP canister.

ii) Remove ECM from its bracket referring to "Engine Control Module (ECM) Removal and Installation: in Section 1C".

iii) Connect special tool between ECM and ECM connector referring to "Inspection of ECM and Its Circuits: in Section 1A"

iv) Turn ON ignition switch.
Using service wire, ground "C37-29" terminal circuit of special tool (valve ON: "B") and unground it (valve OFF: "A").

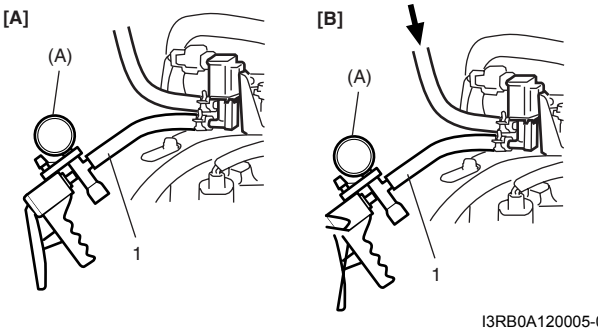


I4RS0B120006-02

2) Check purge valve for operation and vacuum passage for clog when valve is switched ON and OFF by using SUZUKI scan tool or service wire.
If check result is not satisfactory, check vacuum hoses, EVAP canister purge valve, wire harness and connections.

EVAP canister purge valve specification
[A] Valve OFF: When vacuum (–60 kPa (–8.7 psi)) is applied to hose (1), vacuum can be applied.
[B] Valve ON: When vacuum is applied to hose (1), vacuum can not be applied.

Special tool
(A): 09917–47011

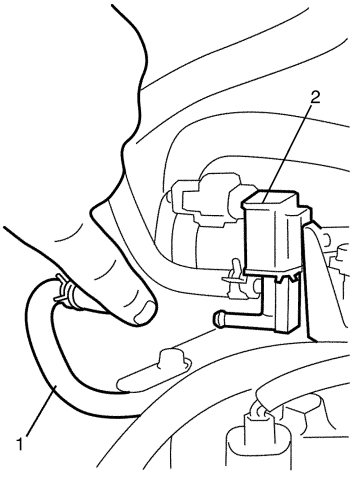


I3RB0A120005-01

Vacuum Passage Inspection

S4RS0B1206003

Start engine and run it at idle speed. Disconnect vacuum hose (1) from EVAP canister purge valve (2). With finger placed against disconnected hose, check that vacuum is applied.
If it is not applied, clean vacuum passage by blowing compressed air.

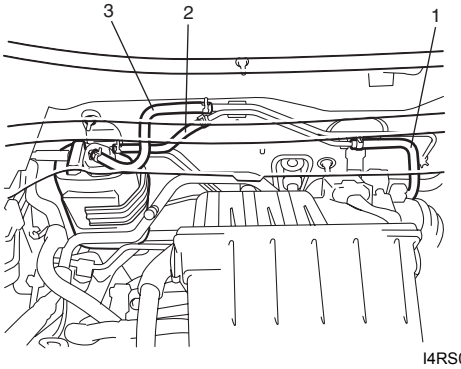


I3RM0A120006-01

Vacuum Hose and Purge Valve Chamber Inspection

S4RS0B1206004

Check hoses and purge valve chamber for connection, leakage, clog and deterioration.
Replace as necessary.



I4RS0B120004-02

1.	Purge hose (EVAP canister purge valve side)
2.	Purge hose (EVAP canister side)
3.	Tank pressure hose

EVAP Canister Purge Valve Inspection

S4RS0B1206005

⚠ WARNING

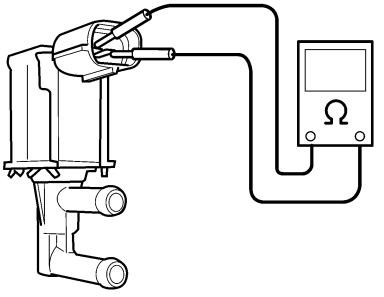
Do not apply vacuum by mouth; otherwise harmful fuel vapor can be breathed in.

⚠ CAUTION

Do not apply vacuum more than –86 kPa (–12.47 psi); otherwise EVAP canister purge valve could be damaged.

1) With ignition switch turned OFF, disconnect coupler and vacuum hoses from canister purge valve.
2) Remove EVAP canister purge valve from air cleaner assembly.
3) Check resistance between two terminals of EVAP canister purge valve.
   If resistance is not as specified, replace EVAP canister purge valve.

EVAP canister resistance
30 – 34 Ω at 20 °C (68 °F)



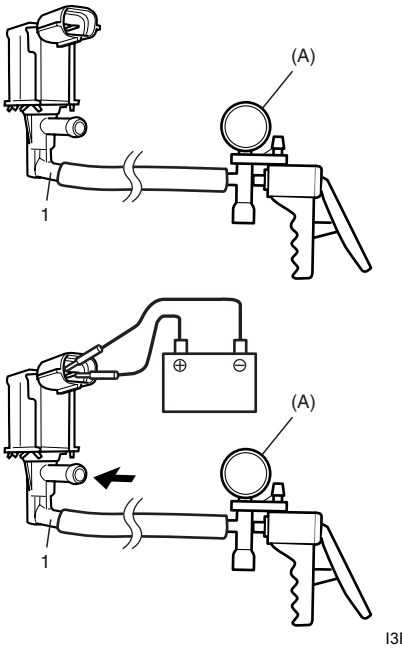
I3RM0A120008-01

4) With coupler disconnected, apply vacuum (–60 kPa (–8.7 psi)) to pipe (1). If vacuum can be applied, go to next step. If vacuum can not be applied, replace EVAP canister purge valve.
5) In this state, connect 12 V-battery to EVAP canister purge valve terminals. If vacuum can not be applied, EVAP canister purge valve is in good condition.
   If applied, replace EVAP canister purge valve.

⚠ WARNING

Do not suck the air through valve. Fuel vapor inside valve is harmful.

Special tool
(A): 09917–47011



I3RB0A120007-01

6) Install EVAP canister purge valve to air cleaner assembly.

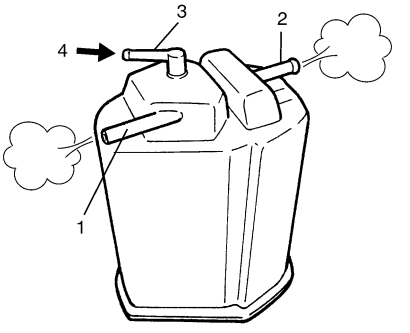
EVAP Canister Inspection

S4RS0B1206006

⚠ WARNING

DO NOT SUCK nozzles on EVAP canister. Fuel vapor inside EVAP canister is harmful.

1) Check outside of EVAP canister visually.
2) Disconnect vacuum hoses from EVAP canister.
3) Check that there is no restriction of flow through purge pipe (1) and air pipe (2) when air is blown (4) into tank pipe (3).
   If any faulty condition is found in this inspection, replace EVAP canister.



I4RS0B120005-01

EGR Valve Removal and Installation

S4RS0B1206007

Removal

1) Disconnect negative cable at battery.
2) Remove air intake pipe.
3) Remove EGR pipe.
4) Disconnect EGR valve connector.
5) Remove EGR valve and gasket from cylinder head.

Installation

Reverse removal procedure noting the following.

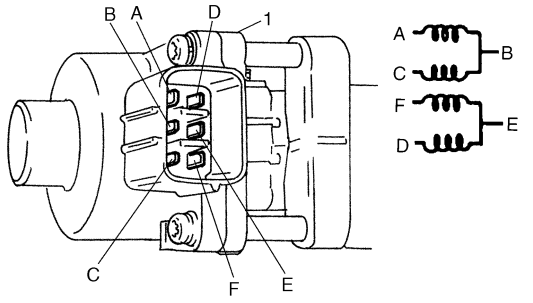
- Clean mating surface of valve and cylinder head.
- Use new gaskets.

EGR Valve Inspection

S4RS0B1206008

1) Check resistance between following terminals of EGR valve (1) in each pair.
   If found faulty, replace EGR valve assembly.

   EGR valve resistance (A – B, C – B, F – E, D – E terminal)
   20 – 24 Ω



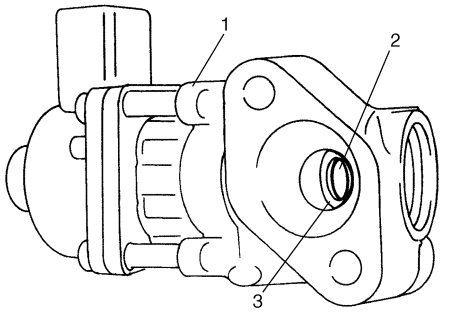
I2RH0B120005-01

2) Remove carbon from EGR valve gas passage.

⚠ CAUTION

Do not use any sharp-edged tool to remove carbon.
Be careful not to damage or bend EGR valve (1), valve seat (3) and rod.

3) Inspect valve (2), valve seat and rod for fault, cracks, bend or other damage.
   If found faulty, replace EGR valve assembly.



I2RH0B120006-01

PCV Hose Inspection

S4RS0B1206009

NOTE

Be sure to check that there is no obstruction in PCV valve or its hoses before checking IAC duty, for obstructed PCV valve or hose hampers its accurate adjustment.

Check hoses for connection, leakage, clog and deterioration.
Replace as necessary.

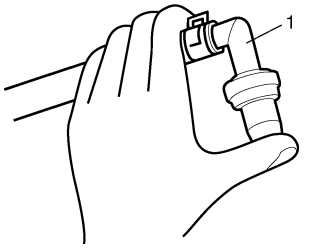
PCV Valve Inspection

S4RS0B1206010

NOTE

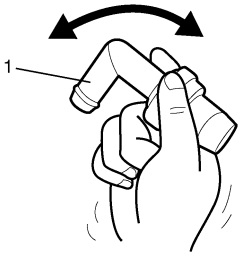
Be sure to check that there is no obstruction in PCV valve or its hoses before checking IAC duty, for obstructed PCV valve or hose hampers its accurate adjustment.

1) Detach air cleaner assembly.
2) Disconnect PCV valve from cylinder head cover and install plug to head cover hole.
3) Install air cleaner assembly temporarily.
4) Run engine at idle.
5) Place your finger over end of PCV valve (1) to check for vacuum.
   If there is no vacuum, check for clogged valve.
   Replace as necessary.



I2RH0B120007-01

6) After checking vacuum, stop engine and remove PCV valve (1).
   Shake valve and listen for rattle of check needle inside the valve. If valve does not rattle, replace PCV valve.



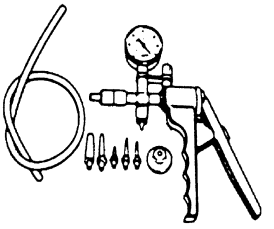
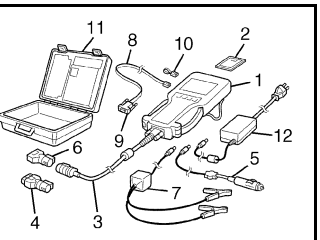
I2RH0B120008-01

7) After checking, remove plug and install PCV valve.
8) Install air cleaner assembly securely.

Special Tools and Equipment

Special Tool

S4RS0B1208001

09917–47011 Vacuum pump gauge ☞ / ☞		SUZUKI scan tool — This kit includes following items. 1. Tech 2, 2. PCMCIA card, 3. DLC cable, 4. SAE 16/19 adapter, 5. Cigarette cable, 6. DLC loopback adapter, 7. Battery power cable, 8. RS232 cable, 9. RS232 adapter, 10. RS232 loop back connector, 11. Storage case, 12. Power supply ☞	

Engine Electrical Devices

Repair Instructions

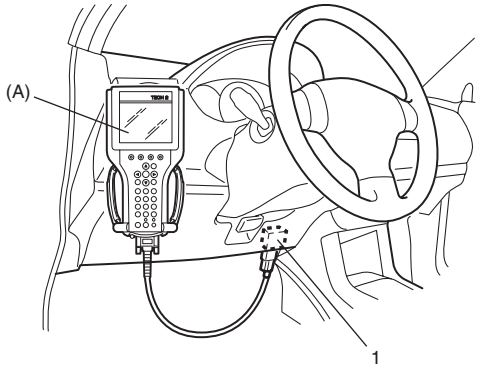
Idle Air Control (IAC) Valve Operation Inspection (For A/T and M/T Models)

S4RS0B1306001

Using SUZUKI scan tool

1) Connect SUZUKI scan tool to DLC (1) with ignition switch turned OFF.

Special tool
(A): SUZUKI scan tool



I4RS0B130001-02

2) Warm up engine to normal operating temperature.
3) Clear DTC and select “MISC TEST” mode on SUZUKI scan tool.
4) Check that idle speed increases and/or reduces when IAC valve is opened and/or when closed by SUZUKI scan tool.
If idle speed does not change, check IAC valve and wire harness.

Not Using SUZUKI Scan Tool

1) Warm up engine to normal operating temperature.
2) Stop engine.
3) Turn ignition switch to ON position.
4) Disconnect IAC valve connector.
5) Start engine.
6) Connect IAC valve connector.
7) Check that idle speed increases and/or reduces when connector is connected to IAC valve.
If idle speed does not change, check IAC valve and wire harness.

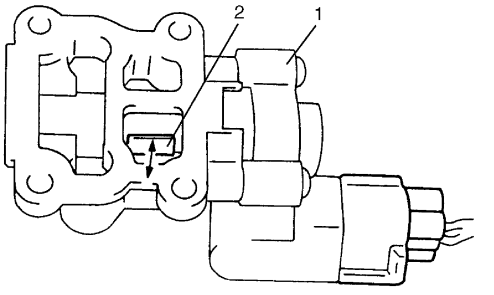
Idle Air Control (IAC) Valve On-Vehicle Inspection (For A/T and M/T Models)

S4RS0B1306002

1) Remove IAC valve referring to “Idle Air Control (IAC) Valve Removal and Installation (For A/T and M/T Models): ”.
2) Connect each connector to IAC valve (1) and TP sensor.
3) Check that rotary valve (2) of IAC valve opens and closes once and then stops in about 60 ms as soon as ignition switch is turned ON.

NOTE

- **This check should be performed by two people, one person turns on ignition switch while the other checks valve operation.**
- **As valve operation is momentary, it may be overlooked. To prevent this, perform this operation check 3 times or more continuously.**
If rotary valve of IAC valve does not operate at all, check wire harness for open and short. If wire harness is in good condition, replace IAC valve and recheck.



I2RH0B130002-01

4) Install IAC valve referring to “Idle Air Control (IAC) Valve Removal and Installation (For A/T and M/T Models): ”.

Idle Air Control (IAC) Valve Removal and Installation (For A/T and M/T Models)

S4RS0B1306003

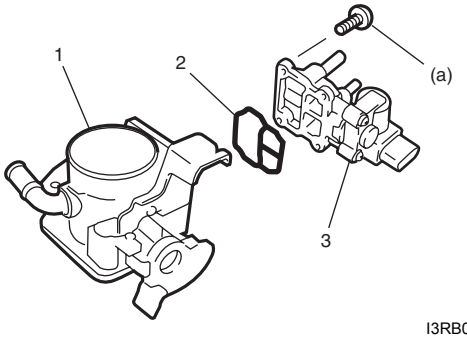
Removal

1) Remove throttle body referring to “Throttle Body Removal and Installation (For A/T and M/T Models): in Section 1D”.
2) Remove IAC valve from throttle body.

Installation

1) Install new gasket (2) to throttle body (1).
2) Install IAC valve (3) to throttle body.
Tighten IAC valve screws to specified torque.

Tightening torque
IAC valve screw (a): 3.5 N·m (0.35 kgf-m, 2.5 lb-ft)



I3RB0A130001-01

3) Install throttle body referring to “Throttle Body Removal and Installation (For A/T and M/T Models): in Section 1D”.

Engine Control Module (ECM) Removal and Installation

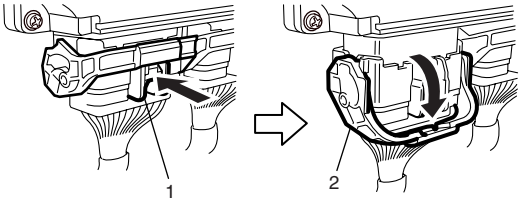
S4RS0B1306004

⚠ CAUTION

As ECM consists of precision parts, be careful not to expose it to excessive shock.

