

# Engine Electrical Devices

## Repair Instructions

### Idle Air Control (IAC) Valve Operation Inspection

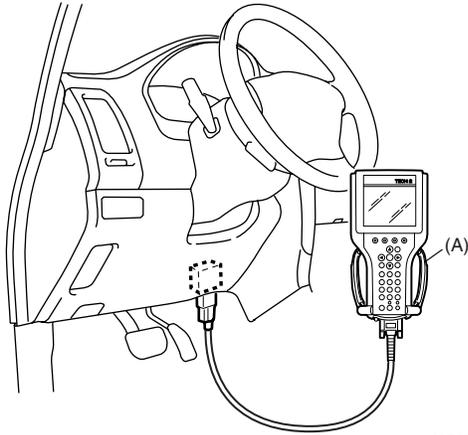
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#### Using SUZUKI Scan Tool

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

#### Special tool

(A): SUZUKI scan tool



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- 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 Removal and Installation

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#### Removal

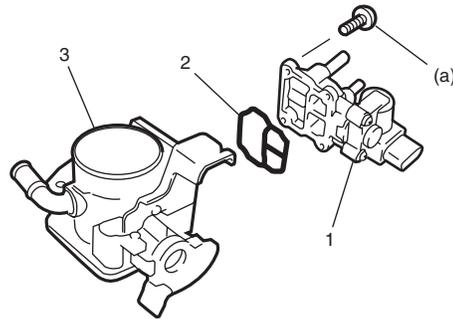
- 1) Remove throttle body from intake manifold referring to "Throttle Body Removal and Installation in Section 1D".
- 2) Remove IAC valve from throttle body.

#### Installation

- 1) Install new gasket (2) to IAC valve (1).
- 2) Install IAC valve (1) to throttle body (3).  
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)



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- 3) Install throttle body to intake manifold referring to "Throttle Body Removal and Installation in Section 1D".

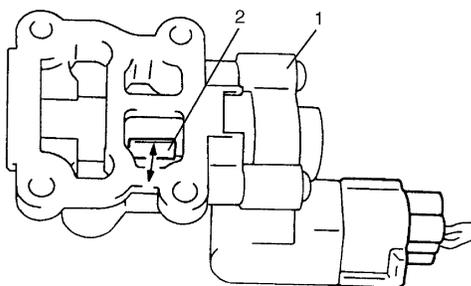
### Idle Air Control (IAC) Valve Inspection

S5RH0A1306002

- 1) Remove IAC valve from throttle body referring to "Idle Air Control (IAC) Valve Removal and Installation".
- 2) Connect each connector to IAC valve (1), TP sensor, MAF and IAT 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 ignition switch ON 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.



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### Engine Control Module (ECM) Removal and Installation

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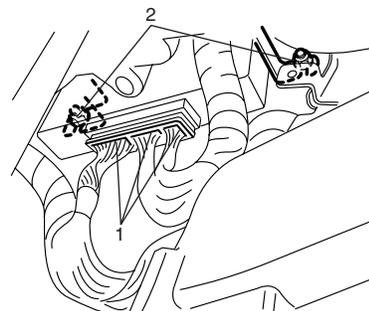
#### ⚠ CAUTION

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

#### Removal

- 1) Disconnect battery negative cable at battery.
- 2) Disable air bag system, refer to "Disabling Air Bag System in Section 8B".
- 3) Remove glove box, referring to Step 5) of "Removal" under "Instrument Panel Removal and Installation in Section".
- 4) Disconnect connectors (1) from ECM while releasing connectors lock.

- 5) Remove ECM from body after removing its nuts (2).



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#### Installation

Reverse removal procedure noting the following:

- Connect connectors to ECM securely until a click is heard.
- When installing each part, be careful not to catch any cable or wiring harness.

### Manifold Absolute Pressure (MAP) Sensor Removal and Installation

S5RH0A1306021

#### ⚠ CAUTION

**Do not expose MAP sensor to excessive shock like a dropping it. If MAP sensor has been exposed to excessive shock, it should be replaced.**

#### Removal

- 1) Disconnect negative cable at battery.
- 2) Remove air cleaner assembly from engine.
- 3) Disconnect connector from MAP sensor.
- 4) Remove MAP sensor from intake manifold.

