Suzuki Swift Sport (RS416)

2004-2008 Service/Repair Manual

SUZUKI

This Service Manual has been prepared with the latest service information available at the time of publication. It is subdivided into various group categories and each section contains diagnostic, disassembly, repair and installation procedures along with complete specifications and tightening references. Please read this manual carefully before proceeding, as incorrect service procedures may result in injury or death to service personnel or to the operator's of the vehicle.

IMPORTANT

WARNING/CAUTION/NOTE

Please read this manual and follow its instructions carefully. To emphasize special information, the words **⚠ WARNING**, **⚠ CAUTION** and **NOTE** have special meanings. Pay special attention to the messages highlighted by these signal words.

⚠ WARNING

Indicates a potential hazard that could result in death or injury.

⚠ CAUTION

Indicates a potential hazard that could result in vehicle damage.

NOTE:

Indicates special information to make maintenance easier or instructions clearer.

⚠ WARNING

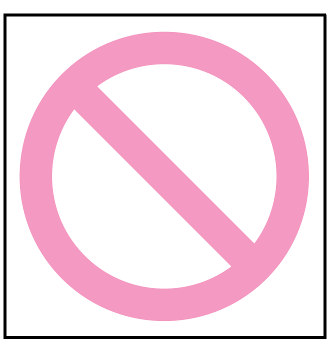
This service manual is intended for authorized Suzuki dealers and qualified service technicians only. Inexperienced technicians or technicians without the proper tools and equipment may not be able to properly perform the services described in this manual.
Improper repair may result in injury to the technician and may render the vehicle unsafe for the driver and passengers.

⚠ WARNING

For vehicles equipped with a Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to “Air Bag System Components and Wiring Location View” under “General Description” in air bag system section in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS and “Service Precautions” under “On-Vehicle Service” in air bag system section before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **If the air bag system and another vehicle system both need repair, Suzuki recommends that the air bag system be repaired first, to help avoid unintended air bag system activation.**
- **Do not modify the steering wheel, instrument panel or any other air bag system component on or around air bag system components or wiring. Modifications can adversely affect air bag system performance and lead to injury.**
- **If the vehicle will be exposed to temperatures over 93 °C (200 °F), for example, during a paint baking process, remove the air bag system components, that is air bag (inflator) modules, SDM and/or seat belt with pretensioner, beforehand to avoid component damage or unintended activation.**

The circle with a slash in this manual means “Don’t do this” or “Don’t let this happen”.



FOREWORD

This manual (Volumes 1 and 2) contains procedures for diagnosis, maintenance, adjustments, minor service operations, replacement of components (Service) and for disassembly and reassembly of major components (Unit Repair-Overhaul).

Applicable Model:
SWIFT (RS416) produced at KOSAI plant in Japan with the following vehicle identification numbers (VINs).

JSAEZC31S###########

The contents are classified into sections each of which is given a section number as indicated in the Table of Contents on following page. And on the first page of each individual section is an index of that section.
This manual should be kept in a handy place for ready reference of the service work.
Strict observance of the so specified items will enable one to obtain the full performance of the vehicle.

When replacing parts or servicing by disassembling, it is recommended to use SUZUKI genuine parts, tools and service materials as specified in each description.

All information, illustrations and specifications contained in this literature are based on the latest product information available at the time of publication approval. And used as the main subject of description is the vehicle of standard specifications among others.
Therefore, note that illustrations may differ from the vehicle being actually serviced.
The right is reserved to make changes at any time without notice.

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Precautions

Precautions for Vehicles Equipped with a Supplemental Restraint (Air Bag) System

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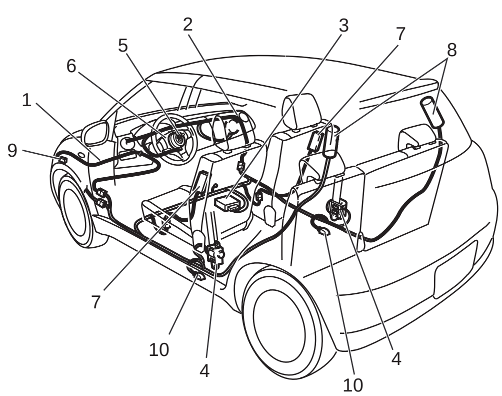
⚠ WARNING

- **The configuration of air bag system parts are as shown in the figure. When it is necessary to service (remove, reinstall and inspect) these parts, be sure to follow procedures described in Air Bag System section. Failure to follow proper procedures could result in possible air bag system activation, personal injury, damage to parts or air bag system being unable to activate when necessary.**
- **If the air bag system and another vehicle system both need repair, SUZUKI recommends that the air bag system be repaired first, to help avoid unintended air bag system activation.**
- **Do not modify the steering wheel, dashboard, or any other air bag system components. Modifications can adversely affect air bag system performance and lead to injury.**
- **If the vehicle will be exposed to temperatures over 93 °C (200 °F) (for example, during a paint baking process), remove the air bag system components beforehand to avoid component damage or unintended air bag system activation.**



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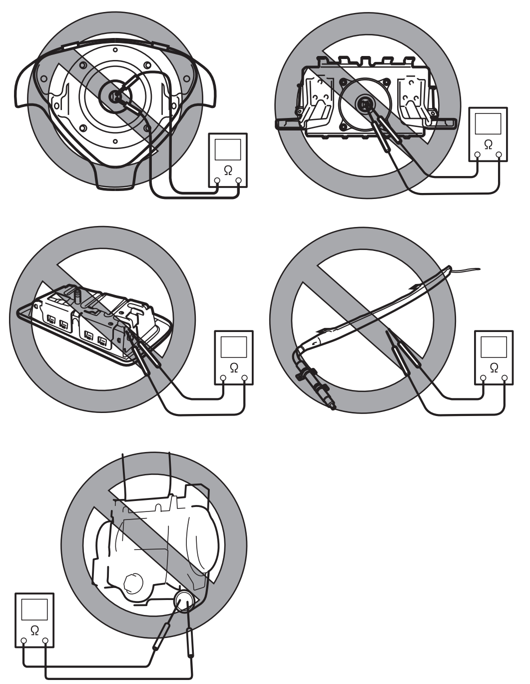
1. Air bag wire harness (in floor, main and instrument panel harness)	6. Driver air bag (inflator) module
2. Passenger air bag (inflator) module	7. Side air bag (inflator) module (if equipped)
3. SDM	8. Curtain air bag (inflator) module (if equipped)
4. Seat belt pretensioner	9. Forward sensor
5. Contact coil	10. Side sensor (if equipped)

Diagnosis

- When troubleshooting air bag system, be sure to follow “Diagnosis” in Air Bag System section. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis, and incorrect parts replacement.
- Never use electrical test equipment other than that specified.

⚠ WARNING

Never attempt to measure the resistance of the air bag (inflator) modules (driver, passenger, side and curtain) and seat belt pretensioners (driver and passenger). It is very dangerous as the electric current from the tester may deploy the air bag or activate the pretensioner.



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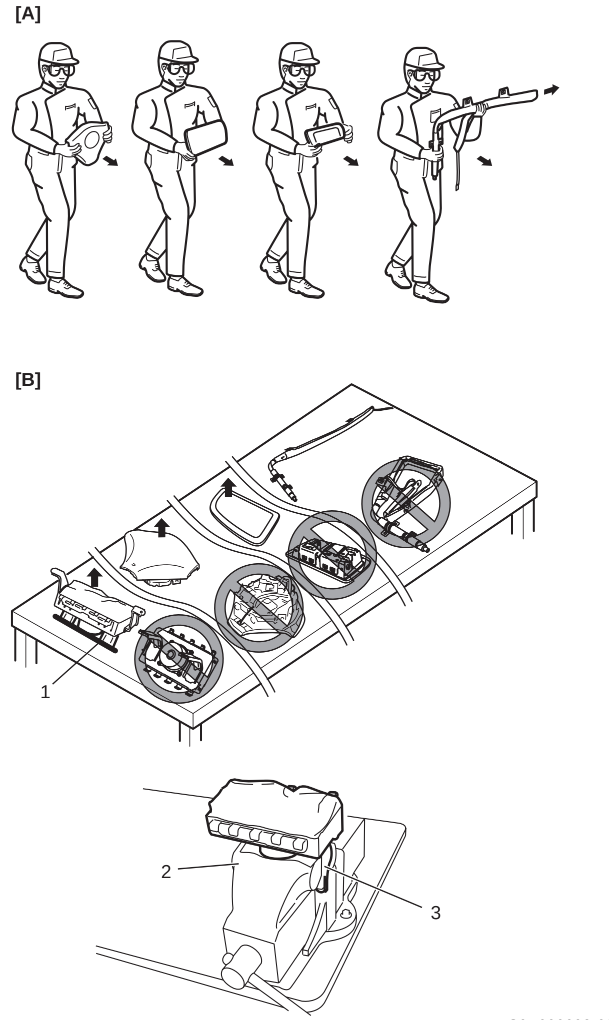
Servicing and Handling

⚠ WARNING

Many of service procedures require disconnection of "A/BAG" fuse and all air bag (inflator) module(s) from initiator circuit to avoid an accidental deployment.
Driver, Passenger, Side and Curtain Air Bag (Inflator) Modules

- **For handling and storage of a live air bag (inflator) module, select a place where the ambient temperature below 65 °C (150 °F), without high humidity and away from electric noise.**
- **When carrying a live air bag (inflator) module, make sure the bag opening is pointed away from you. In case of an accidental deployment, the bag will then deploy with minimal chance of injury. Never carry the air bag (inflator) module by the wires or connector on the underside of the module. When placing a live air bag (inflator) module on a bench or other surface, always face the bag up, away from the surface. As the live passenger air bag (inflator) module must be placed with its bag (trim cover) facing up, place it on the workbench with a slit (1) or use the workbench vise (2) to hold it securely at its lower mounting bracket (3). It is also prohibited to place anything on top of the trim cover and stack air bag (inflator) modules. This is necessary so that a free space is provided to allow the air bag to expand in the unlikely event of accidental deployment. Otherwise, personal injury may result.**
- **Never dispose of live (undeployed) air bag (inflator) modules (driver, passenger, side and curtain). If disposal is necessary, be sure to deploy them according to deployment procedures described in "Air Bag (Inflator) Module and Seat Belt Pretensioner Disposal in Section 8B" before disposal.**
- **The air bag (inflator) module immediately after deployment is very hot. Wait for at least half an hour to cool it off before proceeding the work.**
- **After an air bag (inflator) module has been deployed, the surface of the air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by-products of the chemical reaction. As with many service procedures, gloves and safety glasses should be worn.**



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[A]:	Always carry air bag (inflator) module with trim cover (air bag opening) away from body.
[B]:	Always place air bag (inflator) module on workbench with trim cover (air bag opening) up, away from loose objects.

⚠ WARNING

SDM

- **For handling and storage of a SDM, select a place where the ambient temperature below 65 °C (150 °F), without high humidity and away from electric noise.**
- **During service procedures, be very careful when handling a Sensing and Diagnostic Module (SDM). Never strike or jar the SDM.**
- **Never power up the air bag system when the SDM is not rigidly attached to the vehicle. All SDM and mounting bracket fasteners must be carefully torqued and the arrow must be pointing toward the front of the vehicle to ensure proper operation of the air bag system.**
  The SDM could be activated when powered while not rigidly attached to the vehicle which could cause deployment and result in personal injury.

⚠ WARNING

Driver and Passenger Seat Belt Pretensioners

- **For handling and storage of a live seat belt pretensioner, select a place where the ambient temperature below 65 °C (150 °F), without high humidity and away from electric noise.**
- **Never carry seat belt pretensioner by wire or connector of pretensioner. When placing a live seat belt pretensioner on the workbench or some place like that, never put something on seat belt pretensioner. Otherwise, personal injury may result.**
- **Never dispose of live (inactivated) seat belt pretensioners (drive and passenger). If disposal is necessary, be sure to activate them according to activation procedures described in “Air Bag (Inflator) Module and Seat Belt Pretensioner Disposal in Section 8B” before disposal.**
- **The seat belt pretensioner immediately after activation is very hot. Wait for at least half an hour to cool it off before proceeding the work.**
- **With many service procedures, gloves and safety glasses should be worn to prevent any possible irritation of the skin or eyes.**

- Even when the accident was light enough not to cause air bags to activate, be sure to inspect system parts and other related parts according to instructions under “Repair and Inspection Required after Accident in Section 8B”.
- When servicing parts other than air bag system, if shocks may be applied to air bag system component parts, remove those parts beforehand.
- When handling the air bag (inflator) modules (driver, passenger, side and curtain), seat belt pretensioners (driver and passenger), forward sensor, side sensors or SDM, be careful not to drop it or apply an impact to it. If an excessive impact was applied, never attempt disassembly or repair but replace it with a new one.
- When grease, cleaning agent, oil, water, etc. has got onto air bag (inflator) modules (driver, passenger, side and curtain) or seat belt pretensioners (drive and passenger), wipe off immediately with a dry cloth.
- Air bag wire harness is included in floor and instrument panel wire harnesses. Air bag wire harness branched off from floor and instrument panel wire harnesses can be identified easily as it is covered with a yellow protection tube and it has yellow connectors. Be very careful when handling it.
- When an open in air bag wire harness, damaged wire harness, connector or terminal is found, replace wire harness, connectors and terminals as an assembly.
- Do not apply power to the air bag system unless all components are connected or a diagnostic flow requests it, as this will set a DTC.
- Never use air bag system component parts from another vehicle.
- When using electric welding, be sure to disconnect all air bag (inflator) module connectors and pretensioner connectors from air bag wire harness respectively.
- Never expose air bag system component parts directly to hot air (drying or baking the vehicle after painting) or flames.
- WARNING / CAUTION labels are attached on each part of air bag system components. Be sure to follow the instructions.
- After vehicle is completely repaired, perform “Air Bag Diagnostic System Check in Section 8B”.

General Precautions

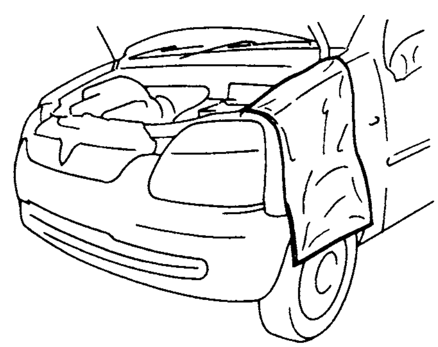
S7RS0B0000002

The WARNING and CAUTION describe some general precautions that you should observe when servicing a vehicle. These general precautions apply to many of the service procedures, and they will not necessarily be repeated with each procedure to which they apply.

⚠ WARNING

- **Whenever raising a vehicle for service, be sure to follow the instructions under "Vehicle Lifting Points in Section 0A".**
- **When it is necessary to do service work with the engine running, make sure that the parking brake is set fully and the transmission is in Neutral (for manual transmission vehicles) or Park (for automatic transmission vehicles), Keep hands, hair, clothing, tools, etc. away from the fan and belts when the engine is running.**
- **When it is necessary to run the engine indoors, make sure that the exhaust gas is forced outdoors.**
- **Do not perform service work in areas where combustible materials can come in contact with a hot exhaust system. When working with toxic or flammable materials (such as gasoline and refrigerant), make sure that the area you work in is well-ventilated.**
- **To avoid getting burned, keep away from hot metal parts such as the radiator, exhaust manifold, tail pipe, muffler, etc.**
- **New and used engine oil can be hazardous. Children and pets may be harmed by swallowing new or used oil. Keep new and used oil and used engine oil filters away from children and pets. Continuous contact with used engine oil has been found to cause [skin] cancer in laboratory animals. Brief contact with used oil may irritate skin. To minimize your exposure to used engine oil, wear a long-sleeve shirt and moisture-proof gloves (such as dish washing gloves) when changing engine oil. If engine oil contacts your skin, wash thoroughly with soap and water. Launder any clothing or rags if wet with oil, recycle or properly dispose of used oil and filters.**
- **Be sure to observe following instructions when handling service materials such as fuel, oil, fluid, coolant, grease, sealant, thread lock cement, etc. Otherwise, your health may be ruined.**
  - **Whenever handling any of these service materials, wear safety glasses to protect your eyes. If it gets into your eye, it may cause inflammation.**
  - **Whenever handling any of these service materials, wear moisture-proof gloves to protect your skin. If it adheres to your skin, it may cause inflammation.**
  - **Do not swallow any of these service materials. It would cause diarrhea or nausea.**
  - **Keep all these materials out of children's reach.**
- **Make sure the bonnet is fully closed and latched before driving. If it is not, it can fly up unexpectedly during driving, obstructing your view and resulting in an accident.**

- Before starting any service work, cover fenders, seats and any other parts that are likely to get scratched or stained during servicing. Also, be aware that what you wear (e.g., buttons) may cause damage to the vehicle's finish.