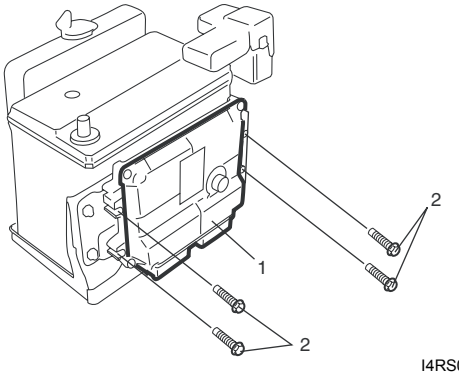
Removal

1) Disconnect negative cable at battery.
2) Disconnect connectors from ECM as follows.
   a) Push lock (1) to release locking of lock lever (2).
   b) Turn lock lever to arrow direction until it stops.



I4RS0A130003-01

3) Remove ECM (1) from its bracket by removing its mounting bolts (2).



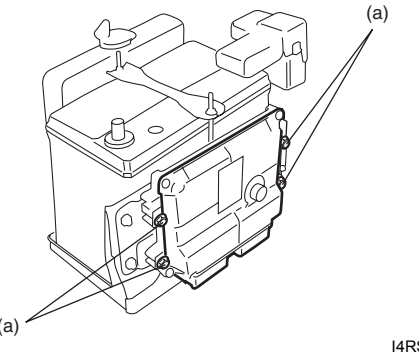
I4RS0B130002-01

Installation

Reverse removal procedure noting the following:

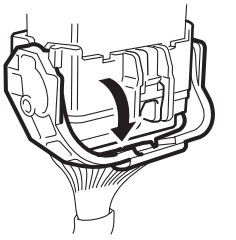
- Tighten ECM mounting bolts to specified torque.

  Tightening torque
  ECM mounting bolt (a): 8 N·m (0.8 kgf-m, 6.0 lb-ft)



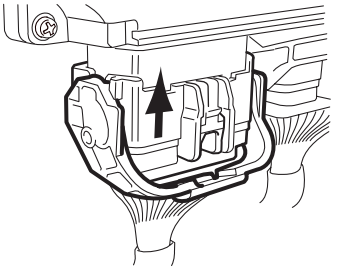
I4RS0B130003-01

- Connect connectors to ECM as follows.
  a. Make sure that lock lever of ECM connector is unlock position.



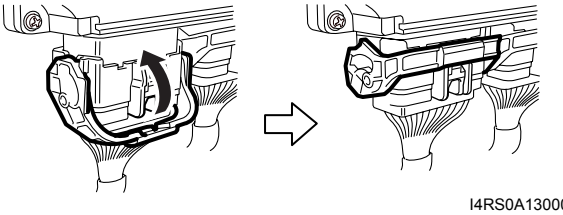
I4RS0B130021-01

  b. Insert ECM connectors to ECM until it stops with unlocked lock lever.



I4RS0B130022-01

  c. Lock ECM connectors securely by pulling its lock lever up.



I4RS0A130004-01

Manifold Absolute Pressure (MAP) Sensor Inspection

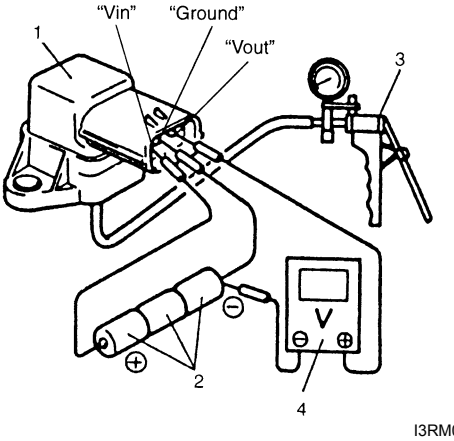
S4RS0B1306005

1) Remove air cleaner assembly.
2) Disconnect connector from MAP sensor.
3) Remove MAP sensor.
4) Arrange 3 new 1.5 V batteries (2) in series (check that total voltage is 4.5 – 5.0 V) and connect its positive terminal to “Vin” terminal of sensor and negative terminal to “Ground” terminal. Then check

voltage between “Vout” and “Ground”. Also, check if voltage reduces when vacuum is applied up to 400 mmHg by using vacuum pump (3).
If check result is not satisfactory, replace MAP sensor (1).

Output voltage (When input voltage is 4.5 – 5.5 V, ambient temp. 20 – 30 °C, 68 – 86 °F)

Altitude (Reference)		Barometric pressure		Output voltage
(ft)	(m)	(mmHg)	(kPa)	(V)
0 – 2000	0 – 610	760 – 707	100 – 94	3.3 – 4.3
2001 – 5000	611 – 1524	Under 707 over 634	94 – 85	3.0 – 4.1
5001 – 8000	1525 – 2438	Under 634 over 567	85 – 76	2.7 – 3.7
8001 – 10000	2439 – 3048	Under 567 over 526	76 – 70	2.5 – 3.3



I3RM0A130005-01

5) Install MAP sensor securely.
6) Connect MAP sensor connector securely.
7) Install air cleaner assembly.

Throttle Position (TP) Sensor On-Vehicle Inspection (For A/T and M/T Models)

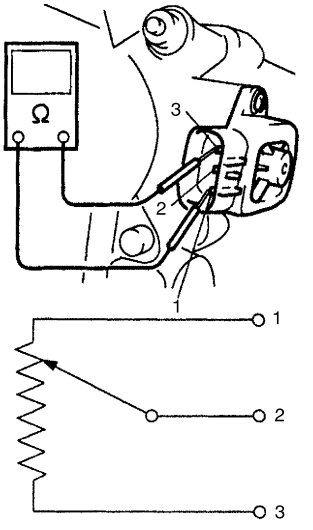
S4RS0B1306006

1) Disconnect negative cable at battery.
2) Disconnect TP sensor connector.
3) Using ohmmeter, check resistance between terminals under each condition.
If check result is not satisfactory, replace TP sensor.

TP sensor resistance
Between terminals “1” and “3”: 4.0 – 6.0 kΩ
Between terminals “2” and “3”: 20 Ω – 6.0 kΩ, varying according to throttle valve opening

NOTE

There should be more than 2 kΩ resistance difference between when throttle valve is at idle position and when it is fully open.



I3RB0A130003-01

1.	Reference voltage terminal
2.	Output voltage terminal
3.	Ground terminal

4) Connect TP sensor connector securely.
5) Connect negative cable to battery.

Throttle Position (TP) Sensor Removal and Installation (For A/T and M/T Models)

S4RS0B1306007

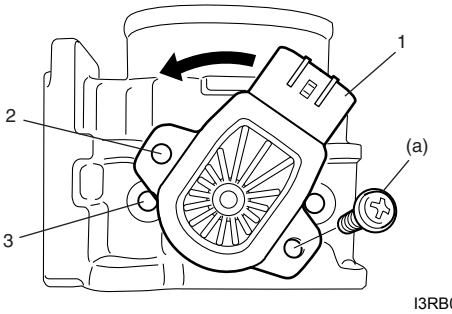
Removal

1) Disconnect negative cable at battery.
2) Disconnect TP sensor connector and remove TP sensor from throttle body.

Installation

1) Install TP sensor (1) to throttle body.
Fit TP sensor to throttle body in such way that its holes (3) are a little away from TP sensor screw holes (2) as shown in the figure and turn TP sensor counterclockwise so that those holes align.

Tightening torque
TP sensor screw (a): 2.5 N·m (0.25 kgf-m, 1.8 lb-ft)



I3RB0A130004-01

2) Connect connector to TP sensor securely.
3) Connect negative cable to battery.

Electric Throttle Body Assembly On-Vehicle Inspection (For Automated Manual Transaxle Model)

S4RS0B1306022

⚠ WARNING

Never touch throttle valve with finger while ignition switch is turned ON and accelerator pedal is depressed. Otherwise, injury may result by pinching the finger between throttle valve and throttle body housing.

⚠ CAUTION

- **Do not disassemble electric throttle body assembly.**
- **Do not expose electric throttle body assembly to excessive shock like a dropping it. If electric throttle body assembly has been exposed to excessive shock, it should be replaced.**
- **Be careful not to accrete a foreign material (like dust and/or metallic particle) to the throttle body housing and/or throttle valve. Otherwise, the throttle body assembly is breaking down by throttle valve accretion.**
- **Do not apply excessive moving force to throttle valve for throttle valve operation check and/or TP sensor performance check.**
  Otherwise, the throttle body assembly is breaking down by damaging the internal resinous gear of throttle valve actuator.

NOTE

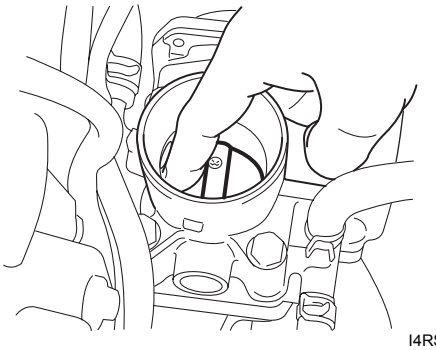
After replacing electric throttle body assembly, perform calibration of electric throttle body assembly referring to "Electric Throttle Body System Calibration (For Automated Manual Transaxle Model): ".

Throttle Valve Visual Check

1) Remove air cleaner outlet hose.
2) Check that there isn't any foreign matter caught between throttle valve and throttle body housing. If there is, take it out after removing throttle body referring to "Electric Throttle Body Assembly Removal and Installation (For Automated Manual Transaxle Model): in Section 1D" and clean inside of throttle body thoroughly.

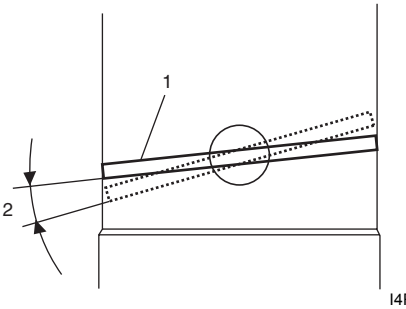
Throttle Valve Operation Check

1) Remove air cleaner outlet hose.
2) Turn OFF ignition switch.
3) Move throttle valve with finger to its full open position and check that it moves smoothly.
4) Move throttle valve with finger to its completely closed position and check that it moves smoothly.



I4RS0B130004-01

5) Take off finger from throttle valve (1) which is at full open position and check that it moves smoothly by its return spring and open spring force back to default position (position where throttle valve is open by 8° (2) from completely closed position).
6) Take off finger from throttle valve (1) which is at completely closed position and check that it moves smoothly by its return spring and open spring force back to default position.

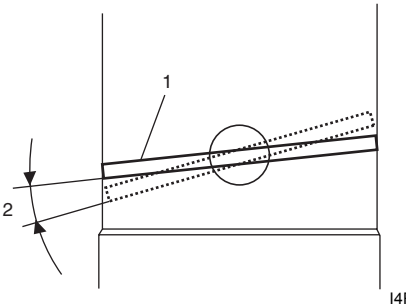


I4RS0B130005-01

If check result is not satisfactory, replace electric throttle body assembly.

Electric Throttle Body Assembly Operation Check

1) Remove air cleaner outlet hose.
2) Turn ON ignition switch.
3) Depress accelerator pedal gradually and check that throttle valve moves smoothly until it opens fully.
4) Release accelerator pedal depressed in Step 3) and check that throttle valve (1) moves back to default position (position where throttle valve is open by 8° (2) from its completely closed position).



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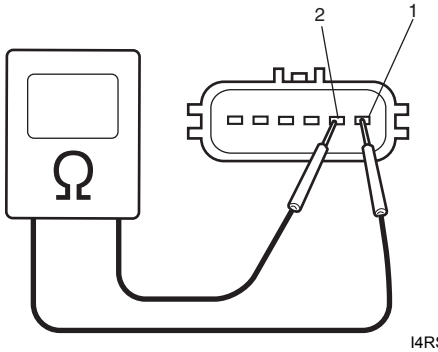
If check result is satisfactory, electric throttle body system is in good condition.If check result is not satisfactory, proceed to next step.

5) Perform “Accelerator Pedal Position (APP) Sensor Assembly On-Vehicle Inspection (For Automated Manual Transaxle Model)”, “Throttle Actuator (Motor) Check” and “Throttle Position Sensor Performance Check”.
   If check results are not satisfactory, replace electric throttle body assembly.
   If check results are satisfactory, wire circuit and/or ECM are faulty.

Throttle Actuator (Motor) Check

1) Turn OFF ignition switch.
2) Disconnect connector from electric throttle body assembly.
3) Measure resistance between “M1” terminal (1) and “M2” terminal (2) of electric throttle body assembly.
   If measured resistance is out of specified value, replace electric throttle body assembly.

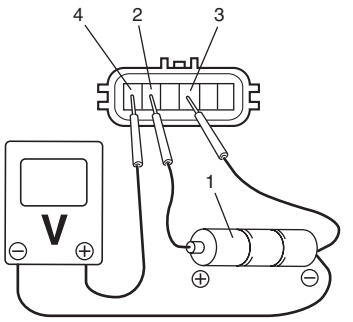
   Throttle actuator (motor) resistance
   0.3 – 100 Ω at 20 °C, 68 °F



I4RS0B130023-01

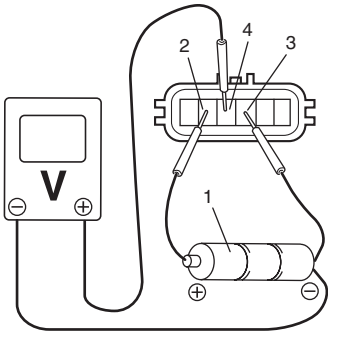
Throttle Position Sensor Performance Check

1) Remove air cleaner outlet hose.
2) Turn OFF ignition switch.
3) Disconnect connector from electric throttle body assembly.
4) Check throttle position sensor (main and sub) output voltage as following steps.
   a) For throttle position sensor (main), arrange 3 new 1.5 V batteries (1) in series (check that total voltage is 4.5 – 5.0 V) and connect its positive terminal to “Vin” terminal (2) and negative terminal to “Ground” terminal (3) of sensor. Then using voltmeter, connect positive terminal to “Vout 1” terminal (4) of sensor and negative terminal to battery.



I4RS0B130007-02

   b) For throttle position sensor (sub), arrange 3 new 1.5 V batteries (1) in series (check that total voltage is 4.5 – 5.0 V) and connect its positive terminal to “Vin” terminal (2) and negative terminal to “Ground” terminal (3) of sensor. Then using voltmeter, connect positive terminal to “Vout 2” terminal (4) of sensor and negative terminal to battery.

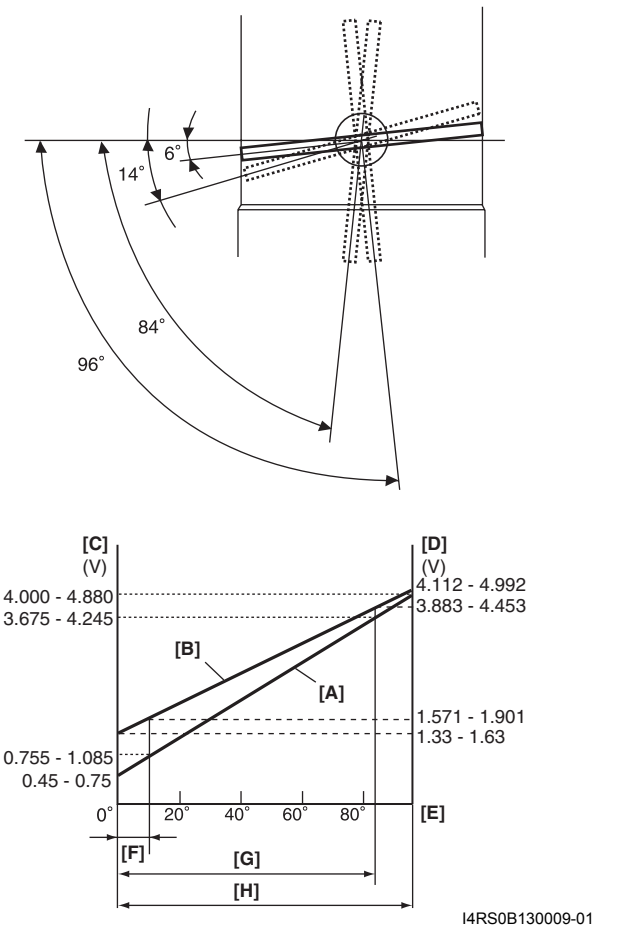


I4RS0B130008-01

   c) Measure output voltage variation while throttle valve is opened and closed as following specification.