#### Installation

Reverse removal procedure noting the following.

- Check sensor O-ring for damage and deterioration. Replace as necessary.
- Apply engine oil to O-ring of MAP sensor if necessary.
- Tighten MAP sensor bolts to specified torque.

#### Tightening torque

**MAP sensor bolt: 5 N·m (0.5 kgf-m, 4.0 lb-ft)**

- Connect connector securely.

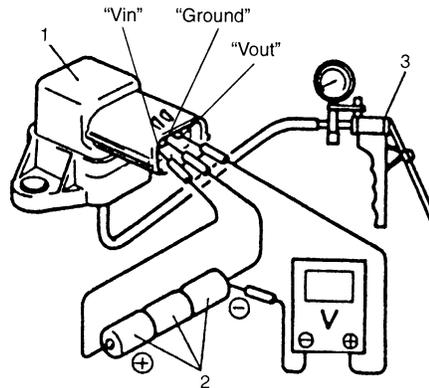
**Manifold Absolute Pressure (MAP) Sensor Inspection**

S5RH0A1306004

- 1) Remove MAP sensor from intake manifold referring to “Manifold Absolute Pressure (MAP) Sensor Removal and Installation”.
  - 2) 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



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- 3) Install MAP sensor (1) to intake manifold referring to “Manifold Absolute Pressure (MAP) Sensor Removal and Installation”.

### Throttle Position (TP) Sensor On-Vehicle Inspection

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

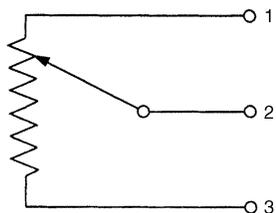
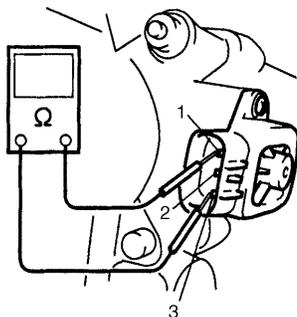
#### TP sensor resistance

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.

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



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

### Throttle Position (TP) Sensor Removal and Installation

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#### Removal

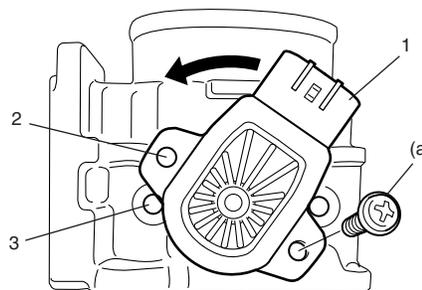
- 1) Disconnect battery negative cable at battery.
- 2) Disconnect connector from TP sensor.
- 3) Remove TP sensor from throttle body.

#### 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 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)



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

## Engine Coolant Temperature (ECT) Sensor Removal and Installation

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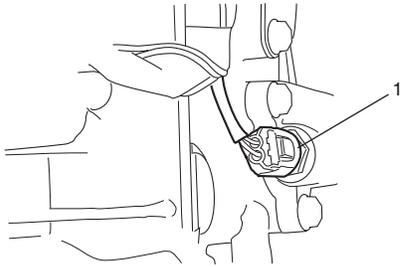
### **▲ WARNING**

To help 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.

### Removal

- 1) Disconnect negative cable from battery.
- 2) Drain coolant referring to "Cooling System Flush and Refill in Section".
- 3) Remove air cleaner assembly from engine.
- 4) Disconnect connector from ECT sensor (1).



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- 5) Remove ECT sensor from thermostat case.

### Installation

Reverse removal procedure noting the following.