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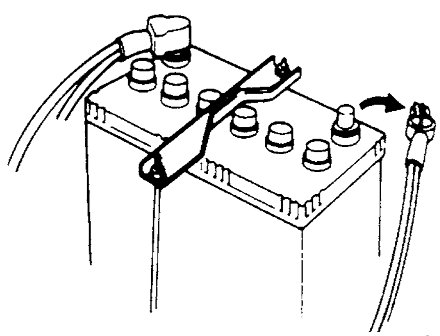
- When performing service to electrical parts that does not require use of battery power, disconnect the negative cable of the battery.
- When disconnecting the negative cable from the battery, be careful to the following.
  – Check and record DTCs in ECM and HVAC control module if necessary before disconnecting.
  – Record displayed contents of the clock and/or audio system, etc. before disconnecting and reset it as before after connecting.
  – For vehicle equipped with electric throttle body system, perform electric throttle body system calibration referring to "Electric Throttle Body System Calibration in Section 1C" after reconnecting the negative cable to the battery.
  – For vehicle equipped with ESP®, calibrate steering angle sensor referring to "Sensor Calibration in Section 4F" after reconnecting the negative cable to the battery.



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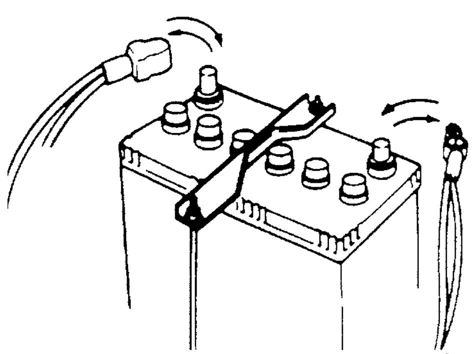
- When removing the battery, be sure to disconnect the negative cable first and then the positive cable. When reconnecting the battery, connect the positive cable first and then the negative cable, and replace the terminal cover.



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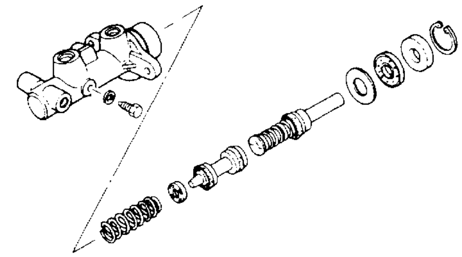
- When removing parts that are to be reused, be sure to keep them arranged in an orderly manner so that they may be reinstalled in the proper order and position.



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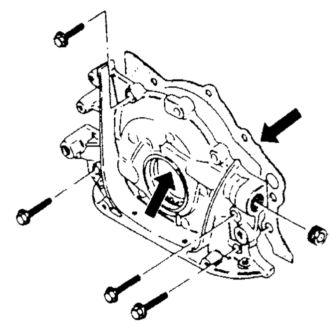
- Whenever you use oil seals, gaskets, packing, O-rings, locking washers, split pins, self-locking nuts, and certain other parts as specified, be sure to use new ones. Also, before installing new gaskets, packing, etc., be sure to remove any residual material from the mating surfaces.



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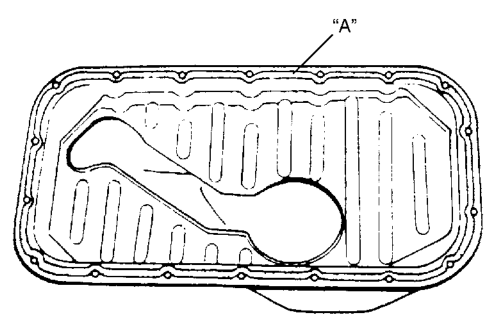
- Make sure that all parts used in reassembly are perfectly clean.
  When use of a certain type of lubricant, bond or sealant is specified, be sure to use the specified type.

"A": Water tight sealant 99000–31250 (SUZUKI Bond No.1207F)



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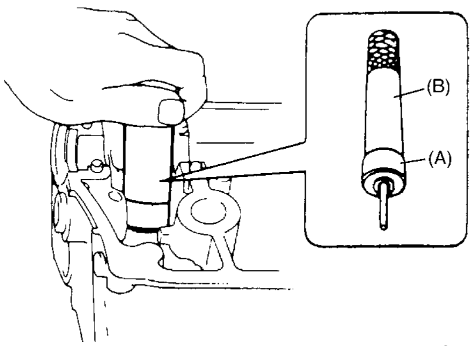
- Be sure to use special tools when instructed.

  Special tool
  (A): 09917-98221
  (B): 09916-58210



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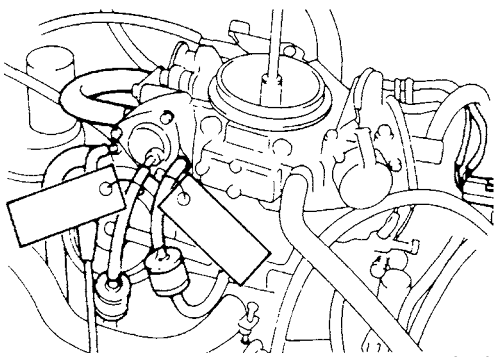
- When disconnecting vacuum hoses, attach a tag describing the correct installation positions so that the hoses can be reinstalled correctly.



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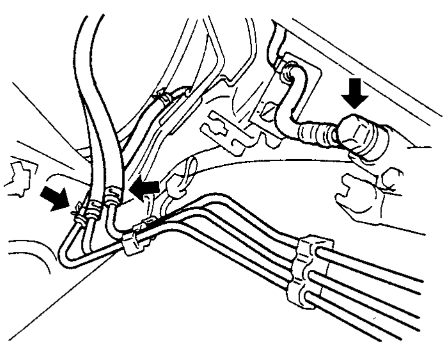
- After servicing fuel, oil, coolant, vacuum, exhaust or brake systems, check all lines related to the system for leaks.



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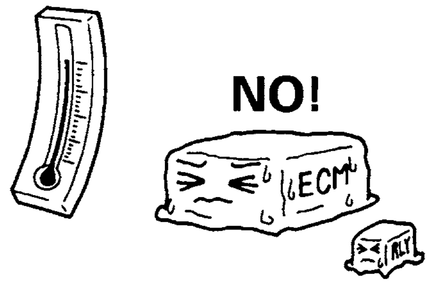
- For vehicles equipped with fuel injection systems, never disconnect the fuel line between the fuel pump and injector without first releasing the fuel pressure, or fuel can be sprayed out under pressure.
- When performing a work that produces a heat exceeding 80 °C (176 °F) in the vicinity of the electrical parts, remove the heat sensitive electrical part(s) beforehand.



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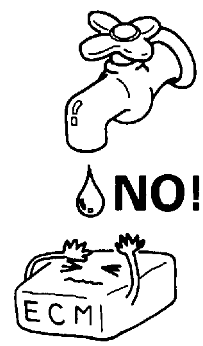
- Use care not to expose connectors and electrical parts to water which will be a cause of a trouble.



I2RH01010035-01

- Always be careful not to handle electrical parts (computer, relay, etc.) in a rough manner or drop them.

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Warning for Wheel (with tire) Removal

S7RS0B0000003

⚠ WARNING

When removing any of these wheels installed with wheel bolts, never remove all wheel bolts at the same time. Leave at least 1 bolt for each wheel as it is to prevent wheel from dropping. When removing this remaining 1 bolt, hold wheel and tire so as not to allow them to come off.

Warning for Handling Emergency Flat Tire Repair Kit

S7RS0B0000004

⚠ WARNING

If vehicle is equipped with Emergency Flat Tire Repair Kit instead of spare tire, be sure to observe "Precaution for Emergency Flat Tire Repair Kit in Section 2D" when handling Emergency Flat Tire Repair Kit and repairing flat tire.
Otherwise, your health may be ruined or it will be impossible to repair flat tire.

Precautions for Catalytic Converter

S7RS0B0000005

For vehicles equipped with a catalytic converter, use only unleaded gasoline and be careful not to let a large amount of unburned gasoline enter the converter or it can be damaged.

- Conduct a spark jump test only when necessary, make it as short as possible, and do not open the throttle.
- Conduct engine compression checks within the shortest possible time.
- Avoid situations which can result in engine misfire (e.g. starting the engine when the fuel tank is nearly empty.)

Precautions for Installing Mobile Communication Equipment

S7RS0B0000006

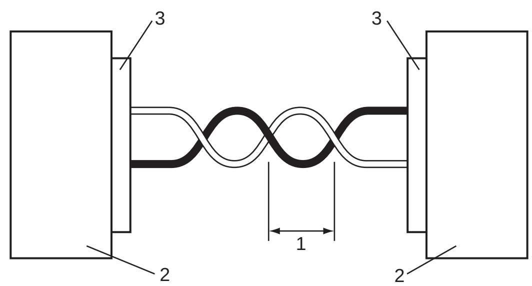
When installing mobile communication equipment such as CB (Citizens-Band)-radio or cellular-telephone, be sure to observe the following precautions.
Failure to follow cautions may adversely affect electronic control system.

- Keep the antenna as far away as possible from the vehicle's electronic control unit.
- Keep the antenna feeder more than 20 cm (7.9 in.) away from electronic control unit and its wire harnesses.
- Do not run the antenna feeder parallel with other wire harnesses.
- Confirm that the antenna and feeder are correctly adjusted.

Precaution for CAN Communication System

S7RS0B0000007

- The loose (1) in the wire harnesses twist of the CAN lines except around the connector (3) should be within 100 mm (3.9 in.). Refer to the wiring diagram for the CAN lines discrimination. Excessively-loosed lines may be influenced by the electric noise.



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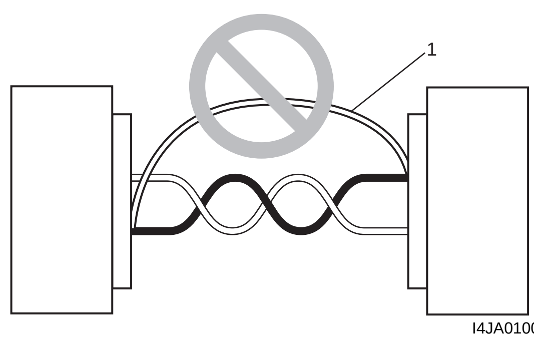
- Do not connect terminals of the CAN line using a bypass wire (1). Otherwise, the CAN line may be influenced by the electric noise.



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Precautions for Electrical Circuit Service

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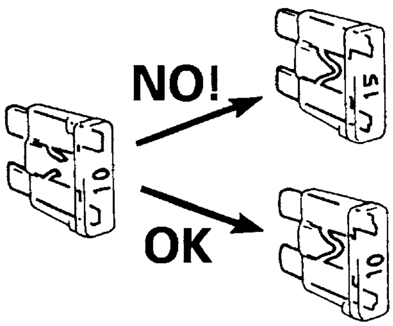
- When replacing a fuse, make sure to use a fuse of the specified capacity. Use of a fuse with a larger capacity will cause a damage to the electrical parts and a fire.



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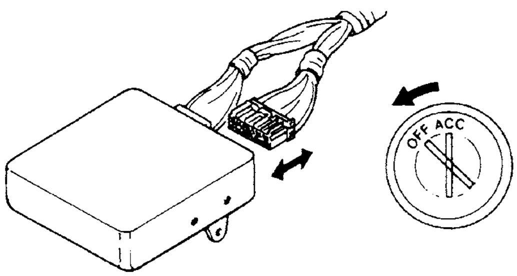
- When disconnecting and connecting coupler, make sure to turn ignition switch OFF, or electronic parts may get damaged.



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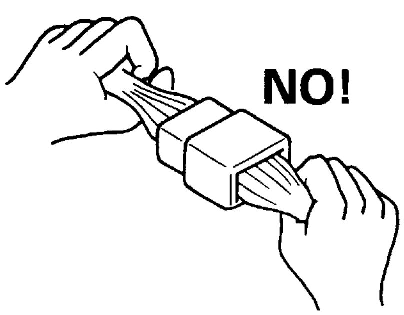
- When disconnecting connectors, never pull the wiring harness. Unlock the connector lock first and then pull them apart by holding connectors themselves.



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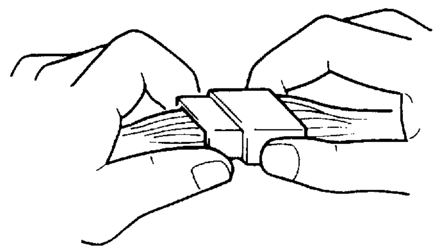
- When connecting connectors, also hold connectors and put them together until they lock securely (a click is heard).



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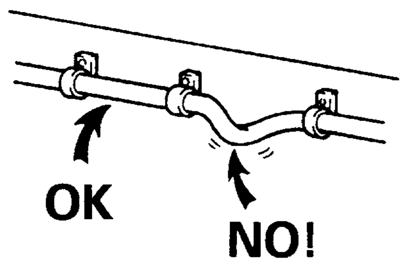
- When installing the wiring harness, fix it with clamps so that no slack is left.



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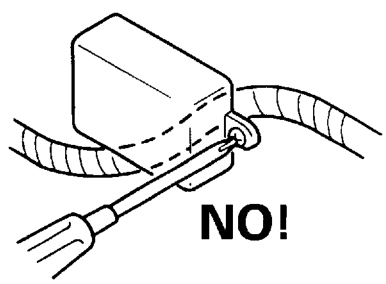
- When installing vehicle parts, be careful so that the wiring harness is not interfered with or caught by any other part.



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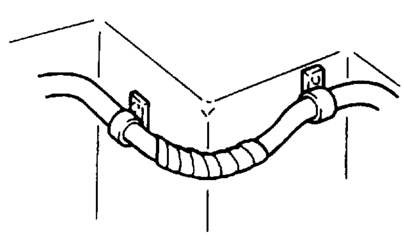
- To avoid damage to the harness, protect its part which may contact against a part forming a sharp angle by winding tape or the like around it.



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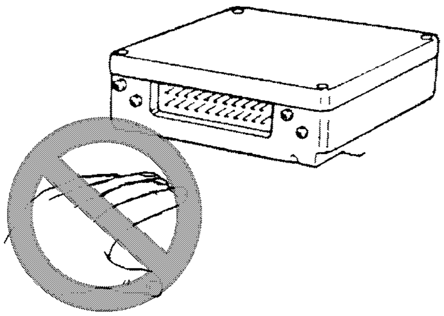
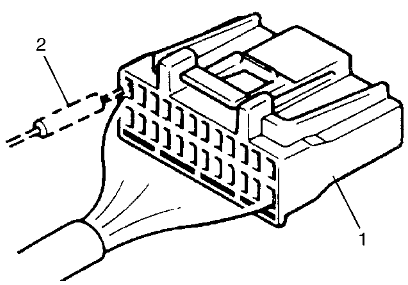
- Be careful not to touch the electrical terminals of parts which use microcomputers (e.g. electronic control unit like as ECM, PCM, P/S controller, etc.). The static electricity from your body can damage these parts.



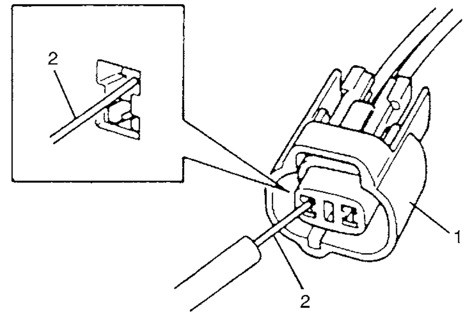
I3RM0A000004-01

- Never connect any tester (voltmeter, ohmmeter, or whatever) to electronic control unit when its coupler is disconnected. Attempt to do it may cause damage to it.
- Never connect an ohmmeter to electronic control unit with its coupler connected to it. Attempt to do it may cause damage to electronic control unit and sensors.
- Be sure to use a specified voltmeter / ohmmeter. Otherwise, accurate measurements may not be obtained or personal injury may result. If not specified, use a voltmeter with high impedance (M Ω/V minimum) or a digital type voltmeter.
- When taking measurements at electrical connectors using a tester probe, be sure to insert the probe (2) from the wire harness side (backside) of the connector (1).



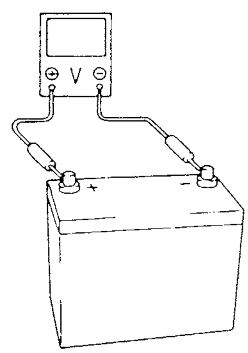
I2RH01010046-01

- When connecting meter probe (2) from terminal side of coupler (1) because it can't be connected from harness side, use extra care not to bend male terminal of coupler of force its female terminal open for connection.
  In case of such coupler as shown connect probe as shown to avoid opening female terminal.
  Never connect probe where male terminal is supposed to fit.



I2RH01010047-01

- When checking connection of terminals, check its male half for bend and female half for excessive opening and both for locking (looseness), corrosion, dust, etc.
- Before measuring voltage at each terminal, check to make sure that battery voltage is 11 V or higher. Such terminal voltage check at low battery voltage will lead to erroneous diagnosis.