If sensor voltage is out of specified value and linear variation as the following graph, replace electric throttle body assembly.

Throttle position sensor output voltage
Throttle position sensor (main) [A]: 0.45 – 4.88 V, varying according to throttle valve opening by finger (Voltage should vary by 0.04 V for each 1° valve opening)
Throttle position sensor (sub) [B]: 1.33 – 4.992 V, varying according to throttle valve opening by finger (Voltage should vary by about 0.032 V for each 1° valve opening)



I4RS0B130009-01

[C]:	Throttle position sensor (main) output voltage
[D]:	Throttle position sensor (sub) output voltage
[E]:	Throttle valve opening
[F]:	Position where throttle valve is open by 8° from completely closed position (default position)
[G]:	Angle obtained when accelerator pedal is depressed fully (84°)
[H]:	Angle obtained when throttle valve is fully opened with finger (96°)

Electric Throttle Body System Calibration (For Automated Manual Transaxle Model)

S4RS0B1306023

NOTE

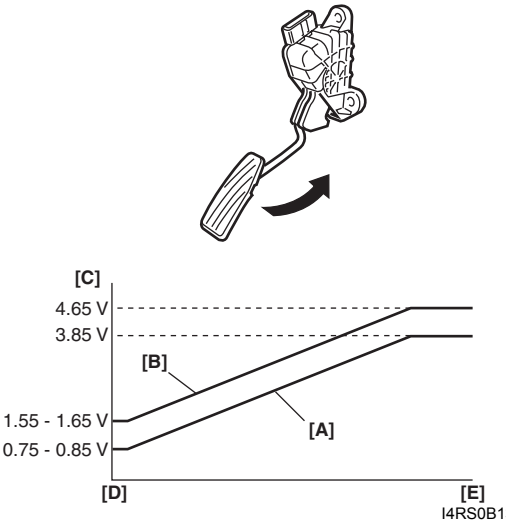
If working the service described under the "Precautions of Electric Throttle Body System Calibration (For Automated Manual Transaxle Model): in Section 1A", perform following steps for electric throttle body system calibration.

1) If electric throttle body assembly and/or accelerator pedal position (APP) sensor assembly are replaced, perform following steps.
   a) Disconnect negative cable at battery for 20 seconds or more for the purpose of clearing calibration data of closed throttle position from memory in ECM.
   b) Connect negative cable to battery.
2) Keep ignition switch at ON position for 5 seconds or more without running engine.

Accelerator Pedal Position (APP) Sensor Assembly On-Vehicle Inspection (For Automated Manual Transaxle Model)

S4RS0B1306024

1) Check that accelerator pedal position (APP) sensor assembly has been mounted to vehicle body properly (no pinched floor carpet, etc).
   If mounting is not properly, reinstall accelerator pedal position (APP) sensor assembly properly referring to "Accelerator Pedal Position (APP) Sensor Assembly Removal and Installation (For Automated Manual Transaxle Model): ".
2) Connect scan tool to DLC with ignition switch turned OFF.
3) Turn ON ignition switch and select "Data List" mode on scan tool.
4) Check that accelerator pedal position sensor voltage varies as the following graph.
   If sensor voltage is out of specified value or does not vary linearly as the following graph, check accelerator pedal position (APP) sensor assembly referring to "Accelerator Pedal Position (APP) Sensor Assembly Inspection (For Automated Manual Transaxle Model): ".



I4RS0B130010-02

[A]:	Accelerator pedal position (APP) sensor (main) voltage
[B]:	Accelerator pedal position (APP) sensor (sub) voltage
[C]:	Voltage
[D]:	Idle position of accelerator pedal
[E]:	Full depressed position of accelerator pedal

Accelerator Pedal Position (APP) Sensor Assembly Removal and Installation (For Automated Manual Transaxle Model)

S4RS0B1306027

⚠ CAUTION

- **Do not expose accelerator pedal position (APP) sensor assembly to excessive shock like a dropping it. If accelerator pedal position (APP) sensor assembly has been exposed to excessive shock, it should be replaced.**
- **Be careful not to expose sensor section of accelerator pedal position (APP) sensor assembly to water.**

NOTE

After replacing accelerator pedal position (APP) sensor assembly, perform calibration of throttle valve referring to "Electric Throttle Body System Calibration (For Automated Manual Transaxle Model): ".

Removal

1) Disconnect negative cable at battery.
2) Disconnect connector from accelerator pedal position (APP) sensor assembly.
3) Remove accelerator pedal position (APP) sensor assembly from its bracket.

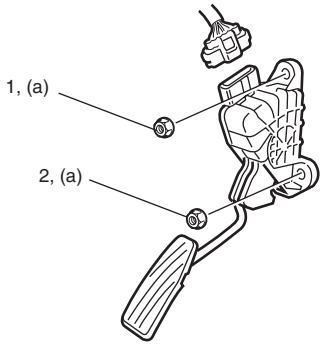
Installation

Reverse removal procedure for installation noting the following.

- Tighten accelerator pedal position (APP) sensor assembly upper nut (1) first and then lower nut (2) to specified torque.

Tightening torque

Accelerator pedal position (APP) sensor assembly nut (a): 5.5 N·m (0.55 kgf-m, 4.0 lb-ft)



I4RS0B130011-01

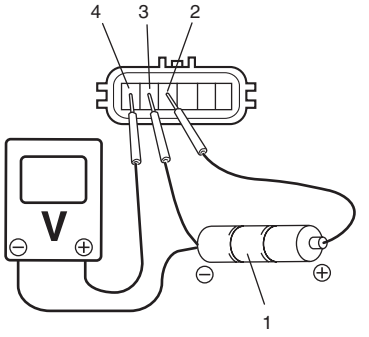
- **Connect connector to accelerator pedal position (APP) sensor assembly securely.**

Accelerator Pedal Position (APP) Sensor Assembly Inspection (For Automated Manual Transaxle Model)

S4RS0B1306026

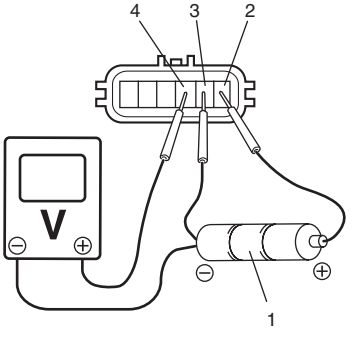
Check accelerator pedal position (APP) sensor (main and sub) output voltage as following steps.

1) For accelerator pedal position (APP) sensor (main), arrange 3 new 1.5 V batteries (1) in series (check that total voltage is 4.5 – 5.0 V) and connect its positive terminal to "Vin 1" terminal (2) and negative terminal to "Ground 1" terminal (3) of sensor. Then using voltmeter, connect positive terminal to "Vout 1" terminal (4) of sensor and negative terminal to battery.



I4RS0B130012-01

2) For accelerator pedal position (APP) sensor (sub), arrange 3 new 1.5 V batteries (1) in series (check that total voltage is 4.5 – 5.0 V) and connect its positive terminal to "Vin 2" terminal (2) and negative terminal to "Ground 2" terminal (3) of sensor. Then using voltmeter, connect positive terminal to "Vout 2" terminal (4) of sensor and negative terminal to battery.



I4RS0B130013-01

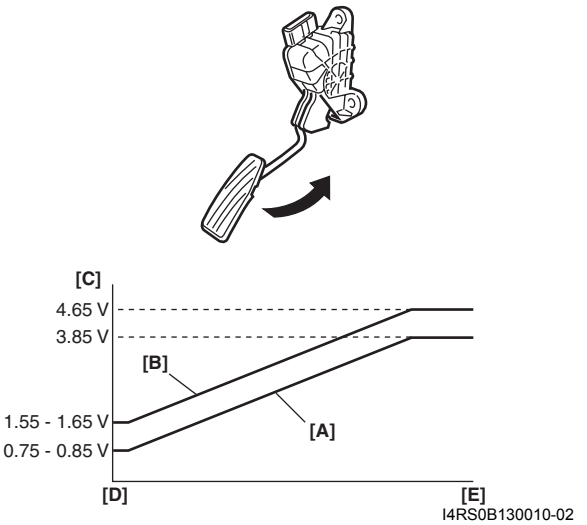
3) Measure output voltage variation while accelerator pedal is no depressed and fully depressed as following specification.

If sensor voltage is out of specified value or does not vary linearly as the following graph, replace accelerator pedal position (APP) sensor assembly.

Accelerator pedal position (APP) sensor output voltage

Accelerator pedal position (APP) sensor (main) output voltage [A]: 0.75 – 3.85 V, varying according to depressed extent of accelerator pedal

Accelerator pedal position (APP) sensor (sub) output voltage [B]: 1.55 – 4.65 V, varying according to depressed extent of accelerator pedal



I4RS0B130010-02

[C]:	Voltage
[D]:	Idle position of accelerator pedal
[E]:	Fully depressed position of accelerator pedal

Engine Coolant Temperature (ECT) Sensor Removal and Installation

S4RS0B1306008

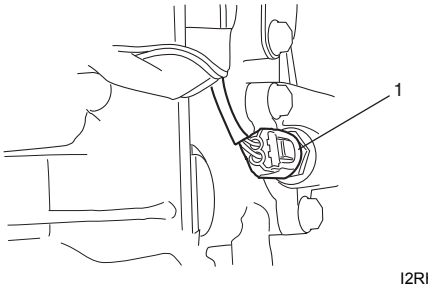
Removal

1) Disconnect negative cable at battery.
2) Drain coolant referring to “Cooling System Draining: in Section 1F”.

⚠ WARNING

To avoid danger of being burned, do not remove radiator cap while engine and radiator are still hot.
Scalding fluid and steam can be blown out under pressure if cap is taken off too soon.

3) Remove air intake pipe.
4) Disconnect connector from ECT sensor (1).



I2RH0B130008-01

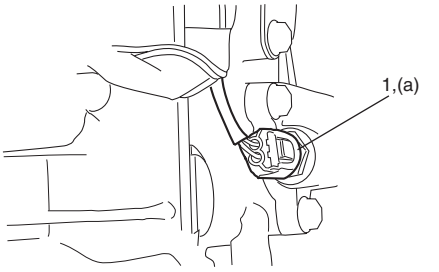
5) Remove ECT sensor from thermostat case.

Installation

Reverse removal procedure noting the following.

- Clean mating surfaces of ECT sensor and thermostat case.
- Check O-ring for damage and replace, if necessary.
- Tighten ECT sensor (1) to specified torque.

Tightening torque
ECT sensor (a): 15 N·m (1.5 kgf-m, 11.0 lb-ft)



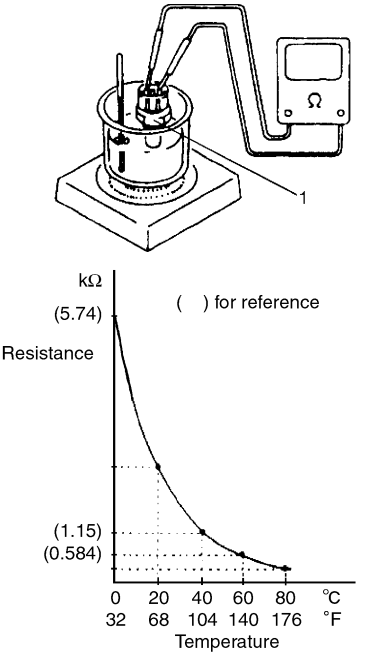
I2RH0B130009-01

- Connect connector to ECT sensor securely.
- Refill coolant referring to “Cooling System Flush and Refill: in Section 1F”.

Engine Coolant Temperature (ECT) Sensor Inspection

S4RS0B1306009

Immerse temperature sensing part of ECT sensor (1) in water (or ice) and measure resistance between sensor terminals while heating water gradually.
If measured resistance doesn’t show such characteristic as shown, replace ECT sensor.



I3RB0A130005-01

Heated Oxygen Sensor (HO2S-1 and HO2S-2) Heater On-Vehicle Inspection

S4RS0B1306010

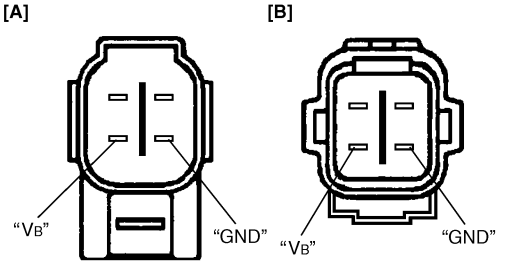
1) Disconnect sensor connector.
2) Using ohmmeter, measure resistance between terminals "V_B" and "GND" of sensor connector. If found faulty, replace oxygen sensor.

NOTE

Temperature of sensor affects resistance value largely. Make sure that sensor heater is at correct temperature.

Resistance of oxygen sensor heater
HO2S-1: 5.0 – 6.4 Ω at 20 °C (68 °F)
HO2S-2: 11.7 – 14.5 Ω at 20 °C (68 °F)

Viewed from terminal side



I4RS0A130006-01

[A]: HO2S-1
[B]: HO2S-2

3) Connect sensor connector securely.

Heated Oxygen Sensor (HO2S-1 and HO2S-2) Removal and Installation

S4RS0B1306011

Removal

⚠ WARNING

To avoid danger of being burned, do not touch exhaust system when system is hot. Oxygen sensor removal should be performed when system is cool.

1) Disconnect negative cable at battery.
2) Disconnect connector of heated oxygen sensor and release its wire harness from clamps.
3) Perform following items before removing heated oxygen sensor.
   a) For HO2S-1, remove exhaust manifold referring to "Exhaust Manifold Removal and Installation: in Section 1K", if necessary.
   b) For HO2S-2, hoist vehicle.
4) Remove heated oxygen sensor (1) from exhaust pipe or exhaust manifold.

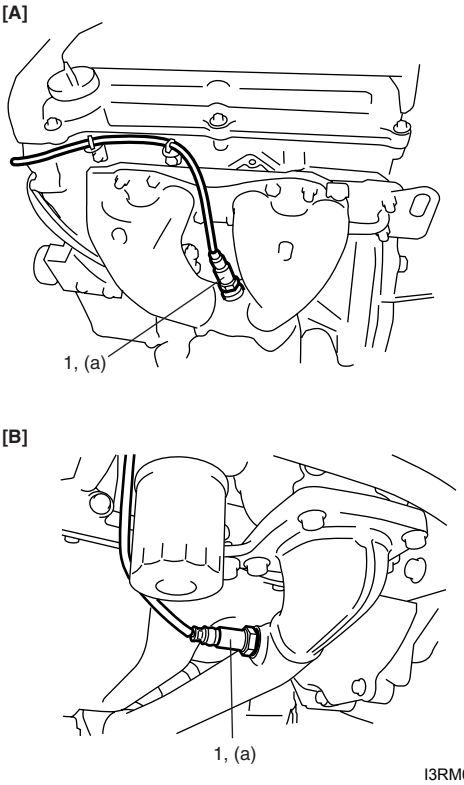
Installation

Reverse removal procedure noting the following.

- Tighten heated oxygen sensor (1) to specified torque.

  Tightening torque
  Heated oxygen sensor (a): 45 N·m (4.5 kgf-m, 32.5 lb-ft)

- Install exhaust manifold referring to "Exhaust Manifold Removal and Installation: in Section 1K", if removed.
- Connect connector of heated oxygen sensor (1) and clamp wire harness securely.
- After installing heated oxygen sensor, start engine and check that no exhaust gas leakage exists.



I3RM0A130007-01

[A]: HO2S-1
[B]: HO2S-2

Camshaft Position (CMP) Sensor Removal and Installation

S4RS0B1306013

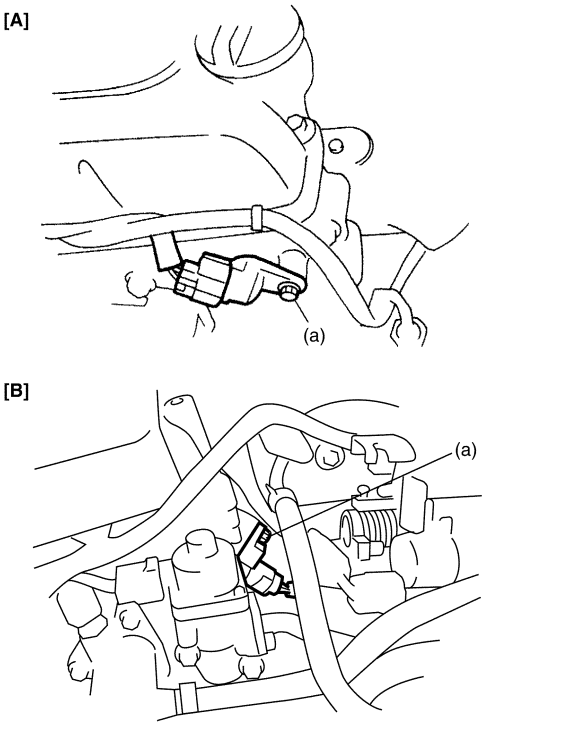
Removal

1) Disconnect negative cable at battery.
2) Disconnect connector from CMP sensor.
3) Remove camshaft position sensor from timing chain cover (for engine without VVT system) or cylinder head (for engine with VVT system).