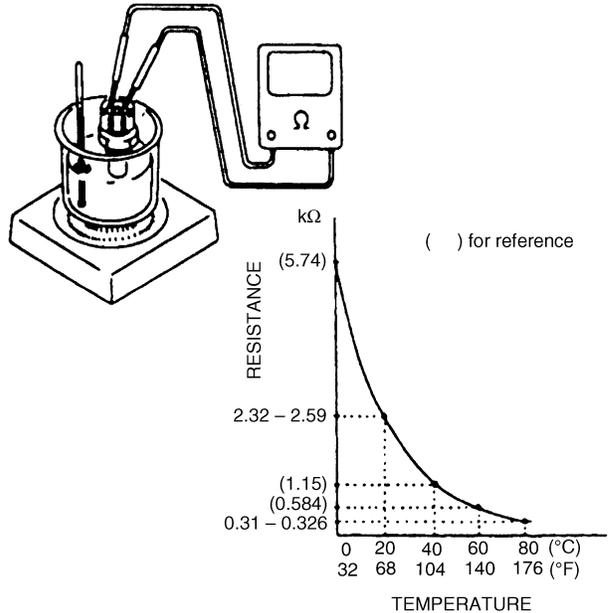
- Clean mating surfaces of sensor and thermostat case.
- Check O-ring for damage and replace, if necessary.
- Tighten ECT sensor to specified torque referring to "Cooling System Components in Section 1F".
- Connect connector to sensor securely.
- Refill cooling system.

## Engine Coolant Temperature (ECT) Sensor Inspection

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Immerse temperature sensing part of ECT sensor 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.



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

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### 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 from battery.
- 2) Disconnect connector of heated oxygen sensor and release its wire harness from clamp.
- 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 from exhaust manifold or exhaust pipe.

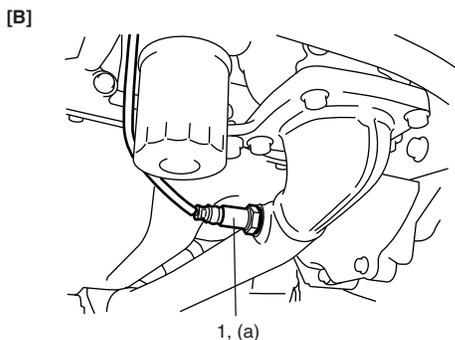
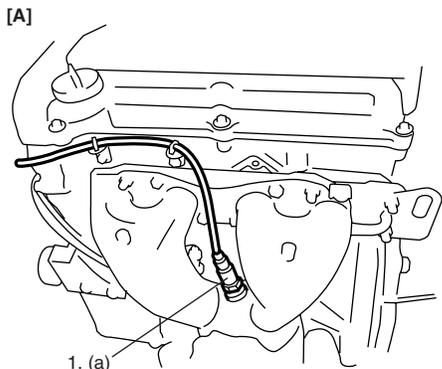
**Installation**

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)



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

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

**Oxygen Sensor Heater Inspection**

S5RH0A1306012

- 1) Disconnect sensor connector.
- 2) Using ohmmeter, measure resistance between terminals “V<sub>B</sub>” and “GND” of sensor connector. If found faulty, replace oxygen sensor.

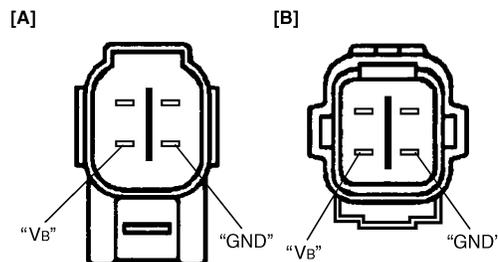
**NOTE**

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**



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

- 3) Connect sensor connector securely.

**Camshaft Position (CMP) Sensor Removal and Installation**

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**Removal**

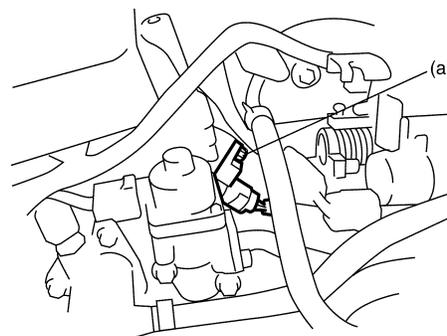
- 1) Disconnect negative cable at battery.
- 2) Disconnect connector from CMP sensor.
- 3) Remove camshaft position sensor from cylinder head.

**Installation**

- 1) Install camshaft position sensor to cylinder head.