I2RH01010048-01

Air Bag Warning

S7RS0B0000009

⚠ WARNING

For vehicles equipped with Supplemental Restraint (Air Bag) System:

- **Service on and around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Refer to “Air Bag System Components, Wiring and Connectors Location in Section 8B” in order to confirm whether you are performing service on or near the air bag system components or wiring. Please observe all WARNINGS in Air Bag System section and “Precautions on Service and Diagnosis of Air Bag System in Section 8B” before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintentional activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **Technical service work must be started at least 90 seconds after the ignition switch is turned to the LOCK position and the negative cable is disconnected from the battery. Otherwise, the system may be activated by reserve energy in the Sensing and Diagnostic Module (SDM).**

Air Bag System Service Warning

S7RS0B0000010

⚠ WARNING

- **Service on or around the air bag system components or wiring must be performed only by an authorized SUZUKI dealer. Please observe all WARNINGS in Air Bag System section and “Precautions on Service and Diagnosis of Air Bag System in Section 8B” before performing service on or around the air bag system components or wiring. Failure to follow WARNINGS could result in unintended activation of the system or could render the system inoperative. Either of these two conditions may result in severe injury.**
- **The procedures in the air bag system section must be followed in the order listed to disable the air bag system temporarily and prevent false DTCs from setting. Failure to follow procedures could result in possible activation of the air bag system, personal injury or otherwise unneeded air bag system repairs.**

Fastener Caution

S7RS0B0000011

⚠ CAUTION

When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread-locking compound, will be called out. The correct torque value must be used when installing fasteners that require it. If the conditions are not followed, parts or system damage could result.

Suspension Caution

S7RS0B0000012

⚠ CAUTION

- **All suspension fasteners are an important attaching part in that it could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of this part.**
- **Never attempt to heat, quench or straighten any suspension part. Replace it with a new part or damage to the part may result.**

Wheels and Tires Caution

S7RS0B0000013

⚠ CAUTION

All wheel fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of the same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts.
There is to be no welding as it may result in extensive damage and weakening of the metal.

Precaution for Vehicle Equipped with ESP® System

S7RS0B0000015

- When testing with any of the following equipments (when vehicle is tested by rotating wheels (tires) under vehicle stop), be sure to deactivate ESP® system referring to “Precautions in Speedometer Test or Other Tests in Section 4F” to obtain correct data.
  - 2 or 4-wheel chassis dynamometer
  - Speedometer tester
  - Brake tester
  - Etc.

ESP® control module

- When ESP® control module is removed / installed, do not use impact wrenches which generate shock or impact to avoid damaging sensors in ESP® control module.
- When any of the following operation is done, calibrate steering angle sensor referring to “Sensor Calibration in Section 4F”.
  - When battery or dome fuse is removed.
  - When steering angle sensor is replaced.

Brake Caution

S7RS0B0000014

⚠ **CAUTION**

All brake fasteners are important attaching parts in that they could affect the performance of vital parts and systems, and/or could result in major repair expense. They must be replaced with one of same part number or with an equivalent part if replacement becomes necessary. Do not use a replacement part of lesser quality or substitute design. Torque values must be used as specified during reassembly to assure proper retention of all parts. There is to be no welding as it may result in extensive damage and weakening of the metal.

Repair Instructions

Electrical Circuit Inspection Procedure

S7RS0B0006001

While there are various electrical circuit inspection methods, described here is a general method to check its open and short circuit by using an ohmmeter and a voltmeter.

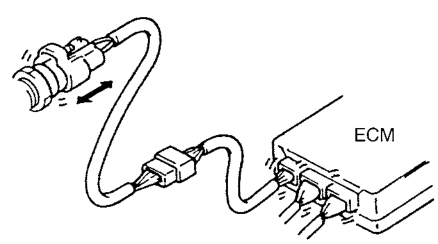
Open Circuit Check

Possible causes for the open circuit are as follows. As the cause is in the connector or terminal in many cases, they need to be checked particularly carefully.

- Loose connection of connector
- Poor contact of terminal (due to dirt, corrosion or rust on it, poor contact tension, entry of foreign object etc.)
- Wire harness being open

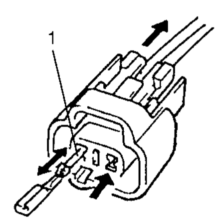
When checking system circuits including an electronic control unit such as ECM, TCM, ABS control module, etc., it is important to perform careful check, starting with items which are easier to check.

1) Disconnect negative (–) cable from battery
2) Check each connector at both ends of the circuit being checked for loose connection. Also check lock condition of connector if equipped with connector lock.



I2RH01010049-01

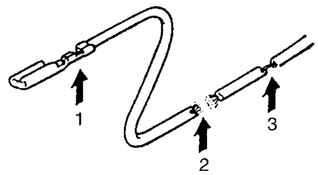
3) Using a test male terminal, check both terminals of the circuit being checked for contact tension of its female terminal. Check each terminal visually for poor contact (possibly caused by dirt, corrosion, rust entry of foreign object, etc.). At the same time, check to make sure that each terminal is locked in the connector fully.



I2RH01010050-01

1.	Check contact tension by inserting and removing just for once.

4) Using continuity check or voltage check the following procedure, check the wire harness for open circuit and poor connection with its terminals. Locate abnormality, if any.

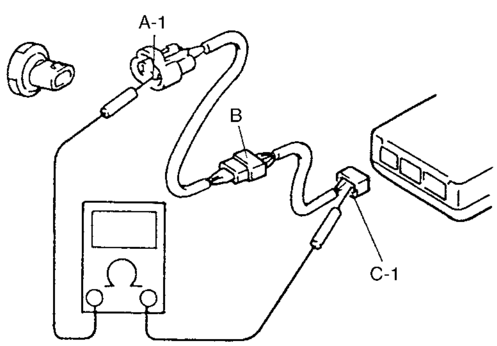


I2RH01010051-01

1.	Looseness of crimping
2.	Open
3.	Thin wire (single strand of wire)

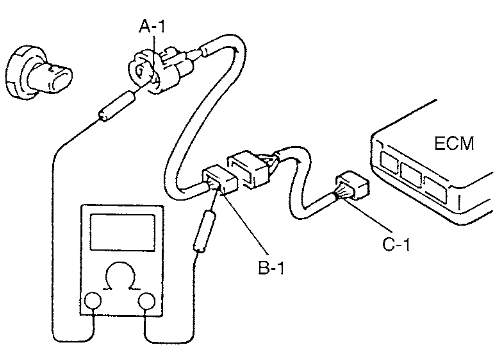
Continuity Check

1) Measure resistance between connector terminals at both ends of the circuit being checked (between "A-1" and "C-1" in the figure). If no continuity is indicated (infinity or over limit), that means that the circuit is open between terminals "A-1" and "C-1".



I2RH01010052-01

2) Disconnect the connector included in the circuit (connector-B in the figure) and measure resistance between terminals "A-1" and "B-1".
If no continuity is indicated, that means that the circuit is open between terminals "A-1" and "B-1". If continuity is indicated, there is an open circuit between terminals "B-1" and "C-1" or an abnormality in connector-B.



I2RH01010053-01

Voltage Check

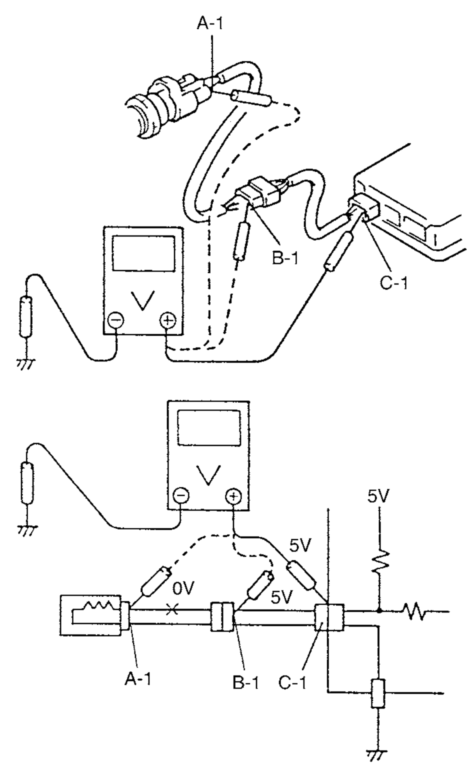
If voltage is supplied to the circuit being checked, voltage check can be used as circuit check.

1) With all connectors connected and voltage applied to the circuit being checked, measure voltage between each terminal and body ground.
   a) If measurements were taken as shown in the figure and results were as listed in the following, it means that the circuit is open between terminals "B-1" and "A-1".

      <u>Voltage between</u>
      "C-1" and body ground: Approx. 5 V
      "B-1" and body ground: Approx. 5 V
      "A-1" and body ground: 0 V

   b) Also, if measured values were as listed in the following, it means that there is a resistance (abnormality) of such level that corresponds to the voltage drop in the circuit between terminals "A-1" and "B-1".

      <u>Voltage between</u>
      "C-1" and body ground: Approx. 5 V
      "B-1" and body ground: Approx. 5 V
      "A-1" and body ground: Approx. 3 V



I5RH01000005-01

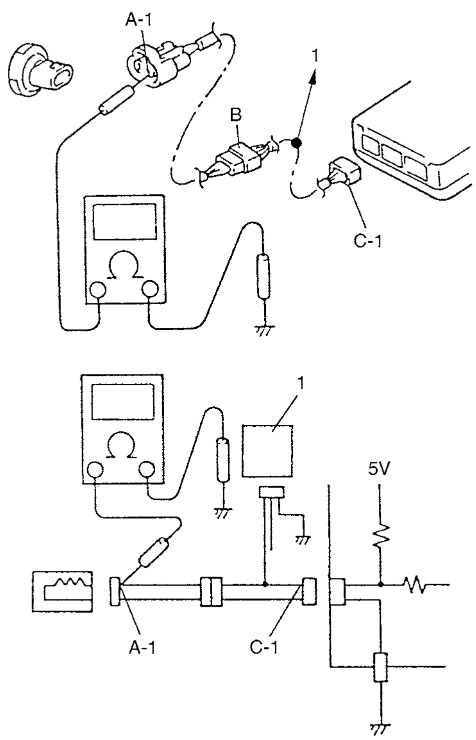
Short Circuit Check (Wire Harness to Ground)

1) Disconnect negative (–) cable at battery.
2) Disconnect connectors at both ends of the circuit to be checked.

NOTE

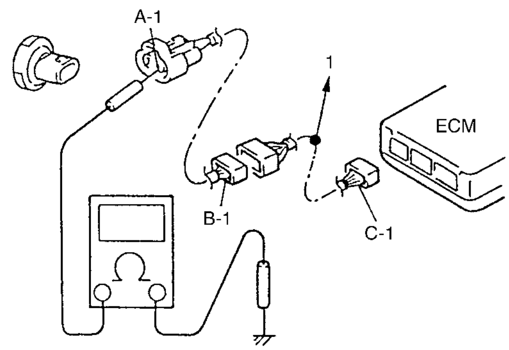
If the circuit to be checked is connected to other parts (1), disconnect all connectors of those parts.
Otherwise, diagnosis will be misled.

3) Measure resistance between terminal at one end of circuit ("A-1" terminal in the figure) and body ground. If continuity is indicated, it means that there is a short to ground between terminals "A-1" and "C-1" of the circuit.



I5RH01000006-01

4) Disconnect the connector included in circuit (connector-B) and measure resistance between "A-1" and body ground. If continuity is indicated, it means that the circuit is shorted to the ground between terminals "A-1" and "B-1".



I2RH01010056-01

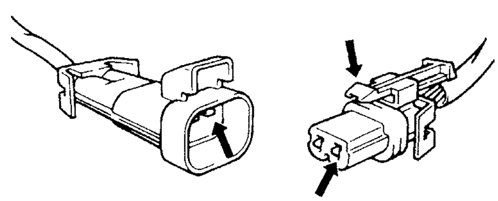
1.	To other parts

Intermittent and Poor Connection Inspection

S7RS0B0006002

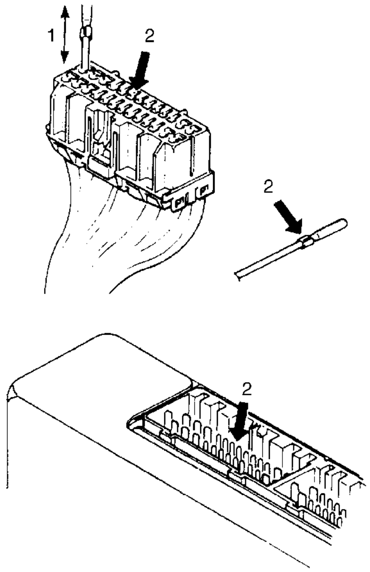
Most intermittent are caused by faulty electrical connections or wiring, although a sticking relay or solenoid can occasionally be at fault. When checking it for proper connection, perform careful check of suspect circuits for:

- Poor mating of connector halves, or terminals not fully seated in the connector body (backed out).
- Dirt or corrosion on the terminals. The terminals must be clean and free of any foreign material which could impede proper terminal contact. However, cleaning the terminal with a sand paper or the like is prohibited.
- Damaged connector body, exposing the terminals to moisture and dirt, as well as not maintaining proper terminal orientation with the component or mating connector.



I2RH01010057-01

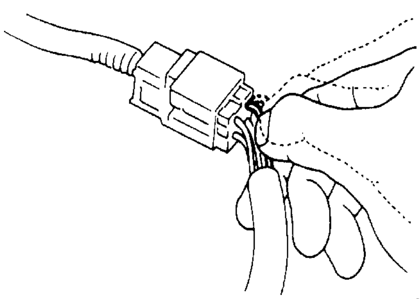
- Improperly formed or damaged terminals.
  Check each connector terminal in problem circuits carefully to ensure good contact tension by using the corresponding mating terminal.
  If contact tension is not enough, reform it to increase contact tension or replace.



I5RH01000007-01

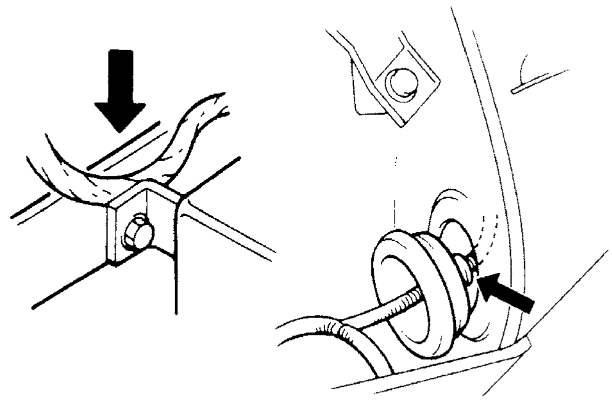
1.	Check contact tension by inserting and removing just once.
2.	Check each terminal for bend and proper alignment.

- Poor terminal-to-wire connection.
  Check each wire harness in problem circuits for poor connection by shaking it by hand lightly. If any abnormal condition is found, repair or replace.



I2RH01010059-01

- Wire insulation which is rubbed through, causing an intermittent short as the bare area touches other wiring or parts of the vehicle.
- Wiring broken inside the insulation. This condition could cause continuity check to show a good circuit, but if only 1 or 2 strands of a multi-strand-type wire are intact, resistance could be far too high.
  If any abnormality is found, repair or replace.