Installation

1) Install camshaft position sensor to timing chain cover (for engine without VVT system) or cylinder head (for engine with VVT system).

   Tightening torque
   CMP sensor bolt (a): 10 N·m (1.0 kgf-m, 7.5 lb-ft)



I4RS0B130014-01

[A]:	For engine without VVT system
[B]:	For engine with VVT system

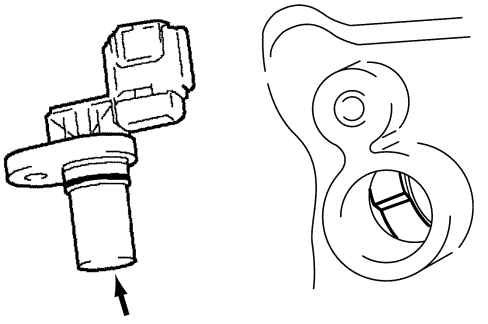
2) Connect connector to CMP sensor securely.
3) Connect negative cable to battery.

Camshaft Position (CMP) Sensor Inspection

S4RS0B1306012

Visual check

- Check that O-ring is free from damage.
- Check that end face of sensor and signal rotor tooth are free from any metal particles and damage.



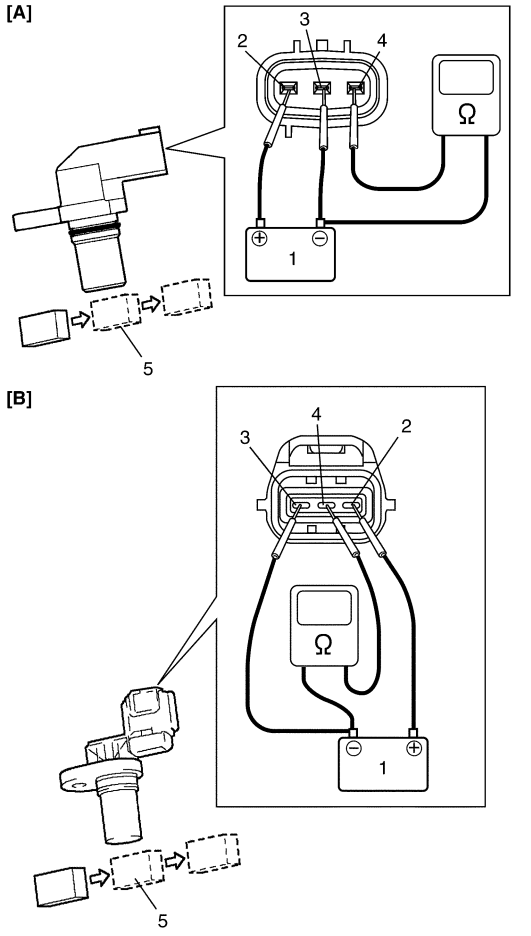
I4RS0B130015-01

Performance check

1) Remove metal particles on end face of CMP sensor, if any.
2) Arrange 12 V battery (1) and connect its positive terminal to “Vin” terminal (2) and negative terminal to “Ground” terminal (3) of sensor. Then using ohmmeter, measure resistance between “Vout” terminal (4) of sensor and negative terminal of battery by passing magnetic substance (iron) (5) while keeping approximately 1 mm (0.03 in.) gap with respect to end face of CMP sensor.
If resistance does not vary as specified below, replace CMP sensor.

CMP sensor resistance

Resistance varies from less than 220 Ω (ON) to infinity (OFF) or from infinity (OFF) to less than 220 Ω (ON)



I4RS0B130016-02

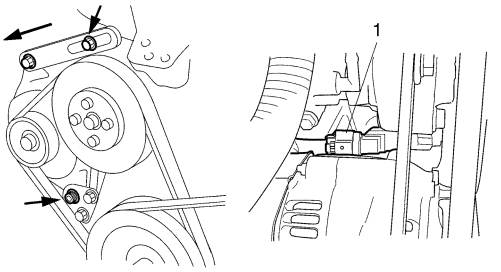
[A]:	For engine without VVT system
[B]:	For engine with VVT system

Crankshaft Position (CKP) Sensor Removal and Installation

S4RS0B1306015

Removal

1) Disconnect negative cable at battery.
2) Remove generator drive belt, loosen pivot bolt and move generator rearward.
3) Disconnect connector from crankshaft position sensor.
4) Remove crankshaft position sensor (1) from cylinder block.

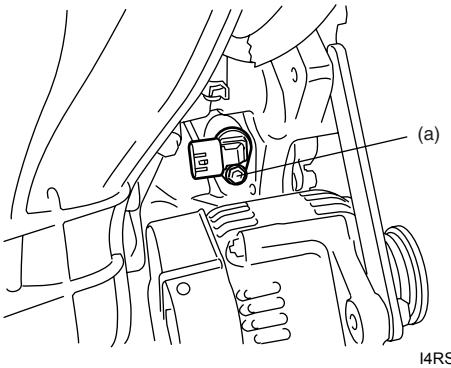


I2RH0B130012-01

Installation

1) Install crankshaft position sensor to cylinder block. Tighten CKP sensor bolt to specified torque.

Tightening torque
CKP sensor bolt (a): 10 N·m (1.0 kgf-m, 7.5 lb-ft)



I4RS0A130007-01

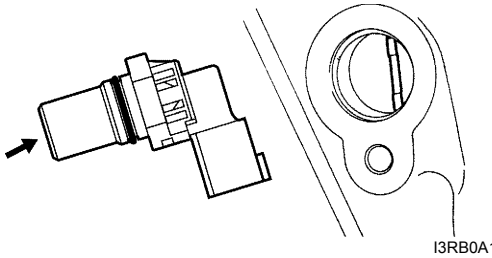
2) Connect connector to CKP sensor securely.
3) Adjust generator drive belt tension referring to "Water Pump / Generator Drive Belt Tension Inspection and Adjustment: in Section 1F".
4) Connect negative cable to battery.

Crankshaft Position (CKP) Sensor Inspection

S4RS0B1306014

Visual check

- Check that O-ring is free from damage.
- Check that end face of sensor and signal pulley tooth are free from any metal particles and damage.

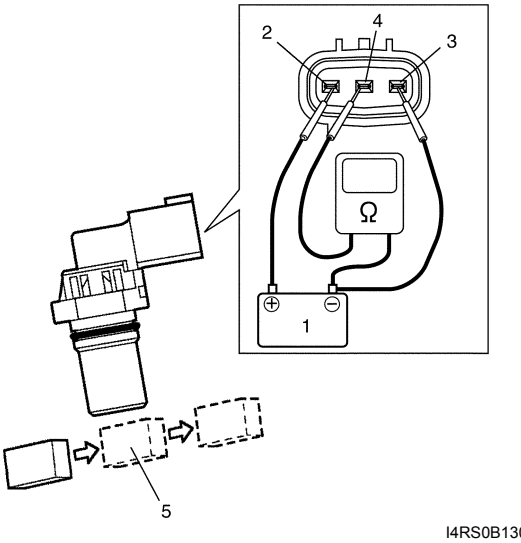


I3RB0A130006-01

Performance check

1) Remove metal particles on end face of CKP sensor, if any.
2) Arrange 12 V battery (1) and connect its positive terminal to "Vin" terminal (2) and negative terminal to "Ground" terminal (3) of sensor. Then using ohmmeter, measure resistance between "Vout" terminal (4) of sensor and negative terminal of battery by passing magnetic substance (iron) (5) while keeping approximately 1 mm (0.03 in.) gap with respect to end face of CKP sensor.
If resistance does not vary as specified below, replace CKP sensor.

CKP sensor resistance
Resistance varies from less than 220 Ω (ON) to infinity (OFF) or from infinity (OFF) to less than 220 Ω (ON)



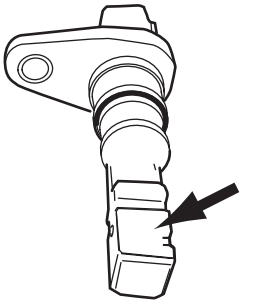
I4RS0B130017-01

Vehicle Speed Sensor (VSS) Inspection (M/T and Automated Manual Transaxle model)

S4RS0B1306016

Visual check

- Check that O-ring is free from damage
- Check that end face of sensor and signal rotor tooth are free from any metal particles and damage.



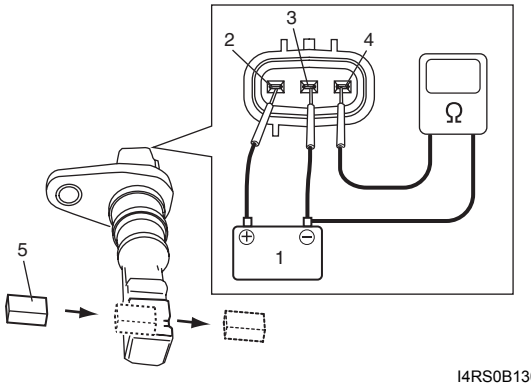
I4RS0B130018-02

Performance check

1) Remove metal particles on end face of VSS, if any.
2) Arrange 12 V battery (1) and connect its positive terminal to "Vin" terminal (2) and negative terminal to "Ground" terminal (3) of sensor. Then using ohmmeter, measure resistance between "Vout" terminal (4) of sensor and negative terminal of

battery by passing magnetic substance (iron) (5) while keeping approximately 1 mm (0.03 in.) gap with respect to end face of VSS.
If resistance does not vary as specified below, replace VSS.

VSS resistance
Resistance varies from less than 100 Ω (ON) to infinity (OFF) or from infinity (OFF) to less than 100 Ω (ON)



I4RS0B130019-01

Knock Sensor Removal and Installation

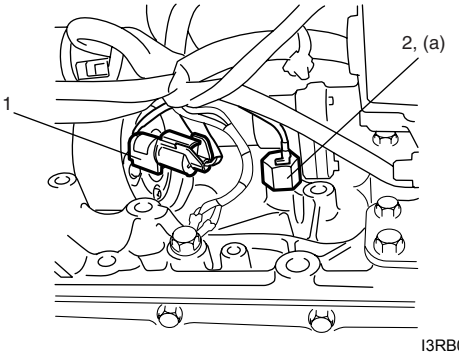
S4RS0B1306017

Removal

1) Disconnect negative cable at battery.
2) Hoist vehicle.
3) Remove right side drive shaft referring to “Front Drive Shaft Assembly Removal and Installation: in Section 3A”
4) Disconnect knock sensor connector (1).
5) Remove knock sensor (2) from cylinder block.

Installation
Reverse removal procedure for installation.

Tightening torque
Knock sensor (a): 22 N·m (2.2 kgf-m, 16.0 lb-ft)

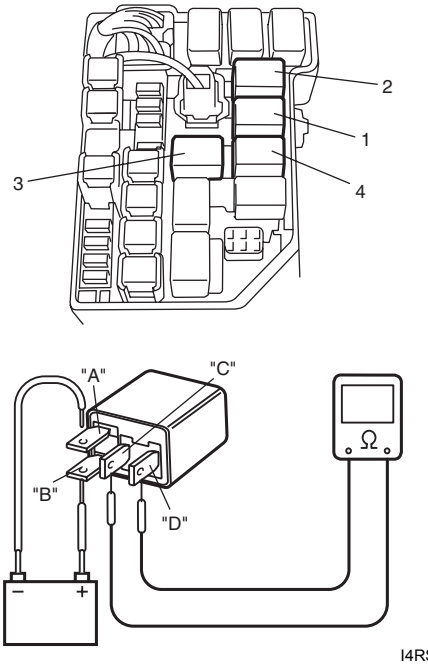


I3RB0A130007-01

Main Relay, Fuel Pump Relay, Starting Motor Control Relay and Throttle Actuator Control Relay Inspection

S4RS0B1306018

1) Disconnect negative cable at battery.
2) Remove main relay (1), fuel pump relay (3), starting motor control relay (2) and/or throttle actuator control relay (4) from individual circuit fuse box No.1.
3) Check that there is no continuity between terminal “C” and “D”. If there is continuity, replace relay.
4) Connect battery positive (+) terminal to terminal “B” of relay. Connect battery negative (–) terminal to terminal “A” of relay. Check for continuity between terminal “C” and “D”. If there is no continuity when relay is connected to the battery, replace relay.



I4RS0B130020-01

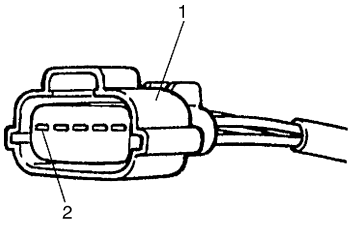
Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor On-Vehicle Inspection

S4RS0B1306019

NOTE

Before performed this inspection, be sure to read the “Precautions of ECM Circuit Inspection: in Section 1A”.

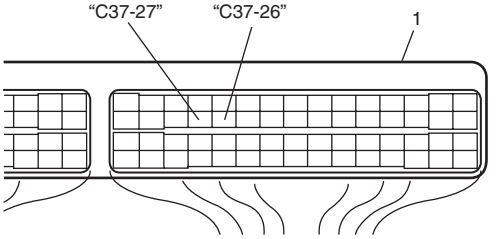
1) Disconnect negative cable at battery.
2) Disconnect MAF and IAT sensor connector.
3) Connect voltmeter to “BLK/RED” wire terminal (2) of MAF and IAT sensor connector (1) disconnected and ground.



I3RB0A130009-01

4) Turn ON ignition switch position and check that voltage is battery voltage.
   If not, check if wire harness is open or connection is poor.
5) Turn OFF ignition switch position and connect connector to MAF and IAT sensor.
6) Remove ECM from its bracket referring to “Engine Control Module (ECM) Removal and Installation: ”
7) Connect special tool between ECM and ECM connector referring to “Inspection of ECM and Its Circuits: in Section 1A”
8) Turn ON ignition switch position and check MAF signal voltage between “C37-26” terminal circuit and “C37-27” terminal circuit of special tool.

   MAF signal voltage between “C37-26” terminal circuit and “C37-27” terminal circuit of special tool
   MAF signal voltage of MAF and IAT sensor with ignition switch turned ON: 0.5 – 1.0 V



I4RS0A130009-01

1. ECM

9) Start engine and check that voltage is lower than 5 V and it rises as engine speed increases.

   MAF signal voltage between “C37-26” terminal circuit and “C37-27” terminal circuit of special tool
   MAF signal reference voltage of MAF and IAT sensor at specified Idle speed: 1.3 – 1.8 V

10) If check result is not as specified above, cause may lie in wire harness, connector connection, MAF and IAT sensor or ECM.

Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor Removal and Installation

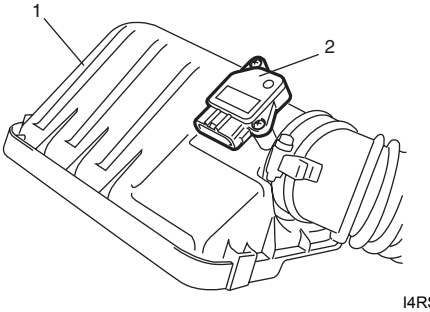
S4RS0B1306020

⚠ CAUTION

- **Do not disassemble MAF and IAT sensor.**
- **Do not expose MAF and IAT sensor to any shock.**
- **Do not clean MAF and IAT sensor.**
- **If MAF and IAT sensor has been dropped, it should be replaced.**
- **Do not blow compressed air by using air gun or the like.**
- **Do not put finger or any other object into MAF and IAT sensor. Malfunction may occur.**

Removal

1) Disconnect negative cable at battery.
2) Disconnect MAF and IAT sensor connector.
3) Remove air cleaner case (1).
4) Remove MAF and IAT sensor (2) from air cleaner case.