**Tightening torque**

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



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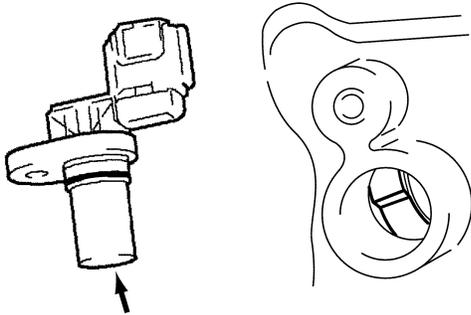
- 2) Connect connector to CMP sensor securely.
- 3) Connect negative cable to battery.

**Camshaft Position (CMP) Sensor Inspection**

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**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.



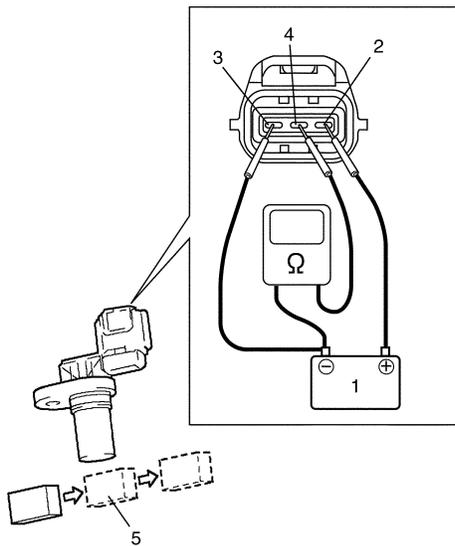
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**Performance check**

- 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)**



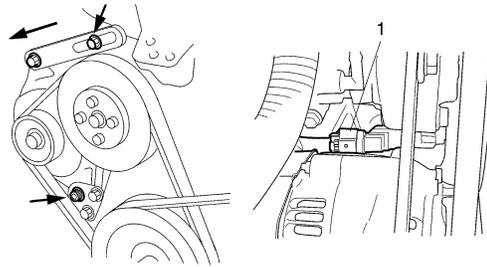
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**Crankshaft Position (CKP) Sensor Removal and Installation**

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**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.



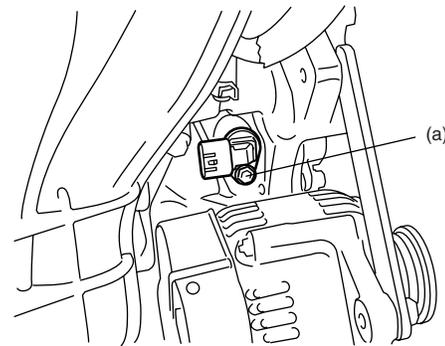
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**Installation**

- 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)**



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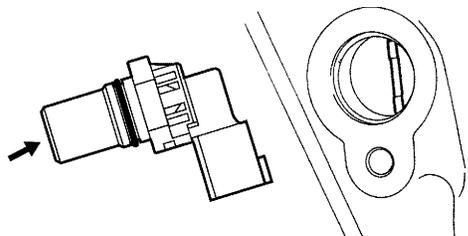
- 2) Connect connector to CKP sensor securely.
- 3) Adjust generator drive belt tension referring to “Water Pump / Generator Drive Belt Tension Inspection and Adjustment in Section 1F”
- 4) Connect negative cable to battery.

### Crankshaft Position (CKP) Sensor Inspection

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#### 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.



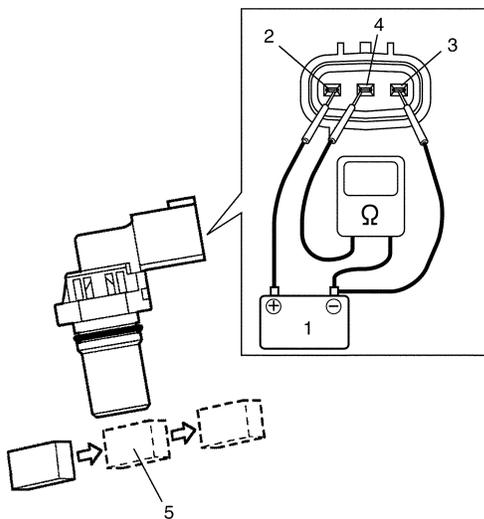
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#### Performance check

- 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)



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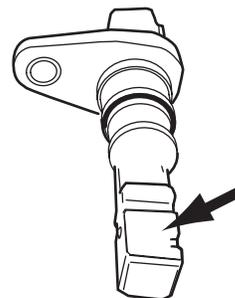
### Vehicle Speed Sensor (VSS) Inspection

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For A/T model, referring to "Output Shaft Speed Sensor (VSS) Inspection in Section".