I2RH01010060-01

Section 0

General Information

CONTENTS

General Information

General Description

Abbreviations

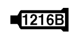
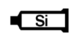
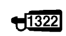
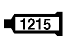
S7RS0B0101001

A:
ABDC: After Bottom Dead Center
ABS: Anti-lock Brake System
AC: Alternating Current
A/C: Air Conditioning
A-ELR: Automatic-Emergency Locking Retractor
A/F: Air Fuel Mixture Ratio
ALR: Automatic Locking Retractor
API: American Petroleum Institute
APP sensor: Accelerator Pedal Position Sensor
A/T: Automatic Transmission, Automatic Transaxle
ATDC: After Top Dead Center
ATF: Automatic Transmission Fluid, Automatic Transaxle Fluid
B:
B+: Battery Positive Voltage
BBDC: Before Bottom Dead Center
BCM: Body Electrical Control Module
BDC: Bottom Dead Center
BTDC: Before Top Dead Center
C:
CAN: Controller Area Network
CKT: Circuit
CKP Sensor: Crankshaft Position Sensor
CMP Sensor: Camshaft Position Sensor
CO: Carbon Monoxide
CPP Switch: Clutch Pedal Position Switch (Clutch Switch, Clutch Start Switch)
CPU: Central Processing Unit
CRS: Child Restraint System
D:
DC: Direct Current
DLC: Data Link Connector (Assembly Line Diag. Link, ALDL, Serial Data Link, SDL)
DOHC: Double Over Head Camshaft
DOJ: Double Offset Joint
DRL: Daytime Running Light
DTC: Diagnostic Trouble Code (Diagnostic Code)
E:
EBCM: Electronic Brake Control Module, ABS Control Module
EBD: Electronic Brake Force Distribution
ECM: Engine Control Module
ECT Sensor: Engine Coolant Temperature Sensor (Water Temp. Sensor, WTS)
EFE Heater: Early Fuel Evaporation Heater (Positive Temperature Coefficient, PTC Heater)
EGR: Exhaust Gas Recirculation
EGRT Sensor: EGR Temperature Sensor (Recirculated Exhaust Gas Temp. Sensor, REGTS)
ELR: Emergency Locking Retractor
ESP®: Electronic Stability Program
EPS: Electronic Power Steering
EVAP: Evaporative Emission
EVAP Canister: Evaporative Emission Canister (Charcoal Canister)
F:
4WD: 4 Wheel Drive
G:
GEN: Generator
GND: Ground
GPS: Global Positioning System
H:
HVAC: Heating, Ventilating and Air Conditioning
HC: Hydrocarbons
HO2S: Heated Oxygen Sensor
I:
IAC Valve: Idle Air Control Valve (Idle Speed Control Solenoid Valve, ISC Solenoid Valve)
IAT Sensor: Intake Air Temperature Sensor (Air temperature Sensor, ATS)
ICM: Immobilizer Control Module
IG: Ignition
ISC Actuator: Idle Speed Control Actuator
L:
LH: Left Hand
LHD: Left Hand Drive Vehicle
LSPV: Load Sensing Proportioning Valve
M:
MAF Sensor: Mass Air Flow Sensor (Air Flow Sensor, AFS, Air Flow Meter, AFM)
MAP Sensor: Manifold Absolute Pressure Sensor (Pressure Sensor, PS)
Max: Maximum
MFI: Multiport Fuel Injection (Multipoint Fuel Injection)
Min: Minimum
MIL: Malfunction Indicator Lamp ("SERVICE ENGINE SOON" Light)
M/T: Manual Transmission, Manual Transaxle
N:
NOx: Nitrogen Oxides
O:
OBD: On-Board Diagnostic System (Self-Diagnosis Function)
O/D: Overdrive
OHC: Over Head Camshaft
O2S: Oxygen Sensor
P:
PCM: Powertrain Control Module
PCV: Positive Crankcase Ventilation
PNP: Park / Neutral Position
P/S: Power Steering
PSP Switch: Power Steering Pressure Switch (P/S Pressure Switch)
R:
RH: Right Hand
RHD: Right Hand Drive Vehicle
S:
SAE: Society of Automotive Engineers

SAS: Steering Angle Sensor
SDM: Sensing and Diagnostic Module (Air Bag Controller, Air bag Control Module)
SDT: Smart Diagnostic Tester
SFI: Sequential Multiport Fuel Injection
SOHC: Single Over Head Camshaft
T:
TBI: Throttle Body Fuel Injection (Single-Point Fuel Injection, SPI)
TCC: Torque Converter Clutch
TCM: Transmission Control Module (A/T Controller, A/T Control Module)
TDC: Top Dead Center
TP Sensor: Throttle Position Sensor
TVV: Thermal Vacuum Valve (Thermal Vacuum Switching Valve, TVSV, Bimetal Vacuum Switching Valve, BVSV)
TWC: Three Way Catalytic Converter (Three Way Catalyst)
2WD: 2 Wheel Drive
U:
USB: Universal Serial Bus
V:
VIN: Vehicle Identification Number
VSS: Vehicle Speed Sensor
VVT: Variable Valve Timing (Camshaft Position Control)
W:
WU-OC: Warm Up Oxidation Catalytic Converter
WU-TWC: Warm Up Three Way Catalytic Converter

Symbols

S7RS0B0101002

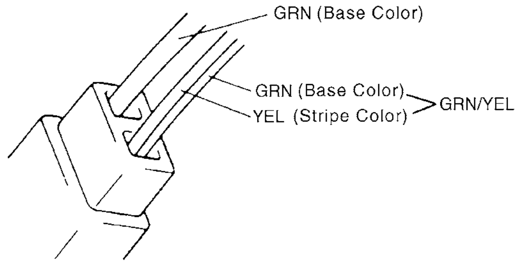
Symbol	Definition	Symbol	Definition
	Tightening torque		Apply SUZUKI BOND NO. 1216B 99000-31230
	Apply oil (engine, transmission, transfer, differential)		Apply SILICONE SEALANT 99000-31120
	Apply fluid (brake, power steering or automatic transmission fluid)		Apply SEALING COMPOUND 366E 99000-31090
	Apply SUZUKI SUPER GREASE A 99000-25011		
	Apply SUZUKI SUPER GREASE C 99000-25030		Apply THREAD LOCK 1322 99000-32110
	Apply SUZUKI SUPER GREASE E 99000-25050		Apply THREAD LOCK 1333B 99000-32020
	Apply SUZUKI SUPER GREASE H 99000-25121		Apply THREAD LOCK 1342 99000-32050
	Apply SUZUKI SUPER GREASE I 99000-25210		
	Apply SUZUKI BOND NO. 1215 99000-31110		Do not reuse
	Apply SUZUKI BOND NO. 1207F 99000-31250		Note on reassembly
	Apply SUZUKI BOND NO. 1217G 99000-31260		

Wire Color Symbols

S7RS0B0101003

Symbol		Wire Color	Symbol		Wire Color
B	BLK	Black	O, Or	ORN	Orange
Bl	BLU	Blue	R	RED	Red
Br	BRN	Brown	W	WHT	White
G	GRN	Green	Y	YEL	Yellow
Gr	GRY	Gray	P	PNK	Pink
Lbl	LT BLU	Light blue	V	PPL	Violet
Lg	LT GRN	Light green			

There are two kinds of colored wire used in this vehicle. One is single-colored wire and the other is dual-colored (striped) wire.
The single-colored wire uses only one color symbol (i.e. "GRN").
The dual-colored wire uses two color symbols (i.e. "GRN/YEL"). The first symbol represents the base color of the wire ("GRN" in the figure) and the second symbol represents the color of the stripe ("YEL" in the figure).



I2RH01010010-01

Fasteners Information

S7RS0B0101004

Metric Fasteners

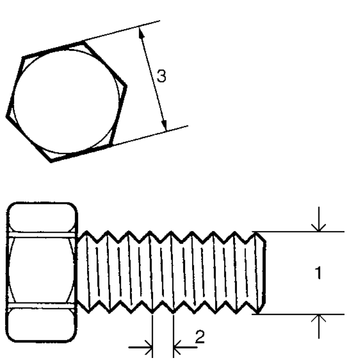
Most of the fasteners used for this vehicle are JIS-defined and ISO-defined metric fasteners. When replacing any fasteners, it is most important that replacement fasteners be the correct diameter, thread pitch and strength.

⚠ CAUTION

Even when the nominal diameter (1) of thread is the same, the thread pitch (2) or the width across flats (3) may vary between ISO and JIS. Refer to JIS-TO-ISO Main Fasteners Comparison Table below for the difference. Installing a mismatched bolt or nut will cause damage to the thread.
Before installing, check the thread pitch for correct matching and then tighten it by hand temporarily. If it is tight, recheck the thread pitch.

JIS-TO-ISO Main Fasteners Comparison Table

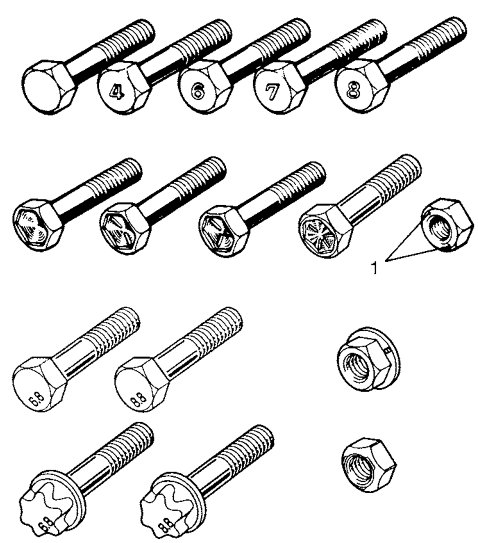
		Nominal diameter				
		M6	M8	M10	M12	M14
JIS	Thread pitch	1.0	1.25	1.25	1.25	1.5
	Width across flats	10	12	14	17	19
ISO	Thread pitch	1.0	1.25	1.5	1.5	1.5
	Width across flats	10	13	16	18	21



I4RH0A010005-01

Fastener Strength Identification

Most commonly used metric fastener strength property classes are 4T, 6.8, 7T, 8.8 and radial line with the class identification embossed on the head of each bolt. Some metric nuts will be marked with punch, 6 or 8 mark strength identification on the nut face. Figure shows the different strength markings.
When replacing metric fasteners, be careful to use bolts and nuts of the same strength or greater than the original fasteners (the same number marking or higher). It is likewise important to select replacement fasteners of the correct diameter and thread pitch. Correct replacement bolts and nuts are available through the parts division.
Metric bolts: Identification class numbers or marks correspond to bolt strength (increasing numbers represent increasing strength).



I5RH01010001-01

1. Nut strength identification

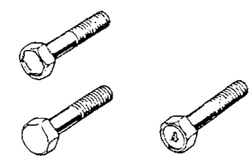
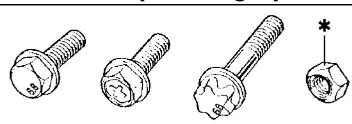
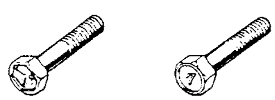
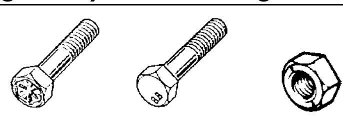
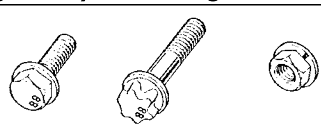
Standard Tightening Torque

Each fastener should be tightened to the torque specified in each section. If no description or specification is provided, refer to the following tightening torque chart for the applicable torque for each fastener. When a fastener of greater strength than the original one is used, however, use the torque specified for the original fastener.

NOTE

- **For the flanged bolt, flanged nut and self-lock nut of 4T and 7T strength, add 10% to the tightening torque given in the following chart.**
- **The following chart is applicable only where the fastened parts are made of steel light alloy.**

Tightening torque chart

Strength	Unit	Thread diameter (Nominal diameter) (mm)								
		4	5	6	8	10	12	14	16	18
A equivalent of 4T strength fastener	N·m	1.5	3.0	5.5	13	29	45	65	105	160
	kgf-m	0.15	0.30	0.55	1.3	2.9	4.5	6.5	10.5	16
 I2RH01010012-01	lb-ft	1.0	2.5	4.0	9.5	21.0	32.5	47.0	76.0	116.0
A equivalent of 6.8 strength fastener without flange	N·m	2.4	4.7	8.4	20	42	80	125	193	280
	kgf-m	0.24	0.47	0.84	2.0	4.2	8.0	12.5	19.3	28
 I2RH01010013-01	lb-ft	2.0	3.5	6.0	14.5	30.5	58.0	90.5	139.5	202.5
A equivalent of 6.8 strength fastener with flange	N·m	2.4	4.9	8.8	21	44	84	133	203	298
	kgf-m	0.24	0.49	0.88	2.1	4.4	8.4	13.3	20.3	29.8
*: Self-lock nut (6 strength)  I2RH01010014-01	lb-ft	2.0	3.5	6.5	15.5	32.0	61.0	96.5	147.0	215.5
A equivalent of 7T strength fastener	N·m	2.3	4.5	10	23	50	85	135	210	240
	kgf-m	0.23	0.45	1.0	2.3	5.0	8.5	13.5	21	24
 I2RH01010015-01	lb-ft	2.0	3.5	7.5	17.0	36.5	61.5	98.0	152.0	174.0
A equivalent of 8.8 strength bolt (8 strength nut) without flange	N·m	3.1	6.3	11	27	56	105	168	258	373
	kgf-m	0.31	0.63	1.1	2.7	5.6	10.5	16.8	25.8	37.3
 I2RH01010016-01	lb-ft	2.5	4.5	8.0	19.5	40.5	76.0	121.5	187.0	270.0
A equivalent of 8.8 strength bolt (8 strength nut) with flange	N·m	3.2	6.5	12	29	59	113	175	270	395
	kgf-m	0.32	0.65	1.2	2.9	5.9	11.3	17.5	27	39.5
 I2RH01010017-01	lb-ft	2.5	5.0	9.0	21.0	43.0	82.0	126.5	195.5	286.0

***:Self-lock nut**

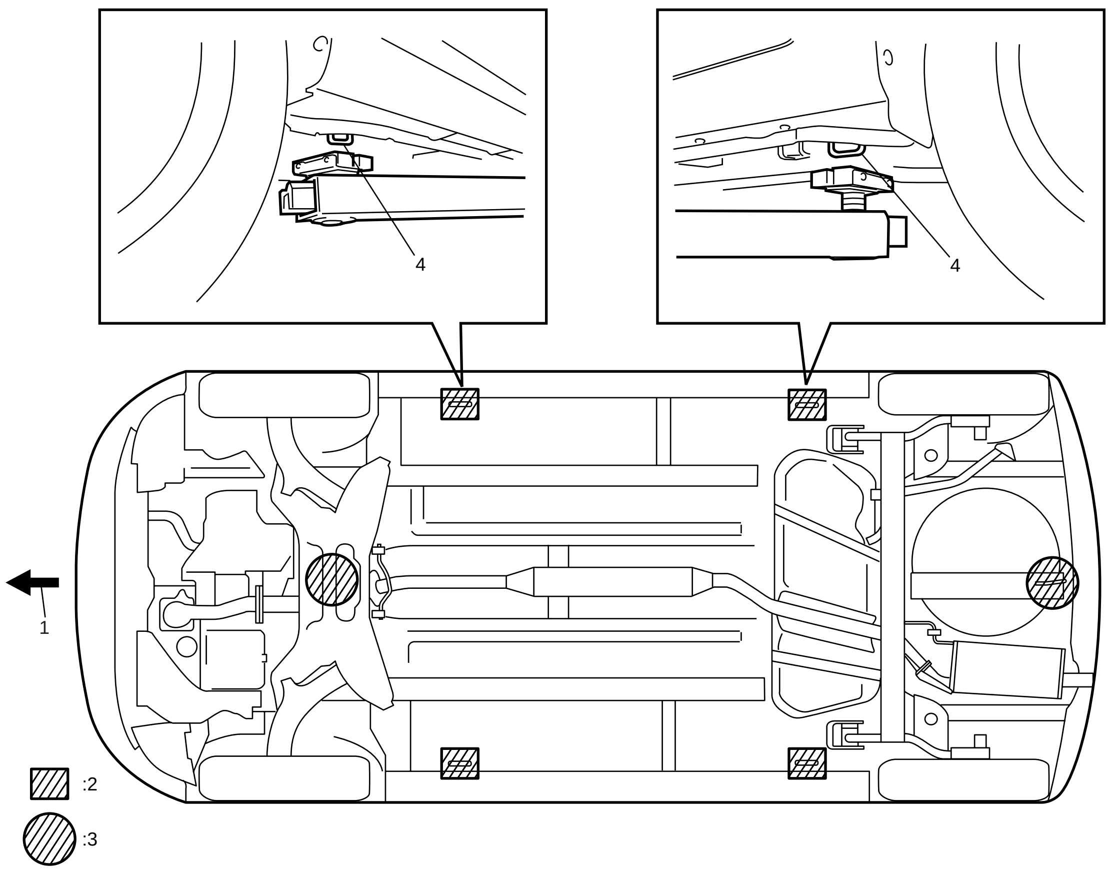
Vehicle Lifting Points

S7RS0B0101005

WARNING

- **Before applying hoist to underbody, always take vehicle balance throughout service into consideration. Vehicle balance on hoist may change depending on what part to be removed.**
- **Before lifting up the vehicle, check to be sure that end of hoist arm is not in contact with brake pipe, fuel pipe, bracket or any other part.**
- **When using frame contact hoist, apply hoist as shown (right and left at the same position). Lift up the vehicle till 4 tires are a little off the ground and make sure that the vehicle will not fall off by trying to move vehicle body in both ways. Work can be started only after this confirmation.**
- **Make absolutely sure to lock hoist after vehicle is hoisted up.**

When Using Frame Contact Hoist



I4RS0A010001-01

1. Vehicle front	3. Floor jack position
2. Support position for frame contact hoist and safety stand	4. Body mounting stay

When Using Floor Jack

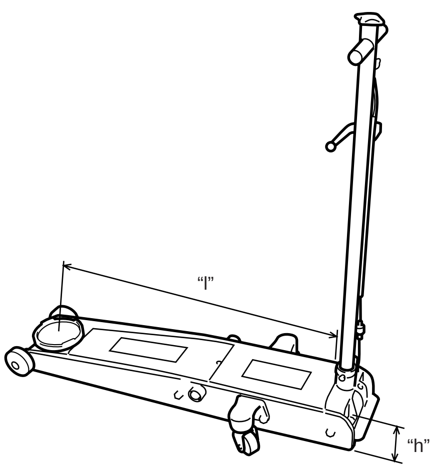
⚠ WARNING

If the vehicle to be jacked up only at the front or rear end, be sure to block the wheels on ground in order to ensure safety.
After the vehicle is jacked up, be sure to support it on stands. It is extremely dangerous to do any work on the vehicle raised on jack alone.