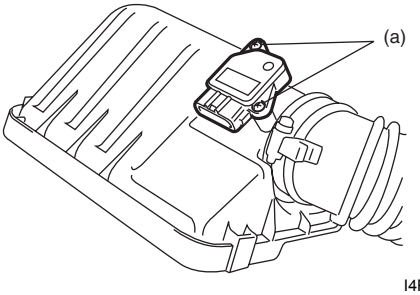
I4RS0A130010-01

Installation

Reverse removal procedure noting the followings.

- Tighten MAF and IAT sensor screws to specified torque.

  Tightening torque
  MAF and IAT sensor screw (a): 1.5 N·m (0.15 kgf-m, 1.1 lb-ft)



I4RS0A130011-01

- Connect MAF and IAT sensor connector securely.

Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor Inspection

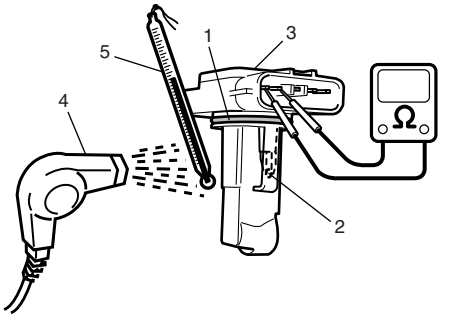
S4RS0B1306021

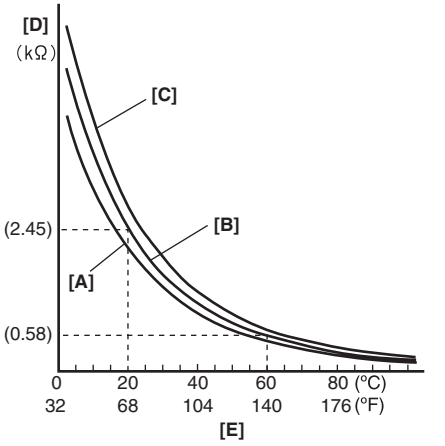
⚠ CAUTION

Do not heat up MAF and IAT sensor more than 100 °C (212 °F). Otherwise, MAF and IAT sensor will be damaged.

- Check sensor O-ring (1) for damage and deterioration. Replace as necessary.
- Blow hot air to temperature sensing part (2) of MAF and IAT sensor (3) using hot air drier (4) and measure resistance between sensor terminals while heating air gradually.
  If measured resistance does not show such characteristic as shown, replace MAF and IAT sensor.

Intake air temperature sensor resistance
–20 °C (–4 °F): 13.6 – 18.4 kΩ
20 °C (68 °F): 2.21 – 2.69 kΩ
60 °C (140 °F): 0.493 – 0.667 kΩ





I4RS0A130012-01

[A]:	Lower limit
[B]:	Nominal
[C]:	Upper limit
[D]:	Resistance
[E]:	Temperature
5.	Temperature gauge

Specifications

Tightening Torque Specifications

S4RS0B1307001

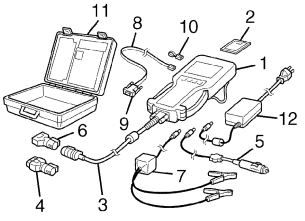
Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
IAC valve screw	3.5	0.35	2.5	☞
ECM mounting bolt	8	0.8	6.0	☞
TP sensor screw	2.5	0.25	1.8	☞
ECT sensor	15	1.5	11.0	☞
Heated oxygen sensor	45	4.5	32.5	☞
CMP sensor bolt	10	1.0	7.5	☞
CKP sensor bolt	10	1.0	7.5	☞
Knock sensor	22	2.2	16.0	☞
MAF and IAT sensor screw	1.5	0.15	1.1	☞

Reference:
For the tightening torque of fastener not specified in this section, refer to “Fasteners Information: in Section 0A”.

Special Tools and Equipment

Special Tool

S4RS0B1308001

SUZUKI scan tool — This kit includes following items. 1. Tech 2, 2. PCMCIA card, 3. DLC cable, 4. SAE 16/19 adapter, 5. Cigarette cable, 6. DLC loopback adapter, 7. Battery power cable, 8. RS232 cable, 9. RS232 adapter, 10. RS232 loop back connector, 11. Storage case, 12. Power supply ☞		

Engine Mechanical

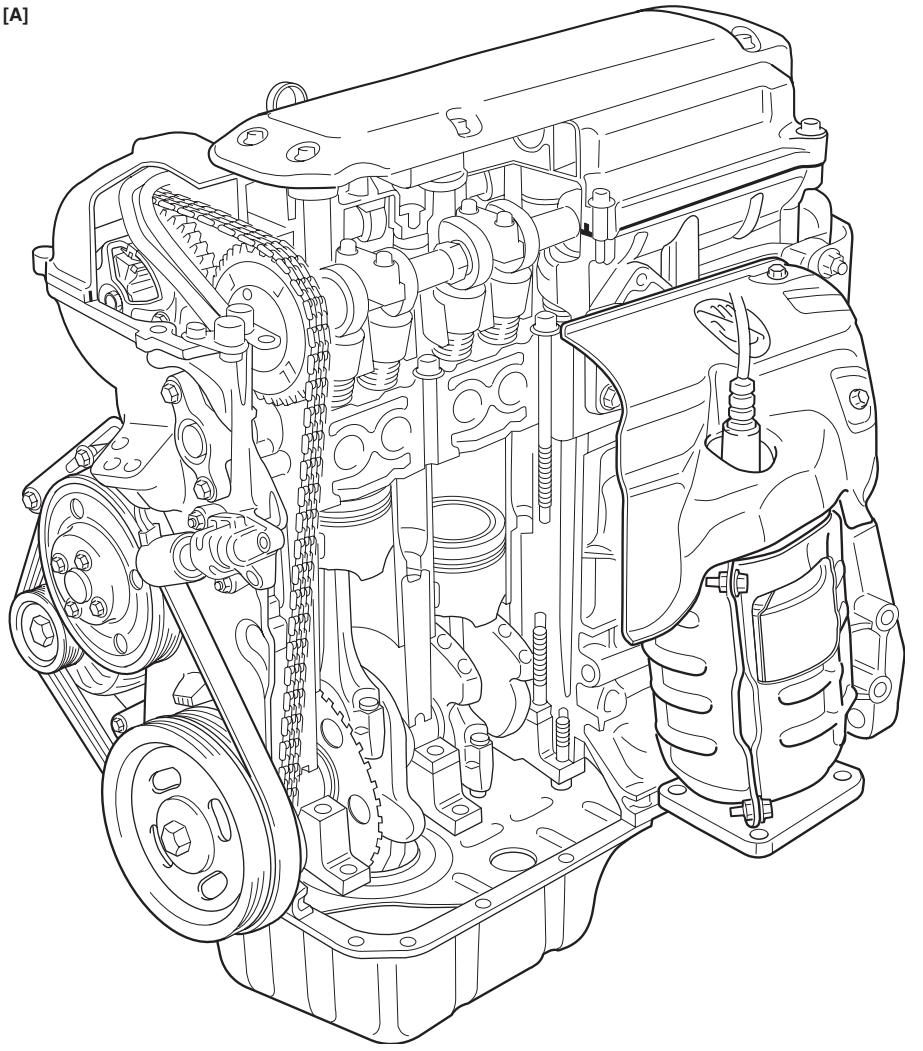
General Description

Engine Construction Description

S4RS0B1401001

The engine is water-cooled, in line 4 cylinders, 4 stroke cycle gasoline unit with its DOHC (Double overhead camshaft) valve mechanism arranged for “V” type valve configuration and 16 valves (4 valves/one cylinder). The double overhead camshaft is mounted over the cylinder head; it is driven from crankshaft through timing chain, and no push rods are provided in the valve train system.

[A]



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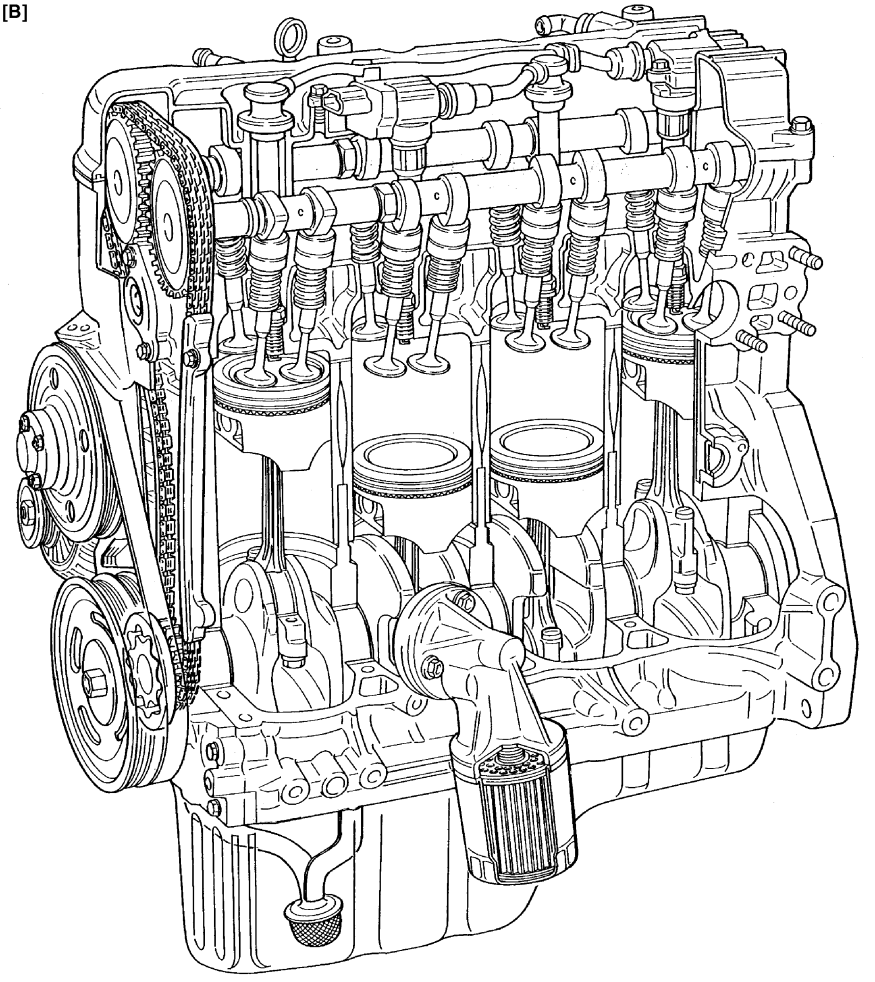
[B]



I4RS0B140002-01

[A]: For engine with VVT system
[B]: For engine without VVT system

Camshaft Position Control (VVT Variable Valve Timing) System Description

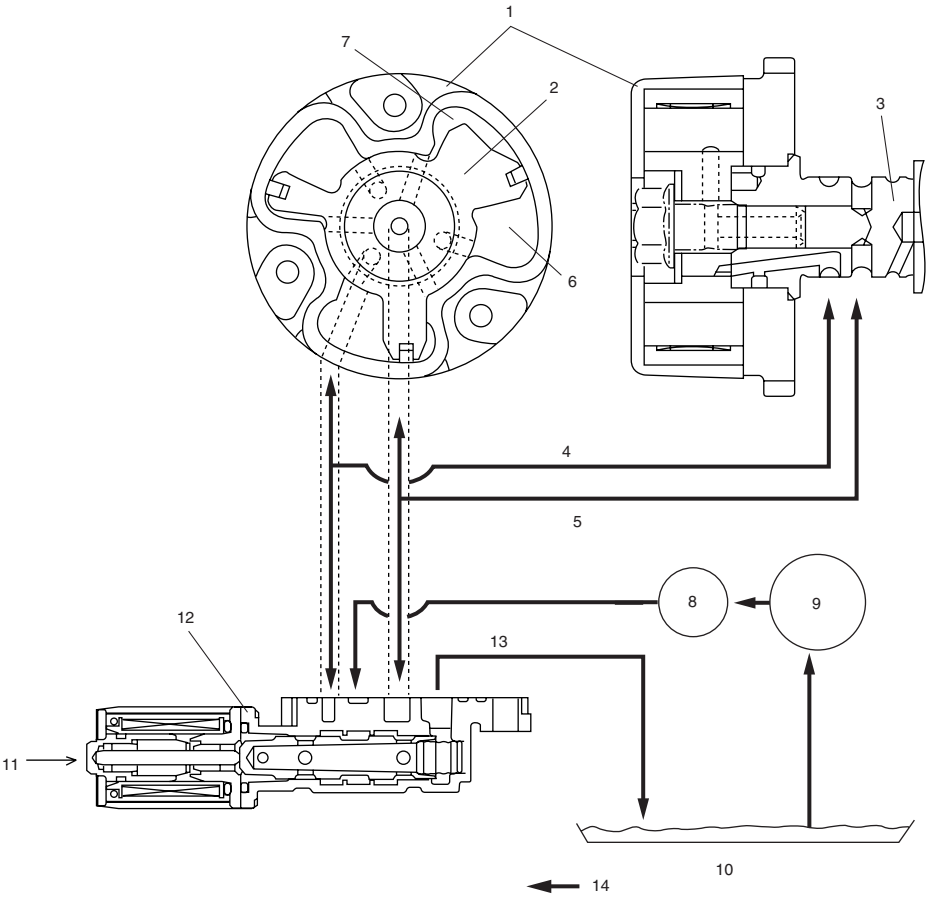
S4RS0B1401002

System Description

The VVT system is an electronic control system which continuously vary and optimize the intake valve timing in response to the engine operating condition.

The optimized intake valve timing produce such an air intake with high efficiency that both the higher power generation and lower fuel consumption can be attained in the whole engine speed range from low to high. In the area of the average engine load, low emission of nitrogen oxides (NOx) and high fuel efficiency can also be attained by making the valve opening overlap between the intake and exhaust valves longer.

For the brief of the system operation, the intake valve timing is varied by the cam timing sprocket (1) which varies the rotational phase between the intake camshaft (3) and sprocket. The rotor (2) in the cam timing sprocket is actuated by switching or adjusting the hydraulic pressure applied to the chambers for the timing advancing (7) and/or retarding (6). To switch or adjust the hydraulic pressure appropriately, ECM operates the oil control valve (12) with detecting the engine speed, intake air value, throttle opening, engine coolant temperature and camshaft position (angle).

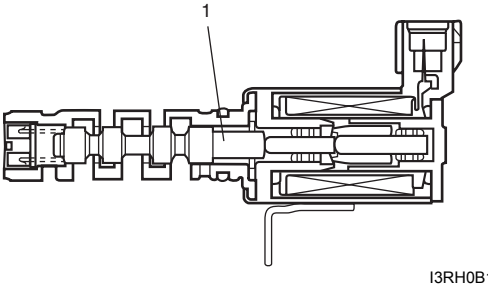


I3RH0B140002-01

4. Oil passage to chamber for timing retarding	8. Oil filter	10. Oil pan	12. Oil flow
5. Oil passage to chamber for timing advancing	9. Oil pump	11. Control signal from ECM	

Oil Control Valve

The oil control valve switches and adjusts the hydraulic pressure applied to the cam timing sprocket by moving the spool valve (1) according to the duty pulse signals output from the ECM. By this operation, the intake valve timing is varied continuously. Signals output from the ECM are the duty pulse of about 240 Hz.

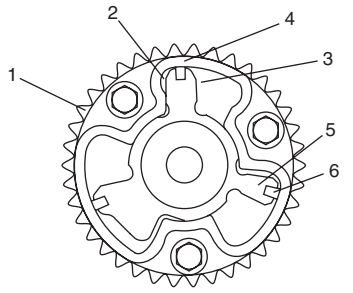


I3RH0B140003-01

Cam Timing Sprocket

The cam timing sprocket is equipped with the chambers for timing advancing (2) and retarding (3) which are separated by the rotor (5). The rotor rotates receiving the hydraulic pressure applied to both the chambers. The

sprocket (1) is installed on the housing (4) and the rotor is secured on the intake camshaft by fastening the bolts. Therefore, the actuation of the rotor makes the phase difference between the sprocket and intake camshaft.