#### Visual check (for M/T model)

- 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.



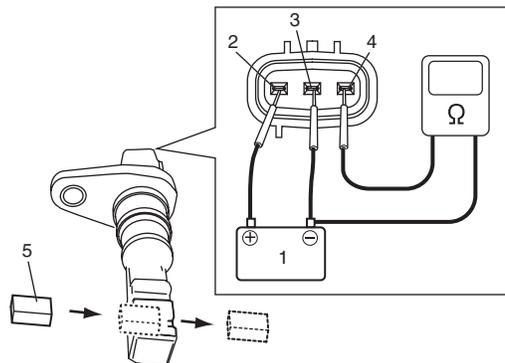
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#### Performance check (for M/T model)

- 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)



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**Knock Sensor Removal and Installation**

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**Removal**

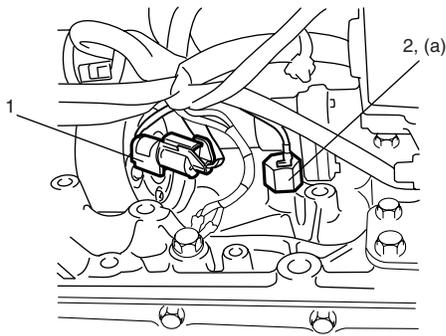
- 1) Disconnect negative cable at battery.
- 2) Hoist vehicle.
- 3) Remove right side drive shaft referring to “Front Drive Shaft Assembly Removal and Installation: in Section ”.
- 4) Disconnect knock sensor connector (1).
- 5) Remove knock sensor (2) from cylinder block.

**Installation**

Reverse removal procedure for installation.

**Tightening torque**

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



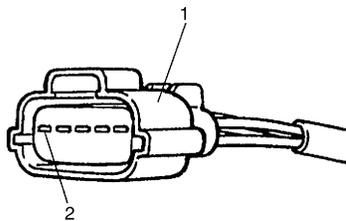
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**Mass Air Flow (MAF) and Intake Air Temperature (IAT) Sensor Inspection**

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**MAF Sensor Signal Inspection**

- 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.



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- 4) Turn ON ignition switch position and check that sensor power supply 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) Check MAF sensor output voltage referring to “Inspection of ECM and Its Circuits in Section 1A”. If check result is not as specified above, cause may lie in wire harness, connector connection, MAF and IAT sensor or ECM.

**Intake Air Temperature (IAT) Sensor Inspection**

**⚠ CAUTION**

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

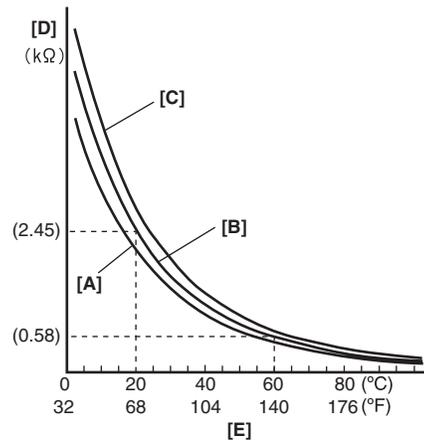
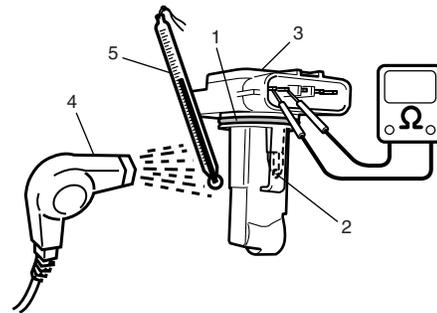
- Check sensor O-ring (1) for damage and deterioration. Replace as necessary.
- Blow hot air to temperature sensing part (2) of MAF and IAT sensor (3) using hot air drier (4) and measure resistance between sensor terminals while heating air gradually. If measured resistance does not show such characteristic 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	[D]: Resistance
[B]: Nominal	[E]: Temperature
[C]: Upper limit	5. Temperature gauge

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

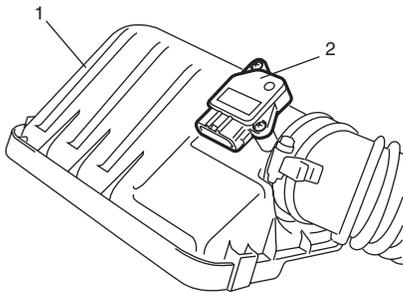
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### ⚠ CAUTION

- 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.