⚠ CAUTION

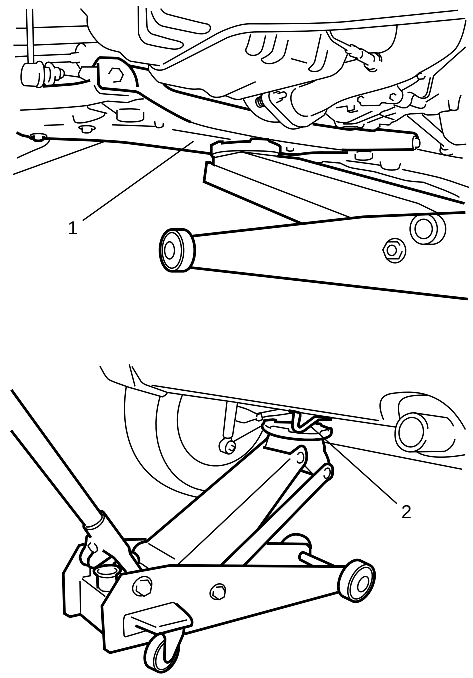
- **Never apply jack against rear suspension parts (i.e., stabilizer, etc.) or vehicle floor, or it may get deformed.**
- **When jacking up the front end, be sure to use an air type floor jack with the following specified height or a manual type floor jack of the following size. Otherwise, the jack may cause the bumper or vehicle body panel a damage.**

Jack size
Height "h": under 145 mm (under 5.71 in.)
Length "l": above 900 mm (above 35.4 in.)



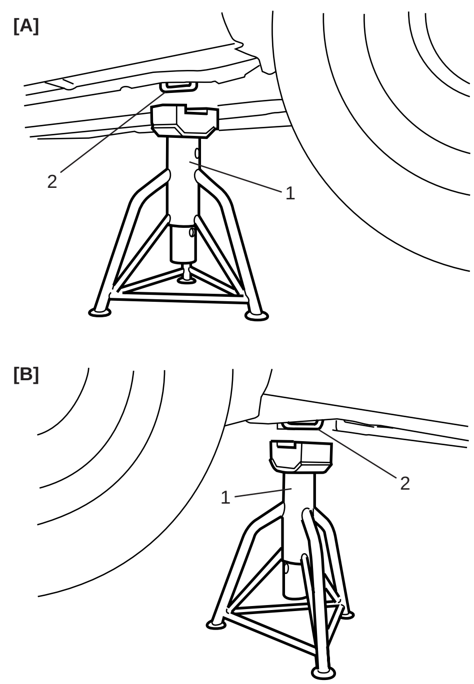
I4RS0A010002-01

In raising front or rear vehicle end off the floor by jacking, be sure to put the jack against front suspension frame (1) or rear jacking bracket (2).



I4RS0A010003-01

To perform service with either front or rear vehicle end jacked up, be sure to place safety stands (1) under body mounting stay (2) so that vehicle body is securely supported. And then check to ensure that body mounting stay (2) does not slide on safety stands (1) and the vehicle is held stable for safety's sake.



I4RS0A010004-01

[A]: Front	[B]: Rear

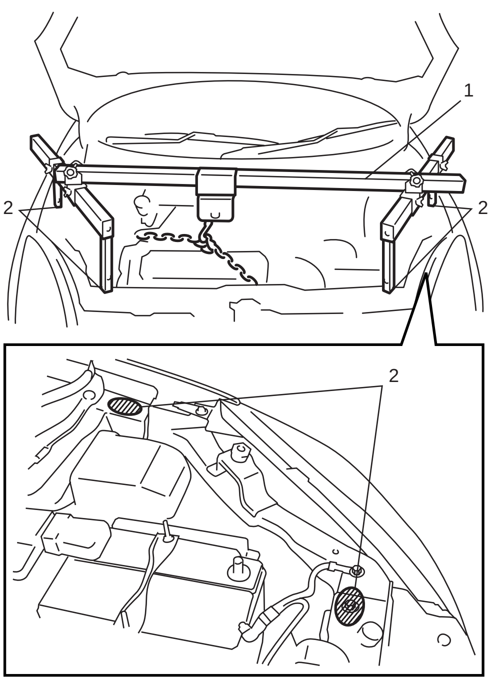
Engine Supporting Points

S7RS0B0101006

⚠ WARNING

When using engine supporting device (1), be sure to observe the followings.
Otherwise, not only deformation of vehicle body but also personal injury may result.

- **Apply supporting device at the specified positions (2) indicated in figure**
- **Install supporting device taking a well-balanced posture.**
- **Do not contact supporting device with other parts than engine room body panel and engine hooks.**

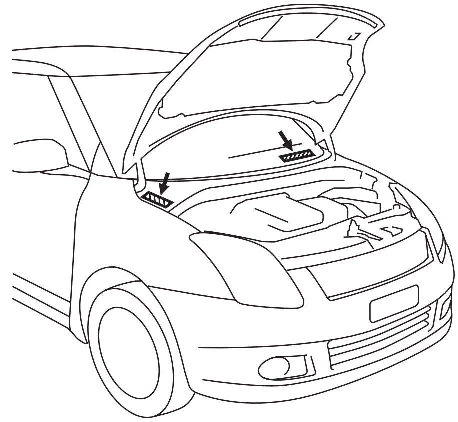


I4RS0A010005-01

Vehicle Identification Number

S7RS0B0101007

The number is punched close by the right side strut support in engine room and it is also attached on the left side of instrument panel depending on the vehicle specification.

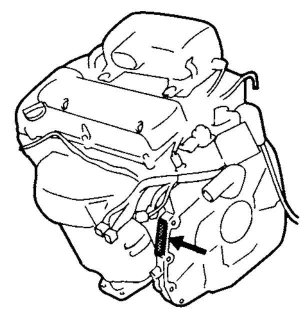


I4RS0B010003-01

Engine Identification Number

S7RS0B0101008

The number is punched on cylinder block.

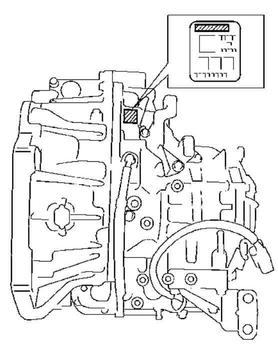


I3RM0A010005-01

Transmission Identification Number

S7RS0B0101009

The automatic transmission identification number is located on transmission case.



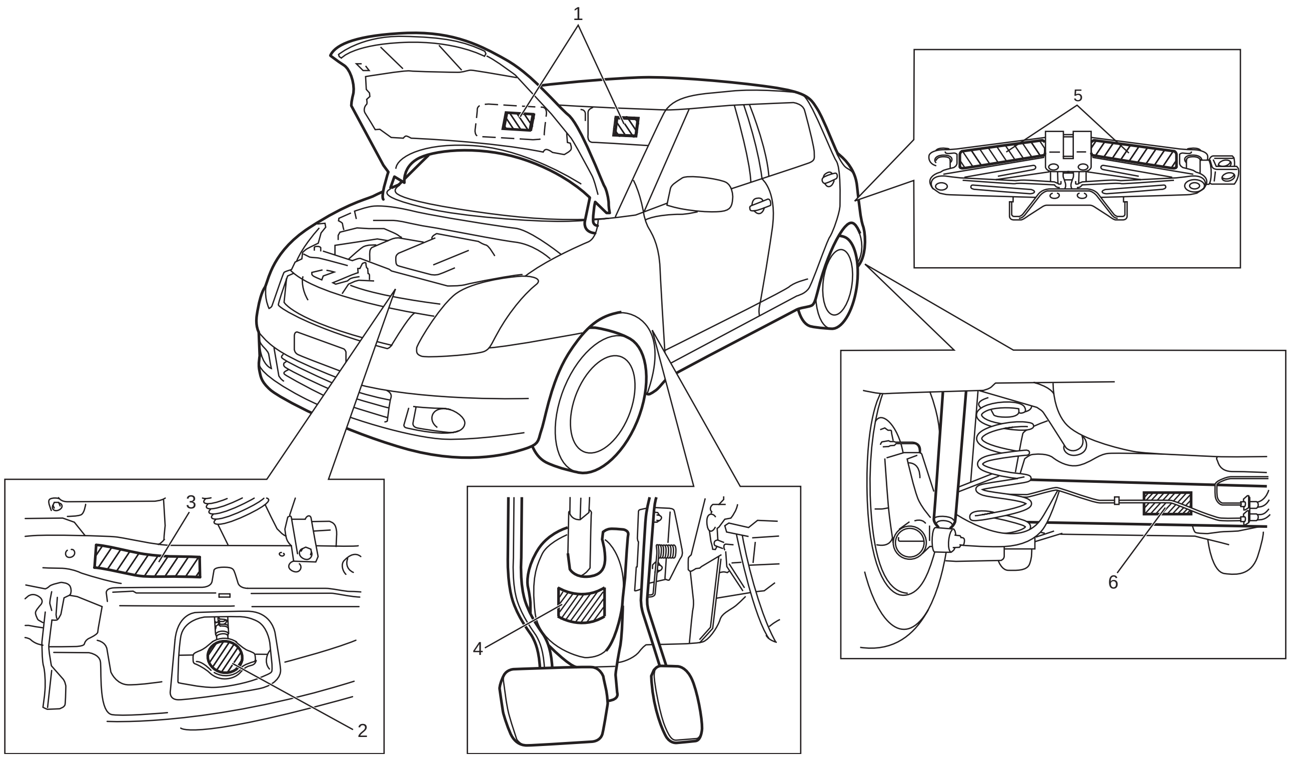
I4RS0A010008-01

Component Location

Warning, Caution and Information Labels Location

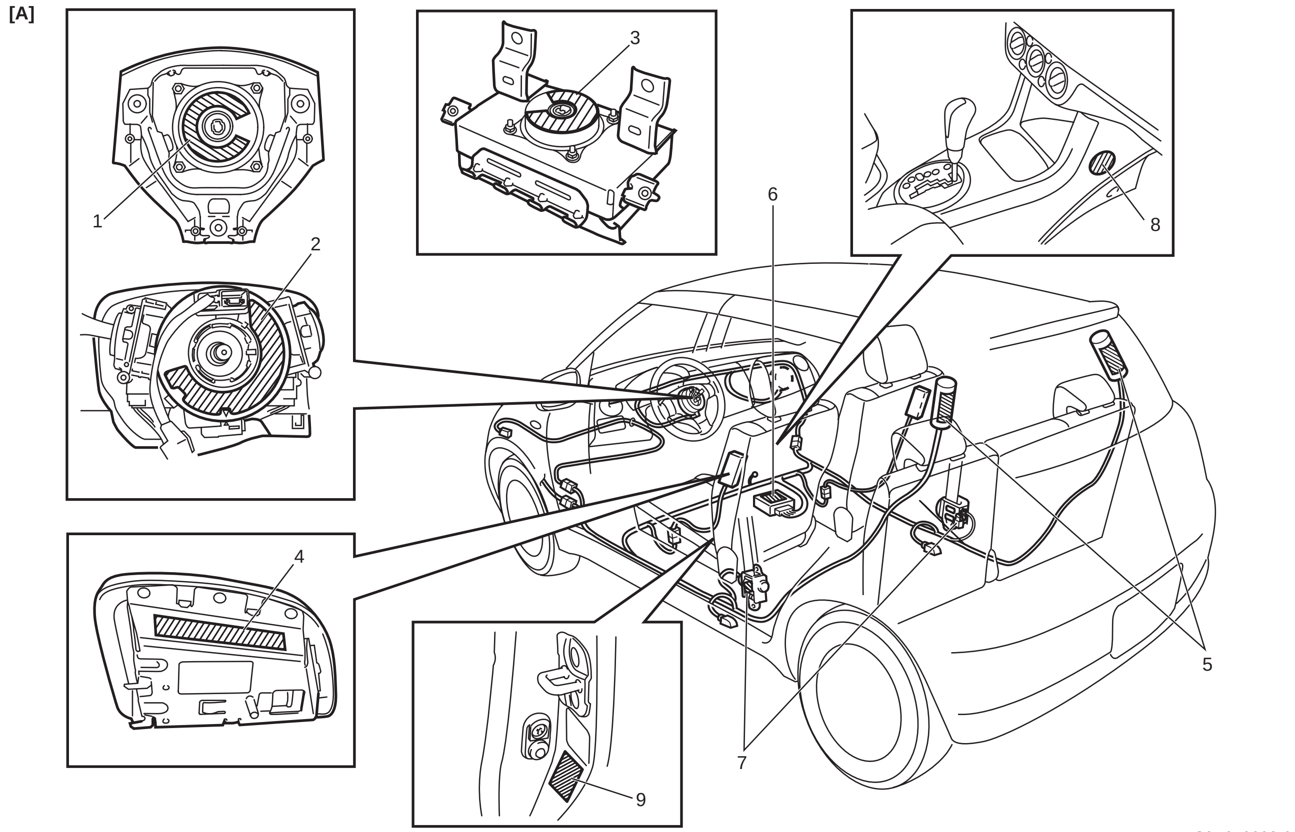
S7RS0B0103001

The figure shows main labels among others that are attached to vehicle component parts.
When servicing and handling parts, refer to WARNING / CAUTION instructions printed on labels.
If any WARNING / CAUTION label is found stained or damaged, clean or replace it as necessary.



I5RS0C010001-02

1. Air bag label on sun visor (if equipped)	4. Steering shaft joint cover label (if equipped)
2. Radiator cap label	5. Jack label
3. Engine cooling fan label	6. Rear beam label



1. Air bag label on driver air bag (inflator) module	6. Air bag label on SDM
2. Air bag label on combination switch and contact coil assembly	7. Pretensioner label on seat belt retractor
3. Air bag label on passenger air bag (inflator) module	8. Child seat label (if equipped)
4. Air bag label on side air bag (inflator) module (if equipped)	9. Side/Curtain air bag label on pillar (both right and left sides) (if equipped)
5. Air bag label on curtain air bag (inflator) module (if equipped)	[A]: These labels are attached on vehicle equipped with air bag system only.

Maintenance and Lubrication

Precautions

Precautions for Maintenance and Lubrication

S7RS0B0200001

Air Bag Warning

Refer to “Air Bag Warning in Section 00”.

Scheduled Maintenance

Maintenance Schedule under Normal Driving Conditions

S7RS0B0205001

NOTE

- **This interval should be judged by odometer reading or months, whichever comes first.**
- **This table includes service as scheduled up to 90,000 km (54,000 miles) mileage. Beyond 90,000 km (54,000 miles), carry out the same services at the same intervals respectively.**

Interval			15	30	45	60	75	90
		Km (x 1,000)	**15**	**30**	**45**	**60**	**75**	**90**
		Miles (x 1,000)	**9**	**18**	**27**	**36**	**45**	**54**
		Months	**12**	**24**	**36**	**48**	**60**	**72**
Engine								
Accessory drive belt (I: ☞, R: ☞)			—	—	I	—	—	R
Valve lash (clearance) (I: ☞)			—	I	—	I	—	I
Engine oil and oil filter (R: ☞)			R	R	R	R	R	R
Engine coolant (R: ☞)			—	—	R	—	—	R
Exhaust system (I: ☞)			—	I	—	I	—	I
Ignition system								
Spark plugs (R: ☞)	When unleaded fuel is used	Iridium Plug	Replace every 60,000 km (36,000 miles) or 48 months					
	When leaded fuel is used, refer to “Maintenance Recommended under Severe Driving Conditions”.							
Fuel system								
Air cleaner filter (R: ☞, I: ☞)		Paved-road	I	I	R	I	I	R
		Dusty conditions	Refer to “Maintenance Recommended under Severe Driving Conditions”.					
Fuel lines and connections (I: ☞)			—	I	—	I	—	I
Fuel filter (R: ☞) (See NOTE below)			Replace every 105,000 km (63,000 miles)					
Fuel tank (I: ☞)			—	—	I	—	—	I
Emission control system								
PCV valve (I: ☞)			—	—	—	—	—	I
Fuel evaporative emission control system (I: ☞)			—	—	—	—	—	I
Brake								
Brake discs and pads (thickness, wear, damage) (I: ☞)			I	I	I	I	I	I
Brake hoses and pipes (leakage, damage, clamp) (I: ☞)			—	I	—	I	—	I
Brake fluid (R: ☞)			—	R	—	R	—	R
Brake lever and cable (damage, stroke, operation) (I: ☞)			Inspect at first 15,000 km (9,000 miles only)					
Chassis and body								
Clutch (fluid leakage, level) (I: ☞)			—	I	—	I	—	I
Tires (wear, damage, rotation) / wheels (damage) (I: ☞ / ☞)			I	I	I	I	I	I
Suspension system (tightness, damage, rattle, breakage) (I: ☞)			—	I	—	I	—	I
Steering system (tightness, damage, breakage, rattle) (I: ☞)			—	I	—	I	—	I
Drive shaft (axle) boots (I: ☞)			—	—	I	—	—	I
Manual transaxle oil (leakage, level) (I: ☞ 1st 15,000 km only) (R: ☞)			I	—	R	—	—	R

Interval							
	Km (x 1,000)	**15**	**30**	**45**	**60**	**75**	**90**
	Miles (x 1,000)	**9**	**18**	**27**	**36**	**45**	**54**
	Months	**12**	**24**	**36**	**48**	**60**	**72**
Automatic transaxle fluid	Fluid level (I: ☞)	—	I	—	I	—	I
	Fluid change (R: ☞)	Replace every 165,000 km (99,000 miles)					
	Fluid hose (I: ☞)	—	—	—	I	—	—
All latches, hinges and locks (I: ☞)		—	I	—	I	—	I
HVAC air filter (if equipped) (I: ☞) (R: ☞)		—	I	R	—	I	R

NOTE

- **"R": Replace or change**
- **"I": Inspect and correct, replace or lubricate if necessary**
- **For spark plugs, replace every 50,000 km if the local law requires.**
- **Periodic replacement of fuel filter is not necessary if it is not instructed in "Periodic Maintenance Schedule" section of the Owner's manual. The scheduled maintenance varies depending on the vehicle specification.**

Maintenance Recommended under Severe Driving Conditions

S7RS0B0205002

If the vehicle is usually used under the conditions corresponding to any severe condition code given below, IT IS RECOMMENDED that applicable maintenance operation be performed at the particular interval as shown in the following table.