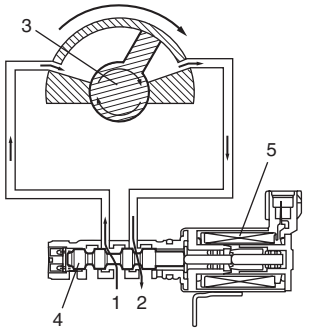


I3RH0B140004-01

6. Seal

Timing Advancing

When the duty ratio of the signal output from the ECM is heavy, the spool valve (4) of the oil control valve moves to the left (opposite direction against the coil (5)). By this spool valve movement, the pressurized oil (1) is led into the chambers for timing advancing and the oil in the chambers for timing retarding is drained. This operations actuate the rotor (3) and result in the advanced timing of the intake valve.

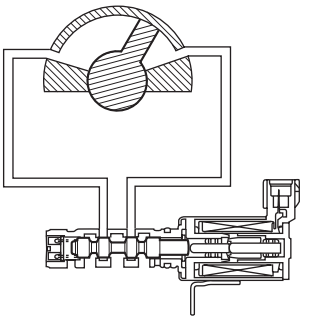


I3RH0B140005-01

2. Drain

Timing Holding

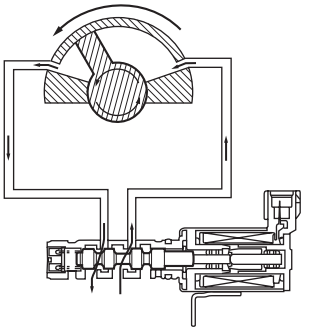
When the duty ratio of the signal output from the ECM shows that of holding, the spool valve of the oil control valve is located at hold position. Because this condition generates no oil pressure changes in both chambers, the rotor is fixed at a target position.



I3RH0B140006-01

Timing Retarding

When the duty ratio of the signal output from the ECM is light, the spool valve of the oil control valve moves to the right (head for the coil). By this spool valve movement, the pressurized oil is led into the chambers for timing retarding and the oil in the chambers for timing advancing is drained. This operations actuate the rotor and result in the retarded timing of the intake valve.



I3RH0B140007-01

Targeted Timing Varying Operation

Driving condition	Valve timing	Target of control	Effect
Engine running at idle speed	Most retarded	To shorten the valve opening overlap in order to prevent the exhaust gas counterflow to intake manifold.	Stabilization of the engine rotation at idle speed.
Average engine load range	To the advanced side	To lengthen the valve opening overlap in order to enhance the internal exhaust gas recirculation and reduce the pumping loss.	Improvement of the fuel efficiency. Lowering of the exhaust emission.
Light engine load range	To the retarded side	To shorten the valve opening overlap in order to prevent the exhaust gas counterflow to intake manifold.	Keeping of the engine stability.
Low or average engine speed range with heavy engine load	To the advanced side	To advance the closing timing of the intake valve in order to improve the volumetric efficiency.	Improvement of generating the engine torque at low and average engine speed.
High engine speed range with heavy engine load	To the retarded side	To retard the closing timing of the intake valve in order to improve the volumetric efficiency.	Improvement of generating the engine power.

Driving condition	Valve timing	Target of control	Effect
Low engine coolant temperature	Most retarded	To shorten the valve opening overlap in order to prevent the exhaust gas counterflow to intake manifold and reduce the fuel increasing. To slow the fast idle speed of the engine as a result of stabilizing the engine idling.	Stabilization of the fast idling of the engine. Improvement of the fuel efficiency.
At engine starting and stopping	Most retarded	To shorten the valve opening overlap in order to prevent the exhaust gas counterflow to intake manifold.	Improvement of start ability.

Diagnostic Information and Procedures

Compression Check

S4RS0B1404001

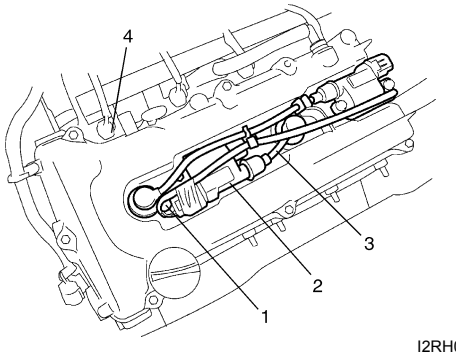
Check compression pressure on all 4 cylinders as follows:

1) Warm up engine to normal operating temperature.
2) Stop engine after warming up.

NOTE

After warming up engine, place transaxle gear shift lever in "Neutral", and set parking brake and block drive wheels.

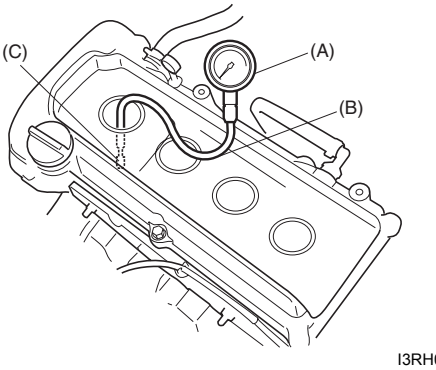
3) Disconnect ignition coil couplers (1).
4) Remove ignition coil assemblies (2) with high-tension cord (3).
5) Remove all spark plugs.
6) Disconnect fuel injector wires (4) at the coupler.



I2RH0B140003-01

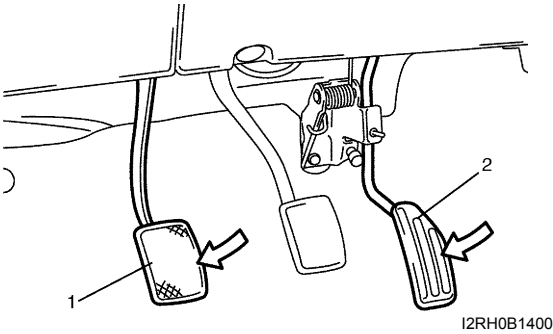
7) Install special tools (Compression gauge) into spark plug hole.

Special tool
(A): 09915–64512
(B): 09915–64530
(C): 09915–67010



I3RH0B140009-01

8) Disengage clutch (1) (to lighten starting load on engine) for M/T vehicle, and depress accelerator pedal (2) all the way to make throttle fully open.



I2RH0B140005-01

9) Crank engine with fully charged battery, and read the highest pressure on compression gauge.

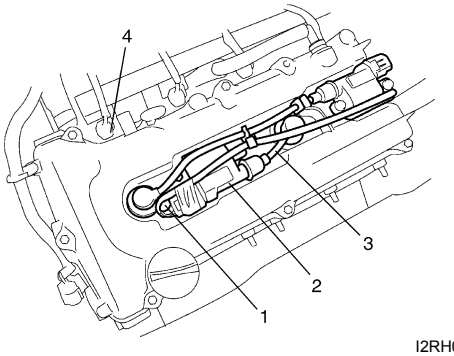
NOTE

- **For measuring compression pressure, crank engine at least 250 r/min. by using fully charged battery.**
- **If measured compression pressure is lower than limit value, check installation condition of special tool. If it is properly installed, possibility is compression pressure leakage from where piston ring and valve contact.**

Compression pressure
Standard: 1400 kPa (14.0 kg/cm^2, 199.0 psi)
Limit: 1100 kPa (11.0 kg/cm^2, 156.0 psi)

Max. difference between any two cylinders: 100 kPa (1.0 kg/cm², 14.2 psi)

10) Carry out Steps 7) through 9) on each cylinder to obtain 4 readings.
11) After checking, install spark plugs and ignition coil assemblies (2) with high-tension cord (3).
12) Connect ignition coil couplers (1).
13) Connect fuel injector wires (4) at the coupler.



I2RH0B140003-01

Engine Vacuum Check

S4RS0B1404002

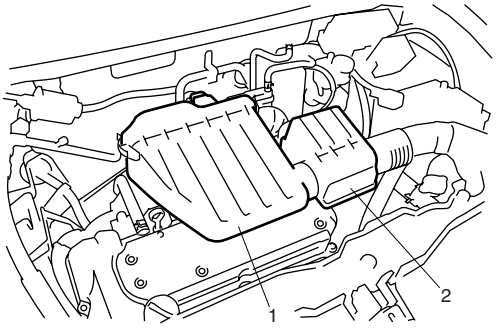
The engine vacuum that develops in the intake line is a good indicator of the condition of the engine. The vacuum checking procedure is as follows:

1) Warm up engine to normal operating temperature.

NOTE

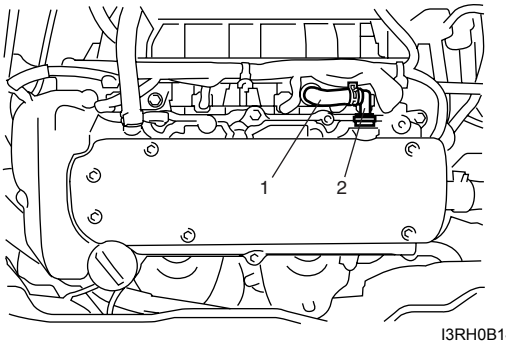
After warming up engine, be sure to place transaxle gear shift lever in "Neutral", and set parking brake and block drive wheels.

2) Stop engine and turn off the all electric switches.
3) Remove air cleaner case (1) and resonator (2).



I3RM0A140002-01

4) Remove PCV hose (1) from PCV valve (2).

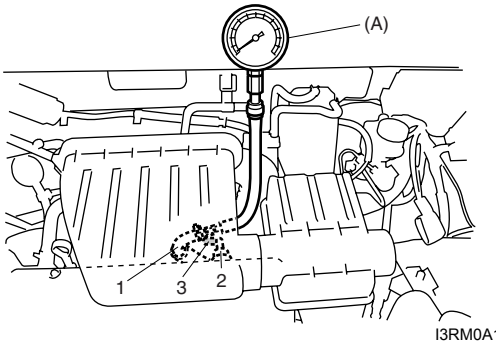


I3RH0B140011-01

5) Connect special tool (Vacuum gauge) to PCV hose (1).

Special tool
(A): 09915–67311

6) Blind PCV valve (2) using tape (3) or the like.



I3RM0A140003-01

7) Install air cleaner case and resonator.
8) Run engine at specified idle speed and read vacuum gauge. Vacuum should be within specification.

Vacuum specification (at sea level)
59 – 73 kPa (45 – 55 cmHg, 17.7 – 21.6 in.Hg) at specified idle speed

9) After checking, disconnect special tool (Vacuum gauge) from PCV valve.
10) Detach blind cap from PCV valve.
11) Install air cleaner case and resonator.

Valve Lash (Clearance) Inspection

S4RS0B1404003

1) Remove negative cable at battery.
2) Remove cylinder head cover referring to "Cylinder Head Cover Removal and Installation: ".
3) Remove right side engine under cover, if necessary.
4) Using 17 mm wrench, turn crankshaft pulley (1) clockwise until cam lobes (2) become perpendicular to shim faces (3) at valves "1" and "7" as shown in the figure.
5) Check valve lashes with thickness gauge (4) according to the following procedure.
   a) Check valve lashes at valves "1" and "7".
   b) Turn camshafts by 90° (by turning crankshaft with wrench).

c) Make sure that cam lobes are perpendicular to shim faces at valves to be checked (in this case, “3” and “8”), if not, adjust it by turning crankshaft. Check valve lashes.

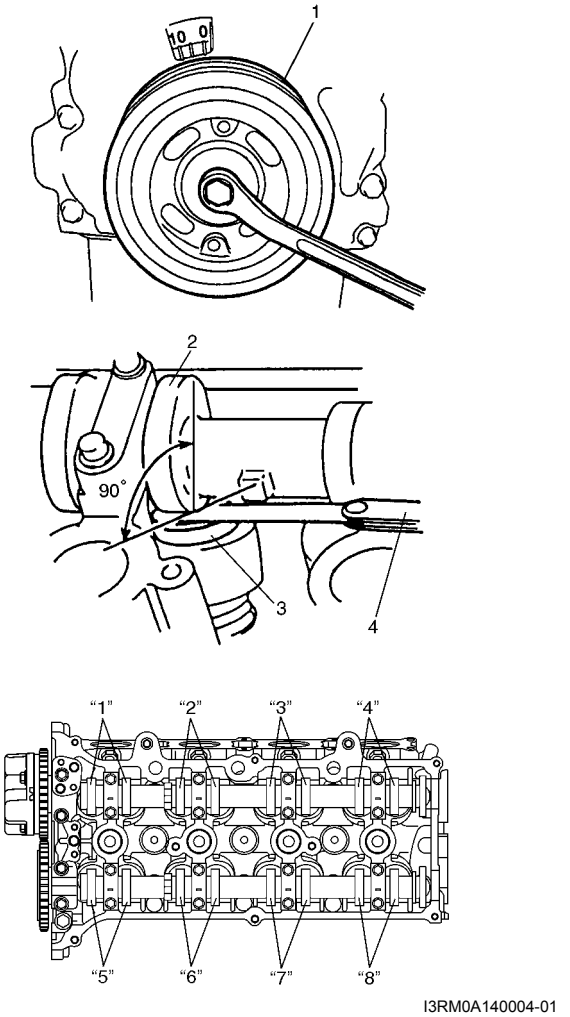
d) In the same manner as b) – c), check valve lashes at valves “4” and “6”.

e) In the same manner as b) – c) again, check valve lashes at valves “2” and “5”.

If valve lash is out of specification, record valve lash and adjust it to specification by replacing shim.

Valve clearance specification

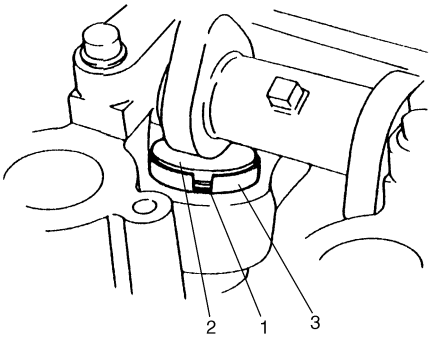
	When cold (Coolant temperature is 15 – 25 °C (59 – 77 °F))	When hot (Coolant temperature is 60 – 68 °C (140 – 154 °F))
Intake	**0.18 – 0.22 mm (0.007 – 0.009 in.)**	**0.21 – 0.27 mm (0.008 – 0.011 in.)**
Exhaust	**0.28 – 0.32 mm (0.011 – 0.013 in.)**	**0.30 – 0.36 mm (0.012 – 0.014 in.)**



I3RM0A140004-01

Replacement of Shim

1) Close the valve whose shim (2) is to be replaced by turning crankshaft, then turn tappet (3) till its cut section (1) faces inside as shown in the figure.



I2RH0B140006-01

2) Lift down the valve by turning crankshaft to 360°.

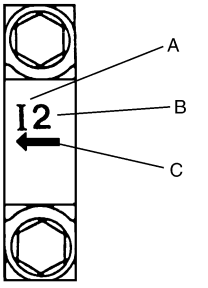
3) Hold tappet at that position using special tool as follows.

a) Remove its housing bolts.

b) Check housing No. and select special tool corresponding to housing No., referring to “Special tool selection table”.

Special tool selection table

No. on camshaft housing	Embossed mark on special tool
I2	IN2
I3, I4, I5	IN345
E2	EX2
E3, E4, E5	EX345



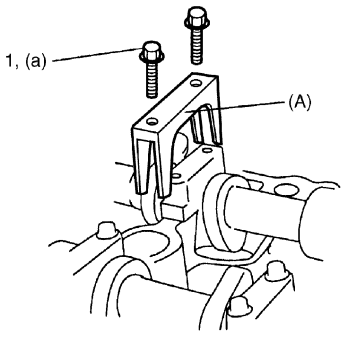
I2RH0B140011-01

A:	I: Intake side or E: Exhaust side
B:	Position from timing chain side
C:	Pointing to timing chain side

c) Hold down the tappet so as not to contact the shim by installing special tool on camshaft housing with housing bolt (1) tighten housing bolts to specified torque.

Special tool
(A): 09916–67020
(A): 09916–67021

Tightening torque
Camshaft housing bolts (a): 8 N·m (0.8 kgf-m, 6.0 lb-ft) for tightening of special tool

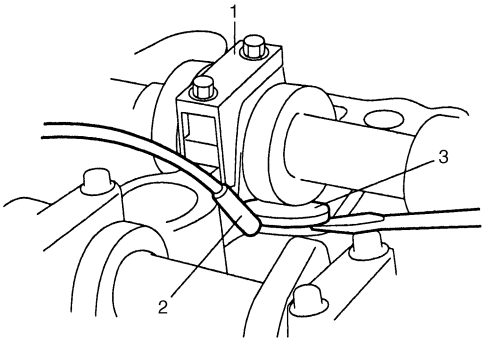


I3RM0A140005-01

4) Turn camshaft by approximately 90° clockwise and remove shim (3).