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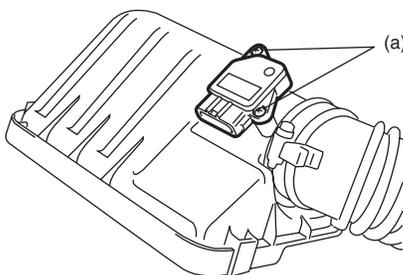
### Installation

Reverse removal procedure noting the following.

- 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)**



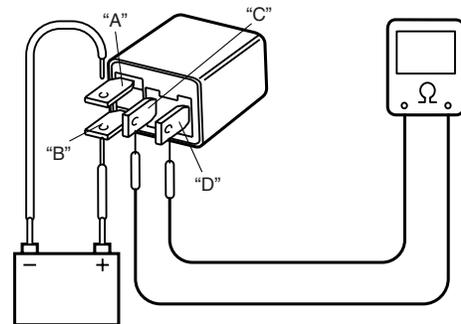
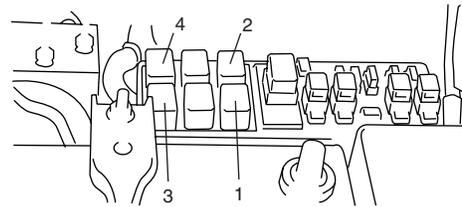
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- Connect MAF and IAT sensor connector securely.

## Main Relay, Fuel Pump Relay, A/C Compressor Relay and A/C Condenser Fan Relay Inspection

S5RH0A1306018

- 1) Disconnect negative cable at battery.
- 2) Remove main relay (1), fuel pump relay (2), A/C compressor relay (3) and A/C condenser fan relay (4) from vehicle.
- 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" or relay. Connect battery negative (-) terminal "A" of relay. Check continuity between terminal "C" and "D". If there is no continuity when relay is connected to the battery, replace relay.

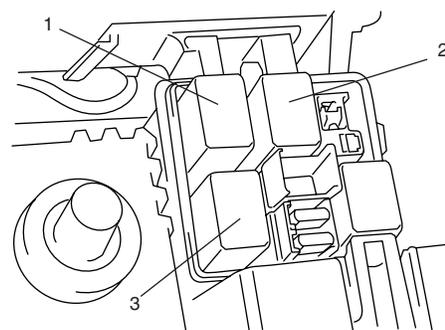


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## Radiator Fan Relay No.1, No.2 and No.3 Inspection

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- 1) Disconnect negative cable at battery.
- 2) Remove relay(s) from connector(s).

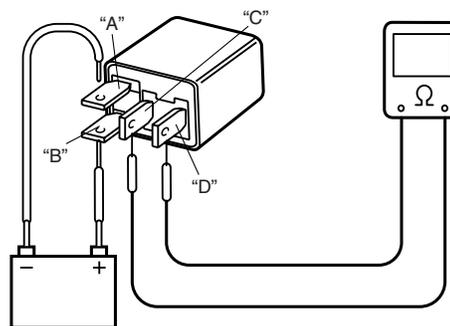


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1.	Radiator fan relay No.1
2.	Radiator fan relay No.2
3.	Radiator fan relay No.3

## 1C-11 Engine Electrical Devices:

- 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 "A" of relay.  
Check continuity between terminal "C" and "D".  
If there is no continuity when relay is connected to the battery, replace relay.



I2RH0B130016-01

## Specifications

### Tightening Torque Specifications

S5RH0A1307001

Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
IAC valve screw	3.5	0.35	2.5	🔧
MAP sensor bolt	5	0.5	4.0	🔧
TP sensor screw	2.5	0.25	1.8	🔧
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

S5RH0A1308001

#### SUZUKI scan tool

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