Severe condition code:

A: Repeated short trips
B: Driving on rough and/or muddy roads
C: Driving on dusty roads
D: Driving in extremely cold weather and/or salted roads
E: Repeated short trips in extremely cold weather
F: Leaded fuel use
G: – – – – –
H: Towing a trailer (if admitted)

Severe condition code	Maintenance		Maintenance operation	Maintenance interval
– B C D – – – –	Accessory drive belt		☞ I	Every 15,000 km (9,000 miles) or 12 months
			☞ R	Every 45,000 km (27,000 miles) or 36 months
A – C D E F – H	Engine oil and oil filter		☞ R	Every 7,500 km (4,500 miles) or 6 months
– – C – – – – –	Air cleaner filter *1		☞ I	Every 2,500 km (1,500 miles)
			☞ R	Every 30,000 km (18,000 miles) or 24 months
A B C – E F – H	Spark plugs	Iridium plug	☞ R	Every 30,000 km (18,000 miles) or 24 months
– B C D – – – H	Wheel bearings		☞ I	Every 15,000 km (9,000 miles) or 12 months
– B – D E – – H	Drive shaft (axle) boots		☞ I	Every 15,000 km (9,000 miles) or 12 months
– B – – E – – H	Manual transaxle oil		☞ R	First time only: 15,000 km (9,000 miles) or 12 months
				Second time and after: Every 30,000 km (18,000 miles) or 24 months reckoning from 0 km (0 mile) or 0 month

Severe condition code	Maintenance	Maintenance operation	Maintenance interval
– B – – E – – H	Automatic transaxle fluid	☞ R	Every 30,000 km (18,000 miles) or 24 months
– – C D – – – –	HVAC air filter (if equipped) *2	☞ I	Every 15,000 km (9,000 miles) or 12 months
		☞ R	Every 45,000 km (27,000 miles) or 36 months

NOTE

- **"I": Inspect and correct or replace if necessary**
- **"R": Replace or change**
- ***1: Inspect or replace more frequently if the vehicle is used under dusty conditions.**
- ***2: Clean or replace more frequently if the air from the air conditioning decreases.**

Repair Instructions

Accessory Drive Belt Inspection

S7RS0B0206001

⚠ WARNING

All inspection and replacement are to be performed with ENGINE NOT RUNNING.

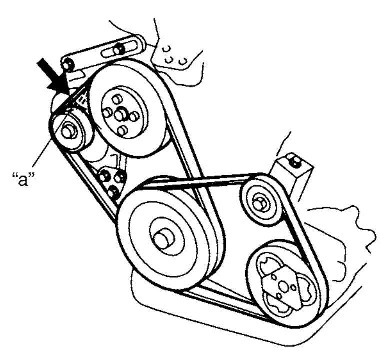
Water Pump and Generator Drive Belt

1) Disconnect negative (–) cable at battery.
2) Inspect belt for cracks, cuts, deformation, wear and cleanliness. If any defect exists, replace.
   Check belt for tension.

   Water pump and generator belt tension
   "a": 4.5 – 5.5 mm (0.18 – 0.22 in.) deflection under 100 N (10 kg, 22 lb) pressure

   NOTE

   When replacing belt with a new one, adjust belt tension to 3.5 – 4 mm (0.14 – 0.16 in.)



I3RM0A020001-01

3) If belt is too tight or too loose, adjust it to specification by adjusting alternator position.
4) Tighten alternator adjusting bolts and pivot bolt.
5) Connect negative (–) cable to battery.

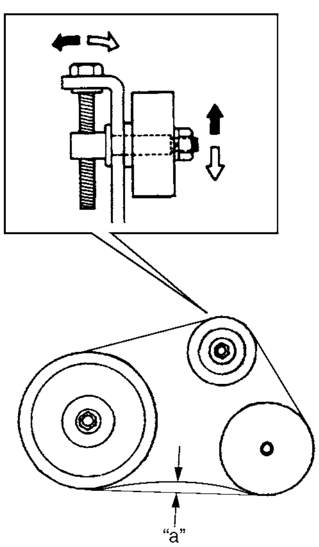
A/C Compressor Drive Belt

1) Disconnect negative (–) cable at battery.
2) Inspect belt for cracks, cuts, deformation, wear and cleanliness. If any defect exists, replace.
   Check belt for tension.
   If belt tension is out of specification, adjust it referring to "Compressor Drive Belt Inspection and Adjustment in Section 7B".

   A/C compressor drive belt tension
   "a": 7 – 8 mm (0.28 – 0.31 in.) deflection under 100 N (10 kg, 22 lb) pressure

   NOTE

   When replacing belt with a new one, adjust belt tension to 6 – 7 mm (0.24 – 0.28 in.).



I4RS0A020001-01

3) Connect negative (–) cable to battery.

Accessory Drive Belt Replacement

S7RS0B0206002

Water Pump and Generator Drive Belt

Replace belt with new one referring to “Water Pump / Generator Drive Belt Removal and Installation in Section 1J”.

A/C Compressor Drive Belt

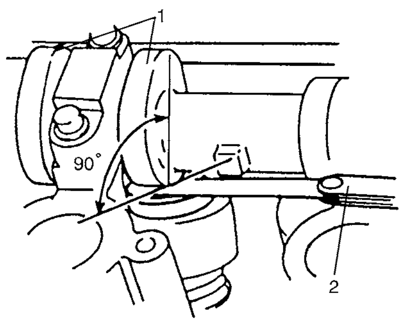
Replace belt with new one referring to “Compressor Drive Belt Removal and Installation in Section 7B”.

Valve Lash (Clearance) Inspection

S7RS0B0206003

Inspect intake and exhaust valve lash and adjust as necessary.

Refer to “Valve Lash (Clearance) Inspection in Section 1D” for valve lash inspection and adjustment procedure.



I2RH0B020003-02

1. Camshaft	2. Thickness gauge

Engine Oil and Filter Change

S7RS0B0206004

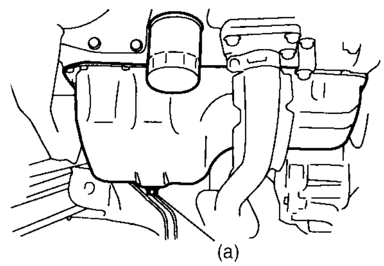
⚠ WARNING

- **New and used engine oil can be hazardous.**
  Be sure to read “WARNING” in “General Precautions in Section 00” and observe what is written there.
- **Step 1) – 7) outlined below must be performed with ENGINE NOT RUNNING.**
  For Step 8), be sure to have adequate ventilation while engine is running.

Before draining engine oil, check engine for oil leakage. If any evidence of leakage is found, make sure to correct defective part before proceeding to the following work.

1) Drain engine oil by removing drain plug.
2) After draining oil, wipe drain plug clean. Reinstall drain plug.

   Tightening torque
   Engine oil drain plug (a): 35 N·m (3.5 kgf-m, 25.5 lb-ft)



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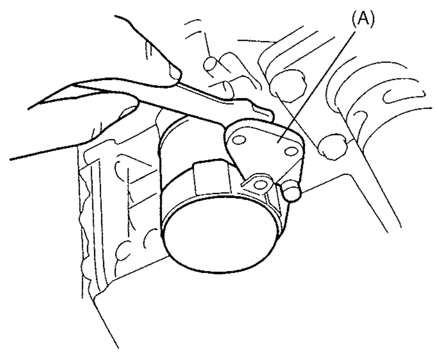
3) Loosen oil filter by using oil filter wrench (special tool).

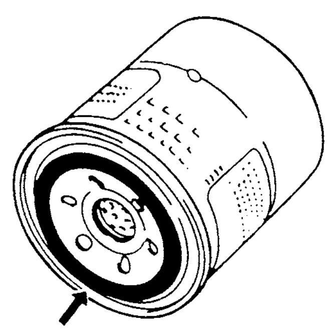
   Special tool
   (A): 09915–47331



I2RH0B020005-01

NOTE

Before fitting new oil filter, be sure to oil its O-ring. Use engine oil for this purpose.



IYSQ01020009-01

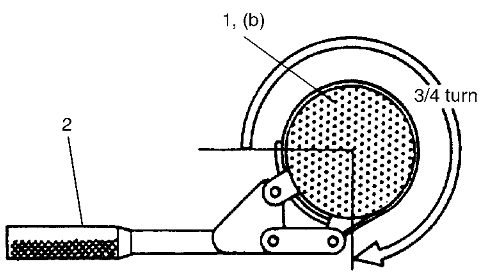
4) Screw new filter on oil filter stand by hand until the filter O-ring contacts mounting surface.

⚠ CAUTION

To tighten oil filter properly, it is important to accurately identify the position at which filter O-ring first contacts mounting surface.

5) Tighten the filter (1) 3/4 turn from the point of contact with the mounting surface using an oil filter wrench (2).

Tightening torque
Oil filter (b): 14 N·m (1.4 kgf-m, 10.5 lb-ft) for reference



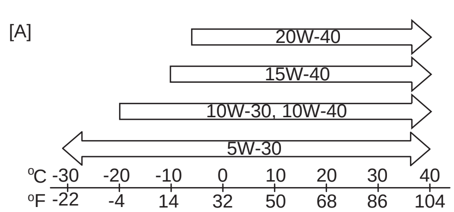
IYSQ01020010-01

6) Replenish oil until oil level is brought to FULL level mark on dipstick (oil pan and oil filter capacity). The filler inlet is at the top of the cylinder head cover. It is recommended to use engine oil of SG, SH, SJ, SL or SM grade. Select the appropriate oil viscosity according to the proper engine oil viscosity chart [A].

NOTE

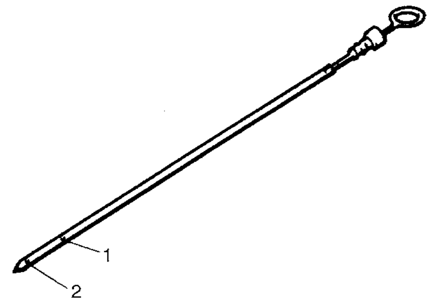
Engine oil capacity is specified as the following.
However, note that the amount of oil required when actually changing oil may somewhat differ from the data depending on various conditions (temperature, viscosity, etc.).

<u>Engine oil specification</u>
Oil pan capacity: About 3.7 liters (7.8 / 6.5 US / Imp pt.)
Oil filter capacity: About 0.2 liter (0.4 / 0.3 US / Imp pt.)
Others: About 0.3 liter (0.6 / 0.5 US / Imp pt.)
Total: About 4.2 liters (8.9 / 7.4 US / Imp pt.)



I7RS0B020001-02

7) Check oil filter and drain plug for oil leakage.
8) Start engine and run it for 3 minutes. Stop it and wait another 5 minutes before checking oil level. Add oil, as necessary, to bring oil level to FULL level mark (1) on dipstick.



IYSQ01020012-01

2. Low level mark (hole)

Engine Coolant Change

S7RS0B0206005

⚠ 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.

⚠ CAUTION

When changing engine coolant, use mixture of 50% specified water and 50% ANTIFREEZE / ANTICORROSION COOLANT for the purpose of corrosion protection and lubrication.

Change engine coolant with new one referring to "Cooling System Flush and Refill in Section 1F".

Exhaust System Inspection

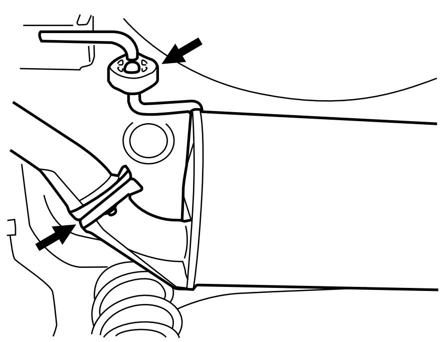
S7RS0B0206006

⚠ WARNING

To avoid danger of being burned, do not touch exhaust system when it is still hot. Any service on exhaust system should be performed when it is cool.

When carrying out periodic maintenance, or the vehicle is raised for other service, check exhaust system as follows:

- Check rubber mountings for damage, deterioration, and out of position.
- Check exhaust system for leakage, loose connections, dents and damages.
  If bolts or nuts are loose, tighten them to specification.
- Check nearby body areas for damaged, missing or mispositioned parts, open seams, holes, loose connections or other defects which could permit exhaust fumes to seep into the vehicle.
- Make sure that exhaust system components have enough clearance from the underbody to avoid overheating and possible damage to floor carpet.



I4RS0A020003-01

- Any defects should be fixed at once.

Spark Plug Replacement

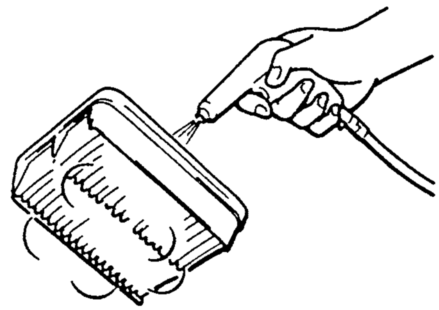
S7RS0B0206007

Replace spark plugs with new ones referring to “Spark Plug Removal and Installation in Section 1H”.

Air Cleaner Filter Inspection

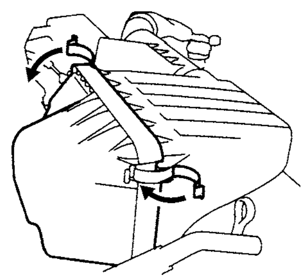
S7RS0B0206008

1) Remove air cleaner case clamps.
2) Take air cleaner filter out of case.
3) Check that filter is not excessively dirty, damaged or oily, clean filter with compressed air from air outlet side of filter.



I2RH01140007-01

4) Install air cleaner filter and Clamp cap securely.



I4RS0B020001-01

Air Cleaner Filter Replacement

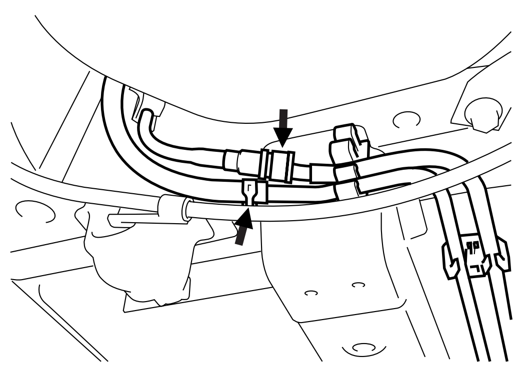
S7RS0B0206009

Replace air cleaner filter with new one according to Steps 1), 2) and 4) of “Air Cleaner Filter Inspection”.

Fuel Lines and Connections Inspection

S7RS0B0206010

Visually inspect fuel lines and connections for evidence of fuel leakage, hose cracking and damage. Make sure all clamps are secure.
Repair leaky joints, if any.
Replace hoses that are suspected of being cracked.