⚠ WARNING

Never put in the hand between camshaft and tappet.

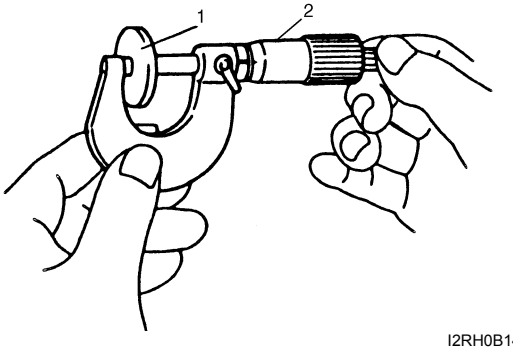


I2RH0B140013-01

1. Special tool
2. Magnet

5) Using a micrometer (2), measure the thickness of the removed shim (1), and determine replacement shim by calculating the thickness of new shim with the following formula and table.

Shim thickness specification
Intake side:
A = B + C – 0.20 mm (0.008 in.)
Exhaust side:
A = B + C – 0.30 mm (0.012 in.)
A: Thickness of new shim
B: Thickness of removed shim
C: Measured valve clearance



I2RH0B140014-01

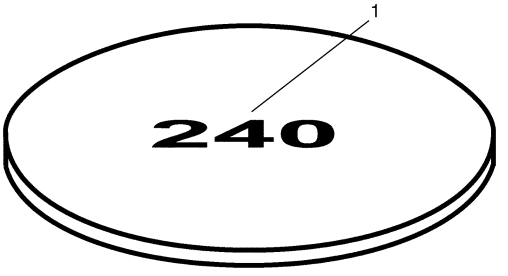
For example of intake side:
When thickness of removed shim is 2.40 mm (0.094 in.), and measured valve clearance is 0.45 mm (0.018 in.).
A = 2.40 mm (0.094 in.) + 0.45 mm (0.018 in.) – 0.20 mm (0.008 in.) = 2.65 mm (0.104 in.)
Calculated thickness of new shim = 2.65 mm (0.104 in.)

6) Select new shim No. (1) with a thickness as close as possible to calculated value.

Available new shims No.

Thickness mm (in.)	Shim No.	Thickness mm (in.)	Shim No.
2.175 (0.0856)	218	2.600 (0.1024)	260
2.200 (0.0866)	220	2.625 (0.1033)	263
2.225 (0.0876)	223	2.650 (0.1043)	265
2.250 (0.0886)	225	2.675 (0.1053)	268
2.275 (0.0896)	228	2.700 (0.1063)	270
2.300 (0.0906)	230	2.725 (0.1073)	273
2.325 (0.0915)	233	2.750 (0.1083)	275
2.350 (0.0925)	235	2.775 (0.1093)	278
2.375 (0.0935)	238	2.800 (0.1102)	280
2.400 (0.0945)	240	2.825 (0.1112)	283
2.425 (0.0955)	243	2.850 (0.1122)	285
2.450 (0.0965)	245	2.875 (0.1132)	288
2.475 (0.0974)	248	2.900 (0.1142)	290
2.500 (0.0984)	250	2.925 (0.1152)	293
2.525 (0.0994)	253	2.950 (0.1161)	295
2.550 (0.1004)	255	2.975 (0.1171)	298
2.575 (0.1014)	258	3.000 (0.1181)	300

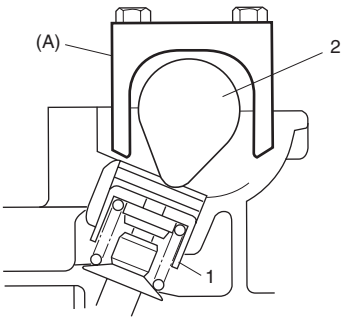
7) Install new shim facing shim No. side with tappet.



I2RH0B140015-01

8) Lift valve by turning crankshaft counterclockwise (in opposite direction against above Step 4)) and remove special tool.

Special tool
(A): 09916–67020
(A): 09916–67021

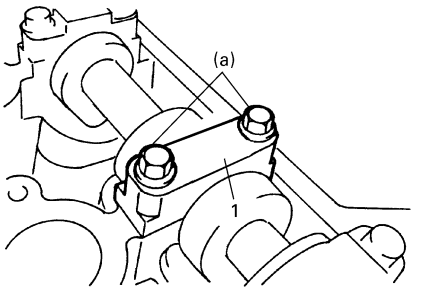


I3RM0A140006-01

1.	Tappet
2.	Camshaft

9) Install camshaft housing (1) and tighten bolts to specified torque.

Tightening torque
Camshaft housing bolt (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)



I2RH0B140149-01

10) Check valve clearance again after adjusting it.
11) After checking and adjusting all valves.
12) Install cylinder head cover referring to “Cylinder Head Cover Removal and Installation: ”.

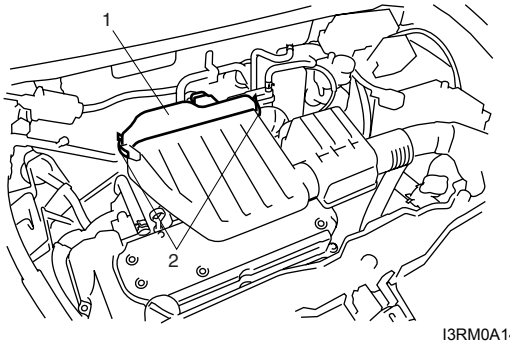
Repair Instructions

Air Cleaner Element Removal and Installation

S4RS0B1406001

Removal

1) Open air cleaner case (1) by unhooking its clamps (2).
2) Remove air cleaner element from case.



I3RM0A140007-01

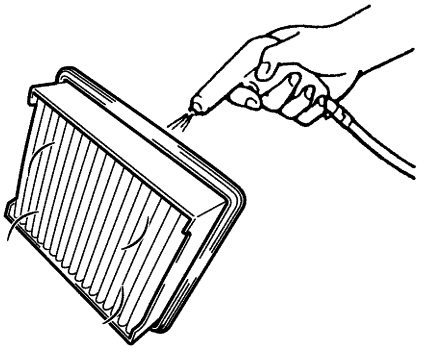
Installation
Reverse removal procedure for installation.

Air Cleaner Element Inspection and Cleaning

S4RS0B1406002

Inspection
Check air cleaner element for dirt. Replace excessive dirty element.

Cleaning
Blow off dust by compressed air from air outlet side of element.



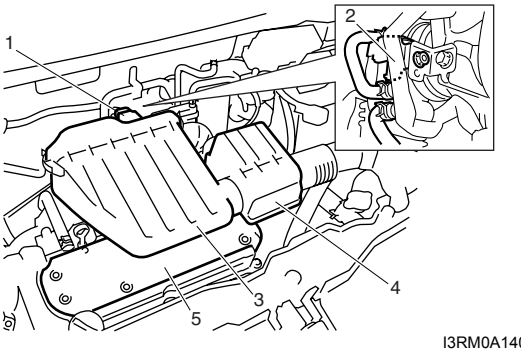
I2RH0B140150-01

Cylinder Head Cover Removal and Installation

S4RS0B1406003

Removal

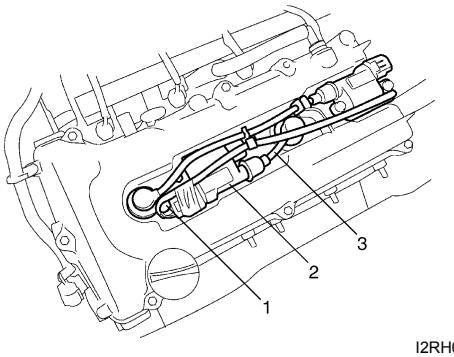
1) Disconnect negative cable at battery.
2) Disconnect MAF sensor coupler (1).
3) Remove EVAP canister purge valve (2).
4) Remove air cleaner case (3) and resonator (4).
5) Remove cylinder head upper cover (5).



I3RM0A140008-01

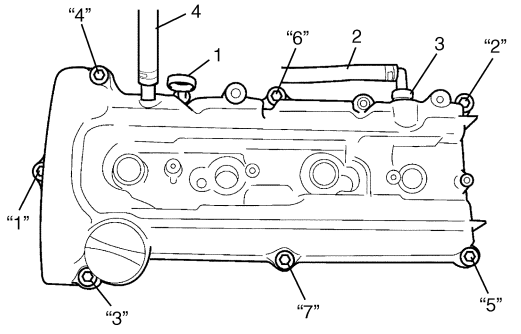
6) Disconnect ignition coil couplers (1).

7) Remove ignition coil assemblies (2) with high-tension cord (3).
8) Remove wire harness clamp (4) from cylinder head cover.



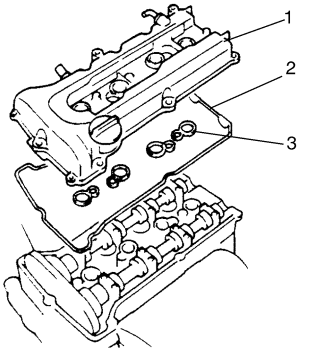
I2RH0B140032-01

9) Remove oil level gauge (1).
10) Disconnect PCV hose (2) from PCV valve (3) and disconnect breather hose (4) from cylinder head cover.
11) Remove cylinder head cover mounting bolts in such order as indicated in the figure.



I2RH0B140033-01

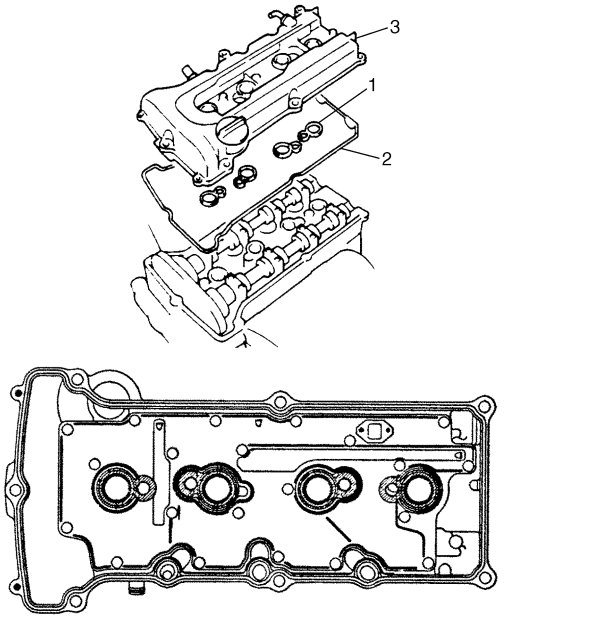
12) Remove cylinder head cover (1) with cylinder head cover gasket (2) and spark plug hole gasket (3).



I2RH0B140034-01

Installation

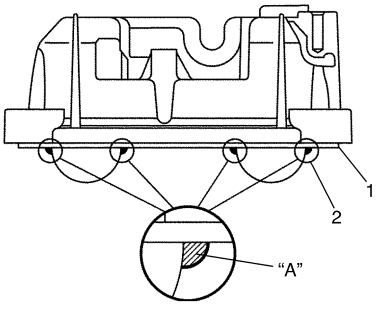
1) Install new spark plug hole gaskets (1) and new cylinder head cover gasket (2) to cylinder head cover (3) as shown in the figure.



I2RH0B140035-01

2) Remove oil, old sealant, and dust from sealing surfaces on cylinder head and cover. After cleaning, apply sealant "A" to the following point.
   - Cylinder head cover gasket (1) sealing surface area (2) as shown.

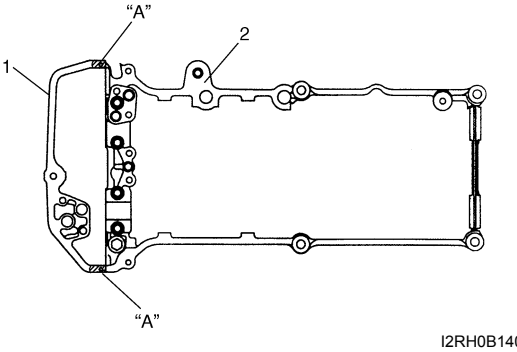
     "A": Water tight sealant 99000–31250



I2RH0B140036-01

   - Timing chain cover (1) and cylinder head (2) mating surface as shown.

     "A": Water tight sealant 99000–31250



I2RH0B140037-01

3) Install cylinder head cover to cylinder head.

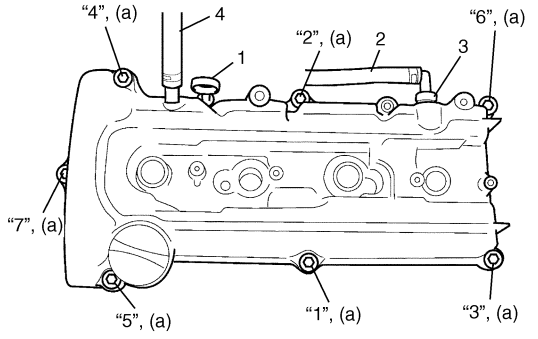
NOTE

When installing cylinder head cover, use care so that cylinder head cover gasket or spark plug hole gaskets will not get out of place or fall off.

4) Tightening bolts in such order as indicated in the figure a little at a time till they are tightened to specified torque.

Tightening torque
Cylinder head cover bolt (a): 8 N·m (0.8 kgf-m, 6.0 lb-ft)

5) Connect PCV hose (2) to PCV valve (1).
6) Connect breather hose (4).
7) Install oil level gauge.



I3RH0B140016-01

8) Install wire harness clamp to cylinder head cover.
9) Install ignition coil assemblies with high-tension cord.
10) Connect ignition coil couplers and clamp harness securely.
11) Install cylinder head upper cover.
12) Install air cleaner case and resonator.
13) Connect negative cable at battery.

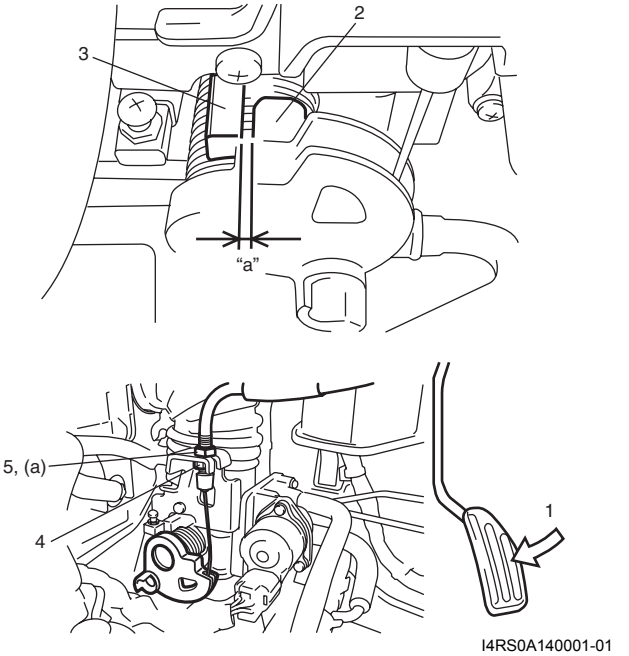
Accelerator Cable Adjustment (For A/T and M/T Models)

S4RS0B1406004

With accelerator pedal depressed fully (1), check clearance between throttle lever (2) and lever stopper (3) of throttle body.
If measured value is out of specification, adjust it to specification with cable adjusting nut (4), and then tighten accelerator cable locking nut to specified torque.