I4RS0A020005-01

Fuel Filter Replacement

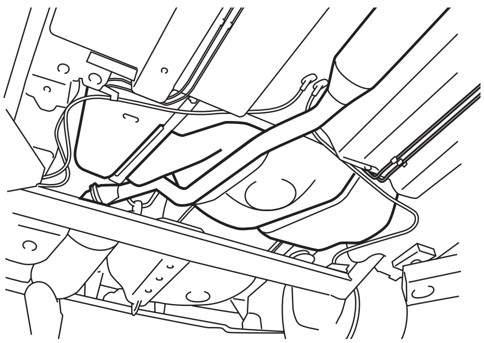
S7RS0B0206011

Fuel filter is installed in fuel pump assembly in fuel tank. Replace fuel filter or fuel pump assembly with new one, referring to “Fuel Pump Assembly Removal and Installation in Section 1G” for proper procedure.

Fuel Tank Inspection

S7RS0B0206012

Check fuel tank damage, cracks, fuel leakage, corrosion and tank bolts looseness.
If a problem is found, repair or replace.



I4RS0B020002-02

PCV Valve Inspection

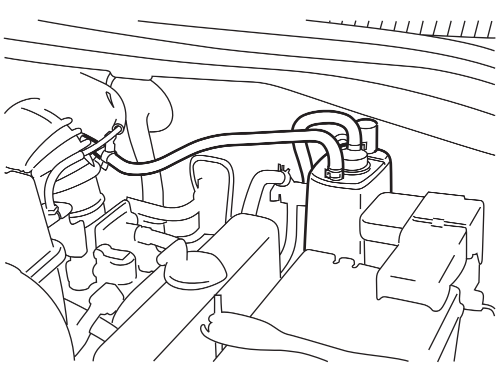
S7RS0B0206013

Check crankcase ventilation hose and PCV hose for leaks, cracks or clog, and PCV valve for stick or clog. Refer to “PCV Valve Inspection in Section 1B” for PCV valve checking procedure.

Fuel Evaporative Emission Control System Inspection

S7RS0B0206014

1) Visually inspect hoses for cracks, damage, or excessive bends. Inspect all clamps for damage and proper position.
2) Check EVAP canister for operation and clog, referring to “EVAP Canister Inspection in Section 1B”.
   If a malfunction is found, repair or replace.

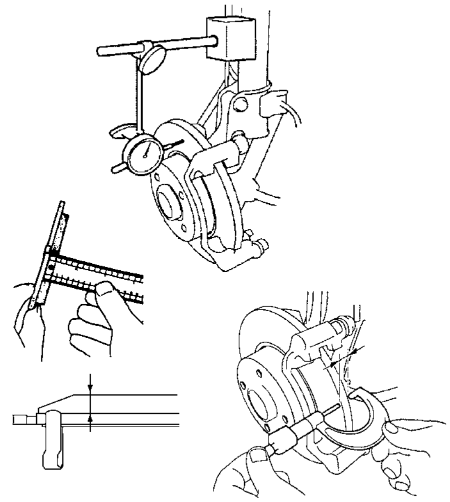


I4RS0A020006-01

Brake Discs and Pads Inspection

S7RS0B0206015

1) Remove wheel and caliper but don’t disconnect brake hose from caliper.
2) Check disc brake pads and discs for excessive wear, damage and deflection. Replace parts as necessary. For details, refer to “Front Disc Brake Pad Inspection in Section 4B”, “Front Brake Disc Inspection in Section 4B”, “Rear Disc Brake Pad Inspection in Section 4C” and/or “Rear Brake Disc Inspection in Section 4C”.
   Be sure to torque caliper pin bolts to specification.



I3RM0A020006-01

Brake Hoses and Pipes Inspection

S7RS0B0206016

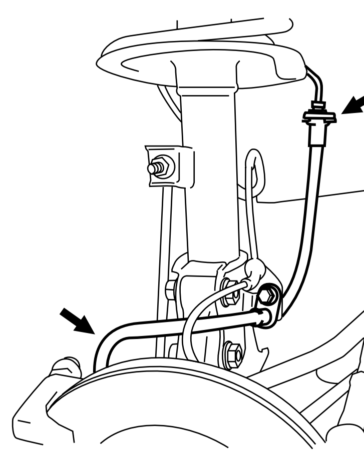
Perform this inspection where these is enough light and use a mirror as necessary.

- Check brake hoses and pipes for proper hookup, leaks, cracks, chafing and other damage.
- Check that hoses and pipes are clear of sharp edges and moving parts.

Repair or replace any of these parts as necessary.

⚠ **CAUTION**

After replacing any brake pipe or hose, be sure to carry out air purge operation.



I4RS0A020008-01

Brake Fluid Inspection

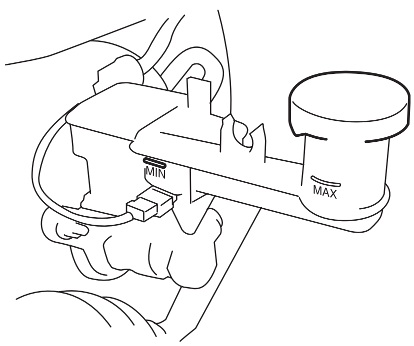
S7RS0B0206035

1) Check around master cylinder and reservoir for fluid leakage. If found leaky, correct.
2) Check fluid level.
   If fluid level is lower than the minimum level of reservoir, refilling is necessary. Fill reservoir with specified brake fluid.
   For the details, refer to “Brake Fluid Level Inspection in Section 4A”.

⚠ CAUTION

Since brake system of this vehicle is factory-filled with brake fluid indicated on reservoir tank cap, do not use or mix different type of fluid when refilling; otherwise serious damage will occur.
Do not use old or used brake fluid, or any fluid from an unsealed container.

Brake fluid
Refer to reservoir cap of brake master cylinder.



I7RW01020002-01

Brake Fluid Replacement

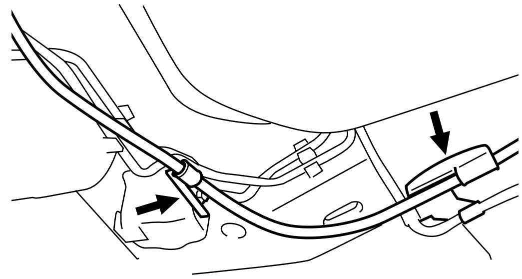
S7RS0B0206017

Change brake fluid as follows.
Drain existing fluid from brake system completely, fill system with specified fluid and carry out air purge operation.
For air purging procedure, refer to“Air Bleeding of Brake System in Section 4A”.

Brake Lever and Cable Inspection

S7RS0B0206018

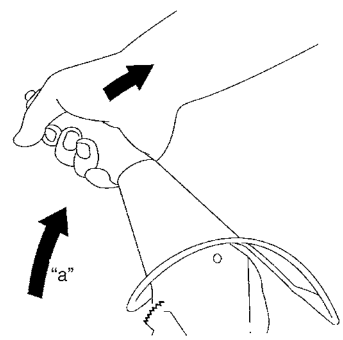
1) Inspect brake cable for damage and smooth movement.
   Replace cable if it is in deteriorated condition.



I4RS0A020009-01

2) Check tooth tip of each notch for damage or wear. If any damage or wear is found, replace parking lever.
3) Check parking brake lever for proper operation and stroke, and adjust it if necessary.
   For checking and adjusting procedures, refer to “Parking Brake Inspection and Adjustment in Section 4D”.

Parking brake lever stroke
“a”: 4 – 9 notches (with 200 N (20 kg, 44 lbs) of pull pressure)

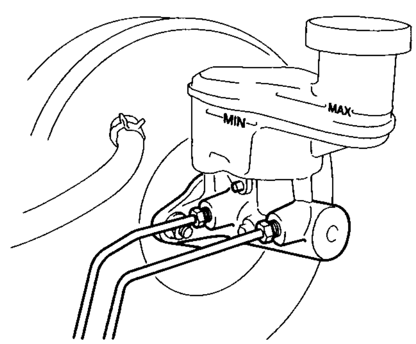


I4RS0B020005-01

Clutch Fluid Inspection

S7RS0B0206019

1) Check clutch system for evidence of fluid leakage. Repair leaky point if any.
2) Check reservoir for fluid level referring to “Clutch Fluid Level Inspection in Section 5C”.
   If fluid is lower than minimum level of reservoir, refill reservoir with specified brake fluid indicated on reservoir cap.

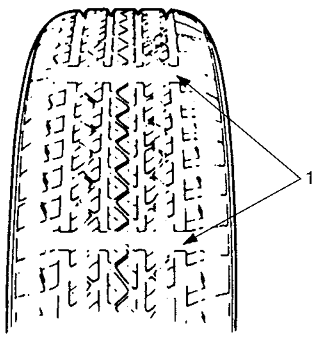


I4RS0A410006-01

Tires Inspection

S7RS0B0206020

1) Check tires for uneven or excessive wear, or damage. If defective, replace.
   Refer to “Irregular and/or Premature Wear Description in Section 2D” and “Wear Indicators Description in Section 2D” for details.



I2RH01020022-01

1. Wear indicator

2) Check inflating pressure of each tire and adjust pressure to specification as necessary.

NOTE

- **Tire inflation pressure should be checked when tires are cool.**
- **Specified tire inflation pressure should be found on tire placard or in owner’s manual which came with the vehicle.**

3) Rotate tires. For details, refer to “Tire Rotation in Section 2D”.

Wheel Discs Inspection

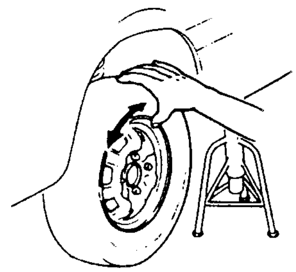
S7RS0B0206021

Inspect each wheel disc for dents, distortion and cracks. A disc in badly damaged condition must be replaced.

Wheel Bearing Inspection

S7RS0B0206022

1) Check front wheel bearing for wear, damage, abnormal noise or rattles. For details, refer to “Front Wheel Hub, Disc, Nut and Bearing Check in Section 2B”.
2) Check rear wheel bearing for wear, damage, abnormal noise or rattles. For details, refer to“Rear Wheel Disc, bolt and Bearing Inspection in Section 2C”.

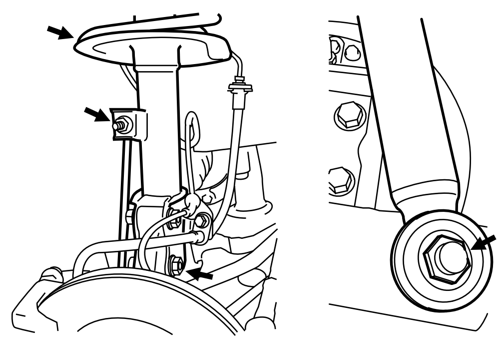


I2RH01020023-01

Suspension System Inspection

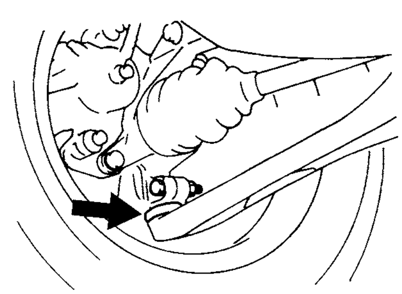
S7RS0B0206023

- Inspect front struts and rear shock absorbers for evidence of oil leakage, dents or any other damage on sleeves; and inspect anchor ends for deterioration. Replace defective parts, if any.
- Check front and rear suspension systems for damaged, loose or missing parts; also for parts showing signs of wear or lack of lubrication. Repair or replace defective parts, if any.



I4RS0A020011-01

- Check front suspension arm ball joint stud dust seals for leakage, detachment, tear or any other damage. Replace defective boot, if any.



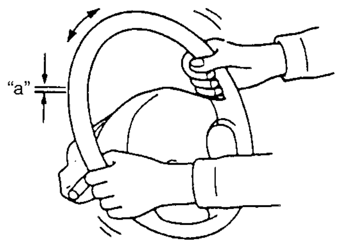
I4RS0A020012-01

Steering System Inspection

S7RS0B0206024

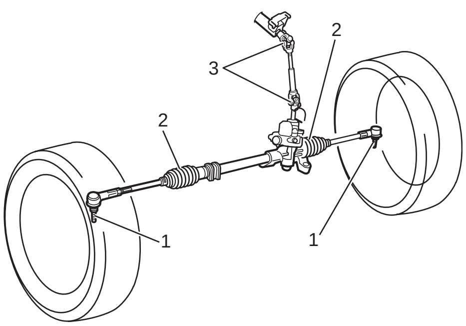
1) Check steering wheel for play and rattle, holding vehicle straight on ground.

Steering wheel play
"a": 0 – 30 mm (0 – 1.1 in.)



I2RH01020026-01

2) Check bolts and nuts for tightness and retighten them as necessary. Repair or replace defective parts, if any.
3) Check steering linkage for looseness and damage. Repair or replace defective parts, if any.
4) Check boots (1) and (2) of steering linkage and steering gear case for damage (leak, detachment, tear, etc.). If damage is found, replace defective boot with new one.
If any dent is found on steering gear case boots, correct it to original shape by turning steering wheel to the right or left as far as it stops and holding it for a few seconds.
5) Check universal joints (3) of steering shaft for rattle and damage. If rattle or damage is found, replace defective part with a new one.



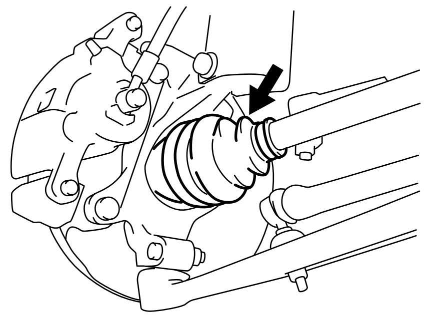
I4RS0B020007-01

6) Check that steering wheel can be turned fully to the right and left. Repair or replace defective parts, if any.
7) If equipped with power steering system, check also, in addition to check items, that steering wheel can be turned fully to the right and left more lightly when engine is running at idle speed than when it is stopped. Repair, if found faulty.
8) Check wheel alignment referring to "Front Wheel Alignment Inspection and Adjustment in Section 2B".

Drive Shaft (Axle) Boots Inspection

S7RS0B0206025

Check drive shaft boots (wheel side and differential side) for leaks, detachment, tear or other damage.
Replace defective parts as necessary.

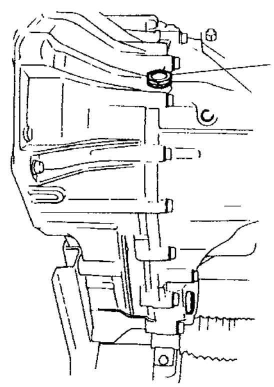


I2RH01310001-01

Manual Transaxle Oil Inspection

S7RS0B0206026

1) Inspect transaxle case for evidence of oil leakage. Repair leaky point if any.
2) Make sure that vehicle is placed level for oil level check.
3) Remove oil filler/level plug (1) of transaxle.



I6RS0C020001-01

4) Check oil level.
Oil level can be checked roughly by means of filler/level plug hole. That is, if oil flows out of level plug hole or if oil level is found up to hole when level plug is removed, oil is properly filled.
If oil is found insufficient, pour specified oil up to level hole. For specified oil, refer to "Manual Transaxle Oil Change in Section 5B".
5) Apply sealant to filler/level plug and tighten it to specified torque.

Manual Transaxle Oil Replacement

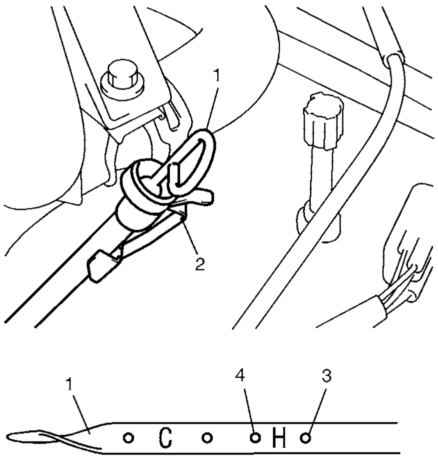
S7RS0B0206027

Change transaxle oil with new specified oil referring to "Manual Transaxle Oil Change in Section 5B".

Automatic Transaxle Fluid Level Inspection

S7RS0B0206028

1) Inspect transaxle case for evidence of fluid leakage. Repair leaky point, if any.
2) Make sure that vehicle is placed level for fluid level check.
3) Check fluid level under specified conditions referring to "A/T Fluid Level Check in Section 5A". If fluid level is low, replenish specified fluid.



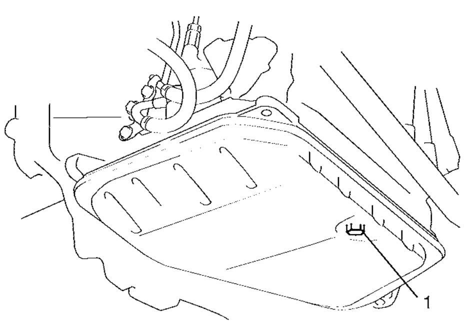
I4RS0A020016-01

1. Dipstick	3. FULL HOT mark
2. Clamp	4. LOW HOT mark

Automatic Transaxle Fluid Replacement

S7RS0B0206029

1) Inspect transaxle case for evidence of fluid leakage. Repair leaky point, if any.
2) Make sure that vehicle is placed level for fluid level check.
3) Change fluid. For its procedure, refer to "A/T Fluid Change in Section 5A".