Tightening torque
Accelerator cable locking nut (a): 12 N·m (1.2 kgf-m, 9.0 lb-ft)

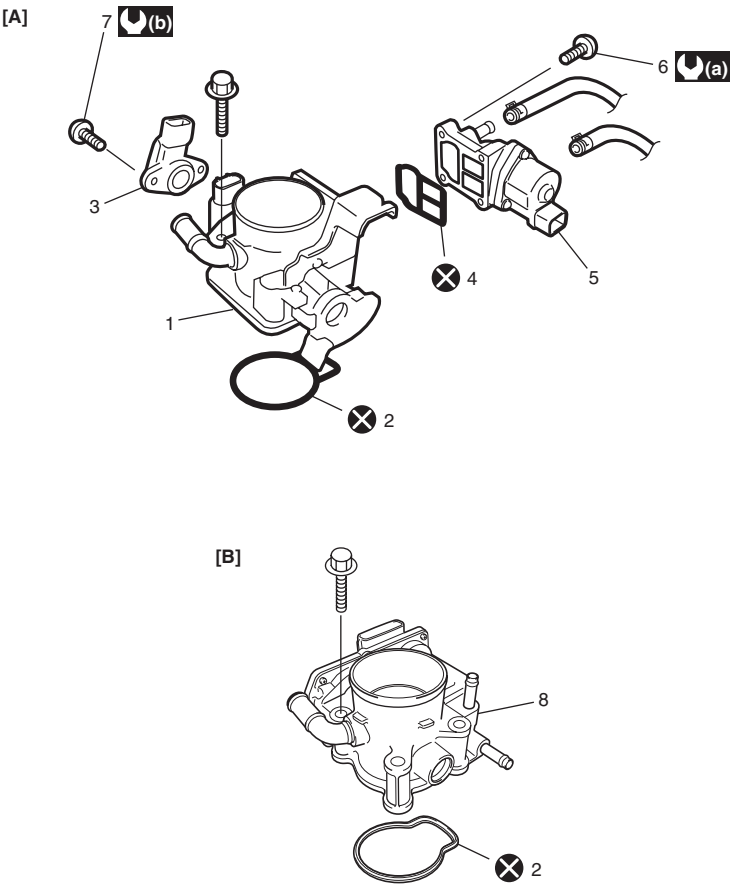
Accelerator cable adjustment clearance (with pedal depressed fully)
"a": 0.5 – 2.0 mm (0.02 – 0.07 in.)



I4RS0A140001-01

Throttle Body Components

S4RS0B1406005



I4RS0B140003-02

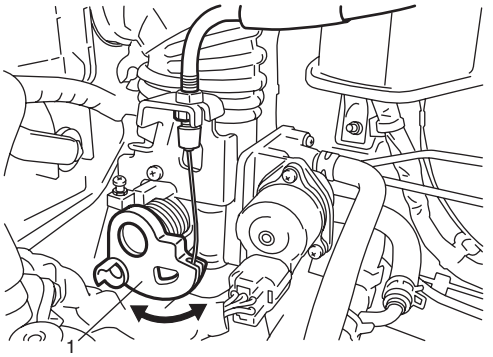
[A]: For A/T and M/T models	4. Gasket	(a) : 3.5 N·m (0.35 kgf-m, 2.5 lb-ft)
[B]: For Automated Manual Transaxle model	5. IAC valve	(b) : 2.5 N·m (0.25 kgf-m, 2.0 lb-ft)
1. Throttle body	6. IAC valve screws	: Do not reuse.
2. Throttle body gasket	7. TP sensor screws	
3. TP sensor	8. Electric throttle body assembly	

Throttle Body On-Vehicle Inspection

S4RS0B1406006

(For A/T and M/T Models)

Check that throttle lever (1) moves smoothly.



I3RM0A140011-01

(For Automated Manual Transaxle Model)

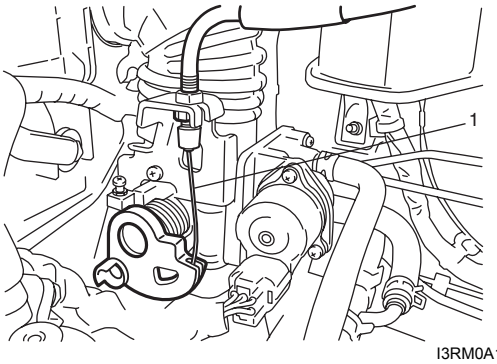
Check electric throttle body assembly referring to "Throttle Valve Operation Check" and "Electric Throttle Body Assembly Operation Check" under "Electric Throttle Body Assembly On-Vehicle Inspection (For Automated Manual Transaxle Model): in Section 1C".

Throttle Body Removal and Installation (For A/T and M/T Models)

S4RS0B1406007

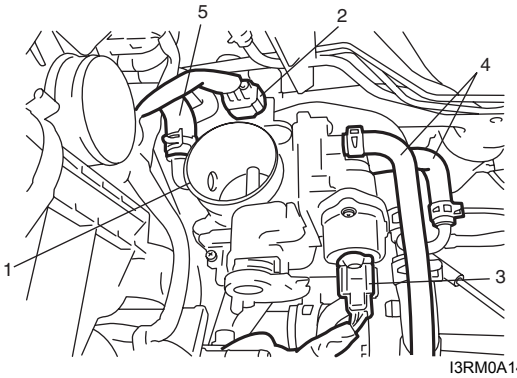
Removal

1) Disconnect negative cable at battery.
2) Drain coolant referring to "Cooling System Draining: in Section 1F".
3) Disconnect accelerator cable (1) from throttle body.



I3RM0A140012-01

4) Detach EVAP canister and purge valve chamber, and remove air cleaner outlet hose.
5) Disconnect connectors from TP sensor (2) and IAC valve (3).
6) Disconnect engine coolant hoses (4) and breather hose (5) from throttle body (1).



I3RM0A140013-01

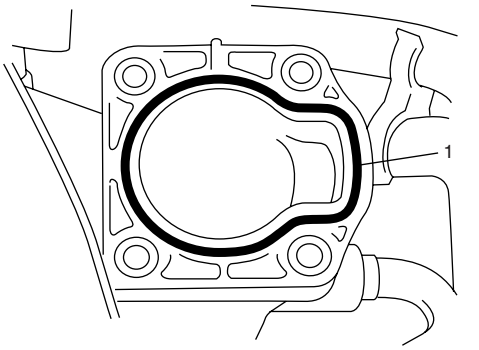
7) Remove throttle body from intake manifold.
8) Remove TP sensor and IAC valve from throttle body.

NOTE

While disassembling and assembling throttle body, use special care not to deform levers on throttle valve shaft or cause damage to any other parts.

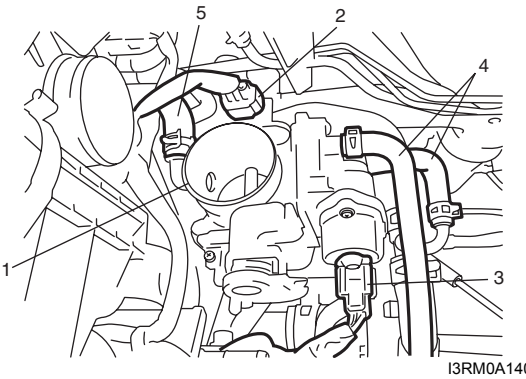
Installation

1) Install IAC valve to throttle body referring to “Idle Air Control (IAC) Valve Removal and Installation (For A/T and M/T Models): in Section 1C”.
2) Install TP sensor to throttle body referring to “Throttle Position (TP) Sensor Removal and Installation (For A/T and M/T Models): in Section 1C”.
3) Clean mating surfaces and install new throttle body gasket (1) to intake manifold.



I3RM0A140014-01

4) Install throttle body (1) to intake manifold.
5) Connect connectors to TP sensor (2) and IAC valve (3) securely.
6) Connect engine coolant hoses (4) and breather hose (5).



I3RM0A140013-01

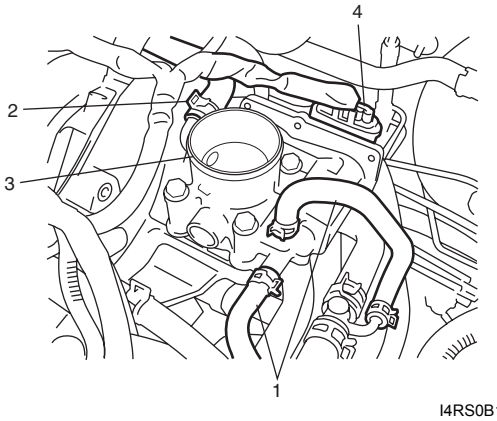
7) Connect accelerator cable and adjust cable play to specification referring to “Accelerator Cable Adjustment (For A/T and M/T Models): ”.
8) Install air cleaner outlet hose, purge valve chamber and EVAP canister.
9) Refill coolant referring to “Cooling System Flush and Refill: in Section 1F”.
10) Connect negative cable at battery.

Electric Throttle Body Assembly Removal and Installation (For Automated Manual Transaxle Model)

S4RS0B1406044

Removal

1) Disconnect negative cable at battery.
2) Drain coolant referring to “Cooling System Draining: in Section 1F”.
3) Detach EVAP canister and purge valve chamber, and remove air cleaner outlet hose.
4) Disconnect engine coolant hoses (1) and breather hose (2) from electric throttle body assembly (3).
5) Disconnect connector (4) from electric throttle body assembly.

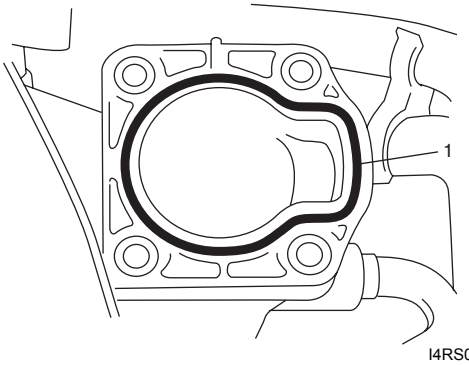


I4RS0B140004-02

6) Remove electric throttle body assembly from intake manifold.

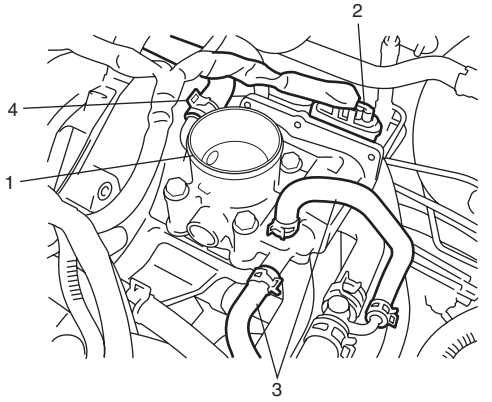
Installation

1) Clean mating surfaces and install new throttle body gasket (1) to intake manifold.



I4RS0B140005-01

2) Install electric throttle body assembly (1) to intake manifold.
3) Connect connector (2) to electric throttle body assembly securely.
4) Connect engine coolant hoses (3) and breather hose (4) to electric throttle body assembly (1).



I4RS0B140006-01

5) Install EVAP canister and purge valve chamber and air cleaner outlet hose.
6) Refill coolant referring to “Cooling System Flush and Refill: in Section 1F”.
7) Connect negative cable at battery.

Throttle Body Cleaning

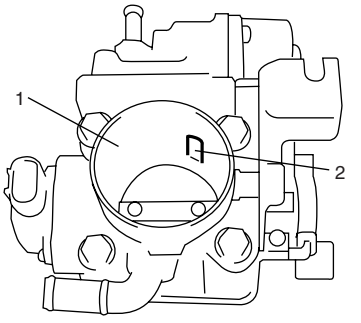
S4RS0B1406008

(For A/T and M/T Models)

Clean throttle body bore (1) and idle air passage (2) by blowing compressed air.

⚠ CAUTION

TP sensor, idle air control valve or other components containing rubber must not be placed in a solvent or cleaner both. A chemical reaction will cause these parts to swell, harden or get distorted.



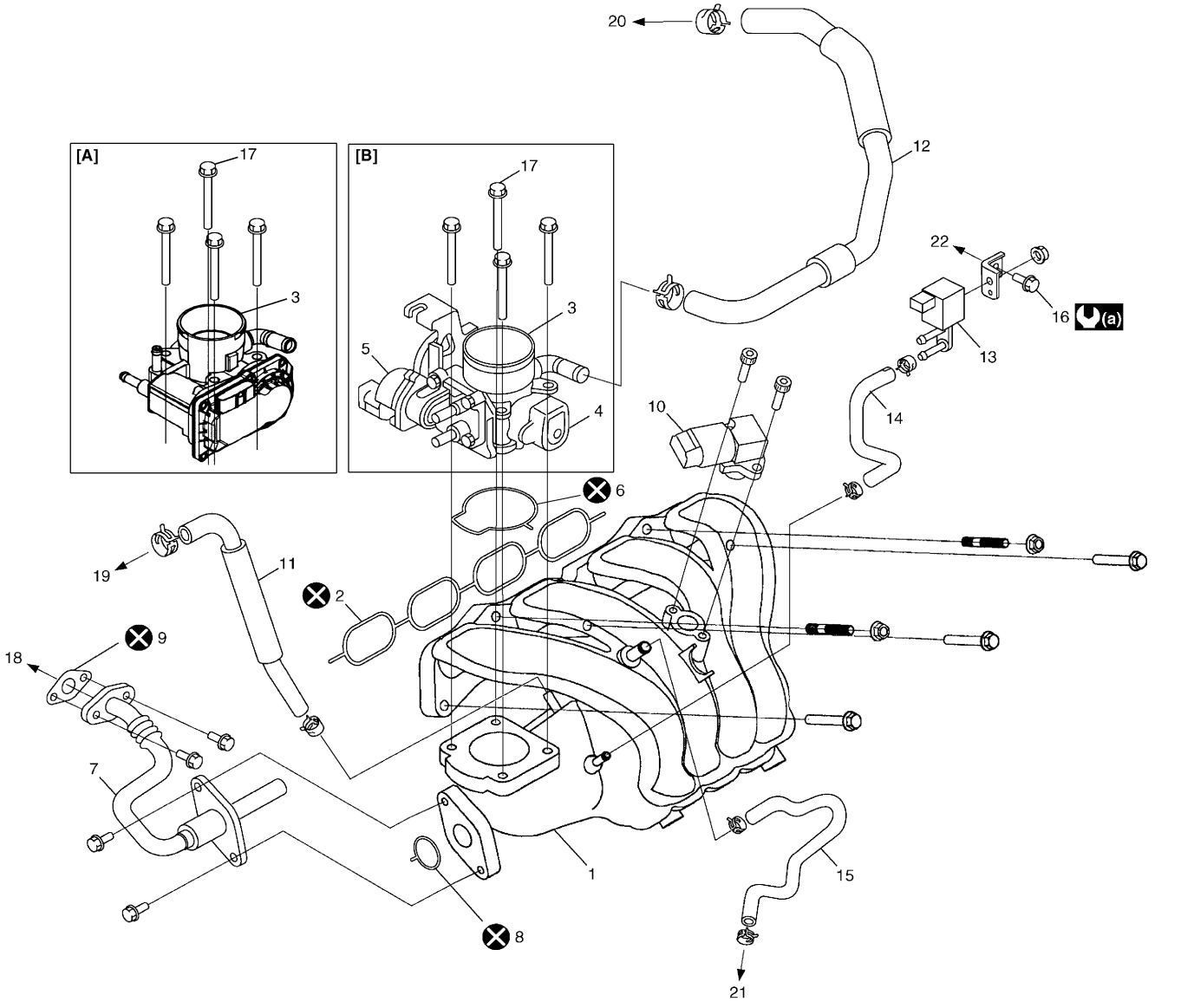
I3RM0A140015-01

(For Automated Manual Transaxle Model)

Clean electric throttle body assembly referring to “Throttle Valve Visual Check” under “Electric Throttle Body Assembly On-Vehicle Inspection (For Automated Manual Transaxle Model): in Section 1C”.

Throttle Body and Intake Manifold Components

S4RS0B1406009



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[A]: For Automated Manual Transaxle model	6. O-ring	13. EVAP canister purge valve	20. To cylinder head cover
[B]: For A/T and M/T models	7. EGR pipe	14. EVAP canister purge valve hose	21. To brake booster
1. Intake manifold	8. O-ring	15. Brake booster hose	22. To air cleaner case
2. Intake manifold O-ring	9. Gasket	16. EVAP canister purge valve bracket bolt	(a) : 5 N·m (0.5 kgf-m, 4.0 lb-ft)
3. Throttle body	10. MAP sensor	17. Throttle body mounting bolt	: Do not reuse.
4. TP sensor	11. PCV valve hose	18. To EGR valve	
5. IAC valve	12. Breather hose	19. To PCV valve	

Intake Manifold Removal and Installation

S4RS0B1406010

Removal

1) Remove throttle body referring to “Throttle Body Removal and Installation (For A/T and M/T Models): ” or “Electric Throttle Body Assembly Removal and Installation (For Automated Manual Transaxle Model): ”.
2) Disconnect MAP sensor coupler (1).
3) Disconnect the following hoses:
   - Brake booster hose (2) from cylinder head cover
   - PCV hose (3) from PCV valve
4) Remove EGR pipe bolt (4) from EGR valve.