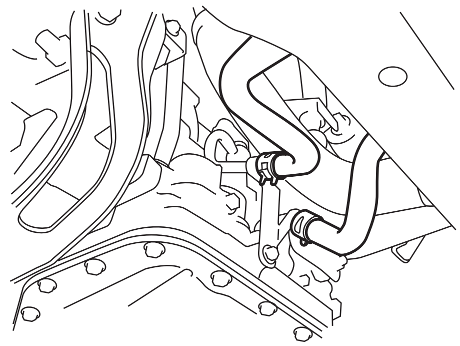
I4RS0A020017-01

1. Drain plug

Automatic Transaxle Fluid Cooler Hose Inspection

S7RS0B0206030

Check automatic transaxle fluid cooler hose for fluid leakage, cracks, damage and deterioration.
Replace hose and/or clamp if any faulty condition is found.



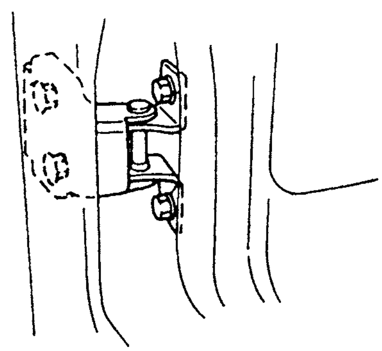
I4RS0A020020-01

All Latches, Hinges and Locks Inspection

S7RS0B0206031

Doors

Check that each door of front, rear and back doors opens and closes smoothly and locks securely when closed.
If any malfunction is found, lubricate hinge and latch or repair door lock system.



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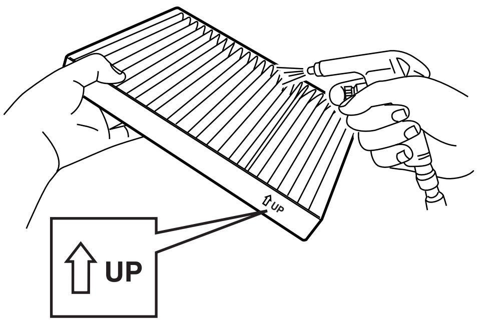
Engine Hood

Check that secondary latch operates properly (check that secondary latch keeps hood from opening all the way even when pulling hood release handle inside vehicle.) Also check that hood opens and closes smoothly and properly and hood locks securely when closed.
If any malfunction is found, lubricate hinge and latch, or repair hood lock system.

HVAC Air Filter (If Equipped) Inspection

S7RS0B0206032

1) Remove HVAC air filter from HVAC unit referring to "HVAC Air Filter Removal and Installation (If Equipped) in Section 7A".
2) Check for dirt and dust. If HVAC air filter is excessively dirty, replace HVAC air filter with new one. If not, go to next step.
3) Blow compressed air on the air outlet side of HVAC air filter for removing dust.



I4RS0A020018-01

4) Install HVAC air filter into HVAC unit referring to "HVAC Air Filter Removal and Installation (If Equipped) in Section 7A".

HVAC Air Filter (If Equipped) Replacement

S7RS0B0206033

Replace HVAC air filter with new one referring to "HVAC Air Filter Removal and Installation (If Equipped) in Section 7A".

Final Inspection for Maintenance Service

S7RS0B0206034

⚠ WARNING

When carrying out road tests, select a safe place where no man or no running vehicle is seen so as to prevent any accident.

Seats

Check that seat slides smoothly and locks securely at any position. Also check that reclining mechanism of front seat back allows it to be locked at any angle.

Seat Belt

Inspect belt system including webbing, buckles, latch plates, retractors and anchors for damage or wear. Check that seat belt is securely locked. If "REPLACE BELT" label on seat belt is visible, replace belt.

Battery Electrolyte Level Check

Check that the electrolyte level of all battery cells is between the upper and lower level lines on the case. If battery is equipped with built-in indicator, check battery condition by the indicator.

Accelerator Pedal Operation

Check that pedal operates smoothly without getting caught or interfered by any other part.

Engine Start

Check engine start for readiness.

⚠ WARNING

Before performing the following check, be sure to have enough room around the vehicle. Then, firmly apply both the parking brake and the regular brakes. Do not use the accelerator pedal. If the engine starts, be ready to turn off the ignition promptly. Take these precautions because the vehicle could move without warning and possibly cause personal injury or property damage.

On automatic transaxle vehicles, try to start the engine in each select lever position. The starting motor should crank only in "P" (Park) or "N" (Neutral).
On manual transaxle vehicles, place the shift lever in "Neutral," depress clutch pedal fully and try to start.
On Automated Manual Transaxle vehicles, try to start the engine in each select lever position. The starting motor should crank only when select lever is in "N" (Neutral) and brake pedal is depressed.

Exhaust System Check

Check for leakage, cracks or loose supports.

Clutch (for Manual Transaxle)

Check for the following.

- Clutch is completely released when depressing clutch pedal,
- No slipping clutch occurs when releasing pedal and accelerating.
- Clutch itself is free from any abnormal condition.

Gearshift or Select Lever (Transaxle)

Check gear shift or select lever for smooth shifting to all positions and for good performance of transaxle in any position.
With automatic transaxle or Automated Manual Transaxle equipped vehicle, also check that shift indicator indicates properly according to which position select lever is shifted to.
With automatic transaxle equipped vehicle, make sure that vehicle is at complete stop when shifting select lever to "P" range position and release all brakes.

Brake

Foot brake

Check the following:

- that brake pedal has proper travel,
- that brake works properly,
- that it is free from noise,
- that vehicle does not pull to one side when brake is applied.
- and that brake do not drag.

Parking brake

Check that lever has proper travel.

⚠ WARNING

With vehicle parked on a fairly steep slope, make sure nothing is in the way downhill to avoid any personal injury or property damage. Be prepared to apply regular brake quickly even if vehicle should start to move.

Check to ensure that parking brake is fully effective when the vehicle is stopped on the safe slope and brake lever is pulled all the way.

Steering

- Check to ensure that steering wheel is free from instability, or abnormally heavy feeling.
- Check that the vehicle does not wander or pull to one side.

Engine

- Check that engine responds readily at all speeds.
- Check that engine is free from abnormal noise and abnormal vibration.

Body, Wheels and Power Transmitting System

Check that body, wheels and power transmitting system are free from abnormal noise and abnormal vibration or any other abnormal condition.

Meters and Gauge

Check that speedometer, odometer, fuel meter, temperature gauge, etc. are operating accurately.

Lights

Check that all lights operate properly.

Windshield Defroster

Periodically check that air comes out from defroster outlet when operating heater or air conditioning.
Set mode control lever to defroster position and fan switch lever to “HI” position for this check.

Specifications

Tightening Torque Specifications

S7RS0B0207001

Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
Engine oil drain plug	35	3.5	25.5	☞
Oil filter	14	1.4	10.5	for reference ☞

Reference:

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

Special Tools and Equipment

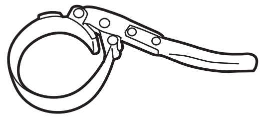
Recommended Fluids and Lubricants

S7RS0B0208001

Engine oil	SG, SH, SJ, SL or SM grade (Refer to “Engine Oil and Filter Change” for engine oil viscosity.)
Engine coolant (Ethylene glycol base coolant)	“Antifreeze/Anticorrosion coolant”
Brake fluid	Refer to reservoir cap of brake master cylinder.
Manual transaxle oil	Refer to “Manual Transaxle Oil Change in Section 5B”.
Automatic transaxle fluid	Refer to “A/T Fluid Change in Section 5A”.
Door hinges	Engine oil or water resistance chassis grease
Hood latch assembly	Engine oil or water resistance chassis grease
Key lock cylinder	Spray lubricant

Special Tool

S7RS0B0208002

09915–47331 Oil filter wrench ☞ 	

Section 1

Engine

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Precautions

Precautions

Precautions for Engine

S7RS0B1000001

Air Bag Warning
Refer to “Air Bag Warning in Section 00”.

Precautions on Engine Service
Refer to “Precautions on Engine Service in Section 1A”.

Precautions in Diagnosing Trouble
Refer to “Precautions in Diagnosing Trouble in Section 1A”.

Precautions of ECM Circuit Inspection
Refer to “Precautions of ECM Circuit Inspection in Section 1A”.

Precautions on Fuel System Service
Refer to “Precautions on Fuel System Service in Section 1G”.

Precaution for CAN Communication System
Refer to “Precaution for CAN Communication System in Section 00”.

Precautions for Catalytic Converter
Refer to “Precautions for Catalytic Converter in Section 00”.

Precautions for Electrical Circuit Service
Refer to “Precautions for Electrical Circuit Service in Section 00”.

Precautions of Electric Throttle Body System Calibration
Refer to “Precautions of Electric Throttle Body System Calibration in Section 1A”.

Engine General Information and Diagnosis

Precautions

Precautions on Engine Service

S7RS0B1100001

⚠ **CAUTION**

The following information on engine service should be noted carefully, as it is important in preventing damage, and in contributing to reliable engine performance.

- When raising or supporting engine for any reason, do not use a jack under oil pan. Due to small clearance between oil pan and oil pump strainer, jacking against oil pan may cause it to be bent against strainer, resulting in damaged oil pick-up unit.
- It should be kept in mind, while working on engine, that 12-volt electrical system is capable of violent and damaging short circuits.
  When performing any work where electrical terminals can be grounded, ground cable of the battery should be disconnected at battery.
- Any time the air cleaner, throttle body or intake manifold is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material which could follow intake passage into cylinder and cause extensive damage when engine is started.

Precaution on On-Board Diagnostic (OBD) System

S7RS0B1100005

There are two types of On-Board Diagnostic (OBD) system, Euro OBD system and non-Euro-OBD system, depending on the vehicle specification.
As the diagnosis function is different between these two types, be sure to fully understand the OBD system referring to “On-Board Diagnostic System Description”.

OBD System Summary Table

	Euro OBD model	Non-Euro-OBD model
Quantity of DTC related to engine control	Approx. 80	Approx. 60
Freeze frame data	Available	Not available
SUZUKI scan tool	Available	Available
OBD generic scan tool	Available	Not available

Precautions in Diagnosing Trouble

S7RS0B1100002

NOTE

There are two types of OBD system depending on the vehicle specification.
For details, refer to “Precaution on On-Board Diagnostic (OBD) System”.

- Don’t disconnect couplers from ECM, battery cable from battery, ECM ground wire harness from engine or main fuse before confirming diagnostic information (DTC, freeze frame data, etc.) stored in ECM memory. Such disconnection will erase memorized information in ECM memory.
- Diagnostic information stored in ECM memory can be cleared as well as checked by using SUZUKI scan tool or OBD generic scan tool. Before using scan tool, read its Operator’s (Instruction) Manual carefully to have good understanding as to what functions are available and how to use it.
  For Euro OBD model it is indistinguishable which module turns on MIL because not only ECM but also TCM (A/T model) turns on MIL (For details of on-board diagnostic system for A/T model, refer to “On-Board Diagnostic System Description in Section 5A”). Therefore, check both ECM and TCM (A/T model) for DTC when MIL lights on.
  When checking ECM for DTC, keep in mind that DTC is displayed on the scan tool as follows depending on the scan tool used.
  - SUZUKI scan tool displays DTC detected by ECM.
  - OBD generic scan tool displays DTC detected by each of ECM and TCM (A/T model) simultaneously.
- Priorities for diagnosing troubles
  If two or more DTCs are stored, proceed to the DTC flow which has been detected earliest in the order and follow the instruction in that flow.
  If no instructions are given, troubleshoot DTCs according to the following priorities.
  a. DTCs other than DTC P0171 / P0172 (Fuel system too lean / too rich), DTC P0300 / P0301 / P0302 / P0303 / P0304 (Misfire detected) and DTC P0401 / P0402 (EGR flow malfunction)
  b. DTC P0171 / P0172 (Fuel system too lean / too rich) and DTC P0401 / P0402 (EGR flow malfunction)
  c. DTC P0300 / P0301 / P0302 / P0303 / P0304 (Misfire detected)

- Be sure to read “Precautions for Electrical Circuit Service in Section 00” before inspection and observe what is written there.
- ECM replacement:
  When substituting a known-good ECM, check for the following conditions. Neglecting this check may cause damage to a known-good ECM.
  – Resistance value of all relays, actuators is as specified respectively.
  – MAP sensor, A/C refrigerant pressure sensor and TP sensor are in good condition and none of power circuits of these sensors is shorted to ground.
- Communication of ECM, BCM, ABS/ESP® control module, combination meter, keyless start control module, steering angle sensor (ESP® model) and TCM (A/T model), is established by CAN (Controller Area Network). (For more detail of CAN communication for ECM, refer to “CAN Communication System Description”). Therefore, handle CAN communication line with care referring to “Precaution for CAN Communication System in Section 00”.
- Immobilizer transponder code registration after replacing ECM
  When ECM is replaced with new one or with another one, make sure to register immobilizer transponder code to ECM correctly according to “Procedure after ECM Replacement in Section 10C”.

Precautions of ECM Circuit Inspection

S7RS0B1100003

- ECM connectors are waterproofed. Each terminal of the ECM connectors is sealed up with the grommet. Therefore, when measuring circuit voltage, resistance and/or pulse signal at ECM connector, do not insert the tester’s probe into the sealed terminal at the harness side. When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to the ECM connectors. And, insert the tester’s probe into the special tool’s connectors at the harness side, and then measure voltage, resistance and/or pulse signal. Or, ECM and its circuits may be damaged by water.
- Wire colors of the special tool’s connectors are different from the ones of the ECM connectors. However, the circuit arrangement of the special tool’s connectors is same as the one of the ECM connectors. Therefore, measure circuit voltage and resistance by identifying the terminal location subject to the measurement.

Precautions of Electric Throttle Body System Calibration

S7RS0B1100004

After performing one of works described below, it is necessary to re-register the completely closed throttle valve reference position stored in memory of ECM. (For detailed information, refer to “Description of Electric Throttle Body System Calibration”.) For the procedure to register such data in ECM, refer to “Electric Throttle Body System Calibration in Section 1C”.

- To shut off backup power of ECM for such purposes of battery replacement or “DOME” fuse removal
- To erase DTCs P0122, P0123, P0222, P0223, P2101, P2102, P2103, P2111, P2112, P2113, P2119, P2123, P2127, P2128, P2135 and/or P2138
- To replace ECM
- To replace throttle body and/or accelerator pedal position (APP) sensor assembly

General Description

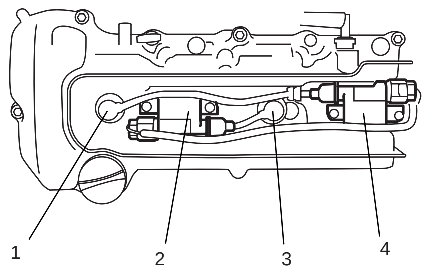
Statement on Cleanliness and Care

S7RS0B1101001

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the thousands of an millimeter (ten thousands of an inch).
Accordingly, when any internal engine parts are serviced, care and cleanliness are important.
It should be understood that proper cleaning and protection of machined surfaces and friction areas is part of the repair procedure. This is considered standard shop practice even if not specifically stated.

- A liberal coating of engine oil should be applied to friction areas during assembly to protect and lubricate the surfaces on initial operation.
- Whenever valve train components, pistons, piston rings, connecting rods, rod bearings, and crankshaft journal bearings are removed for service, they should be retained in order.
  At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.
- Battery cables should be disconnected before any major work is performed on the engine.
  Failure to disconnect cables may result in damage to wire harness or other electrical parts.

- The four cylinders of the engine are identified by numbers; No.1 (1), No.2 (2), No.3 (3) and No.4 (4) counted from crankshaft pulley side to flywheel side.



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Engine Diagnosis General Description

S7RS0B1101002

NOTE

There are two types of OBD system depending on the vehicle specification.
For details, refer to "Precaution on On-Board Diagnostic (OBD) System".

This vehicle is equipped with an engine and emission control system which are under control of ECM.
The engine and emission control system in this vehicle are controlled by ECM. ECM has an On-Board Diagnostic system which detects a malfunction in this system and abnormality of those parts that influence the engine exhaust emission. When diagnosing engine troubles, be sure to have full understanding of the outline of "On-Board Diagnostic System Description" and each item in "Precautions in Diagnosing Trouble" and execute diagnosis according to "Engine and Emission Control System Check".
There is a close relationship between the engine mechanical, engine cooling system, ignition system, exhaust system, etc. and the engine and emission control system in their structure and operation. In case of an engine trouble, even when the malfunction indicator lamp (MIL) doesn't turn ON, it should be diagnosed according to "Engine and Emission Control System Check".

On-Board Diagnostic System Description

S7RS0B1101003

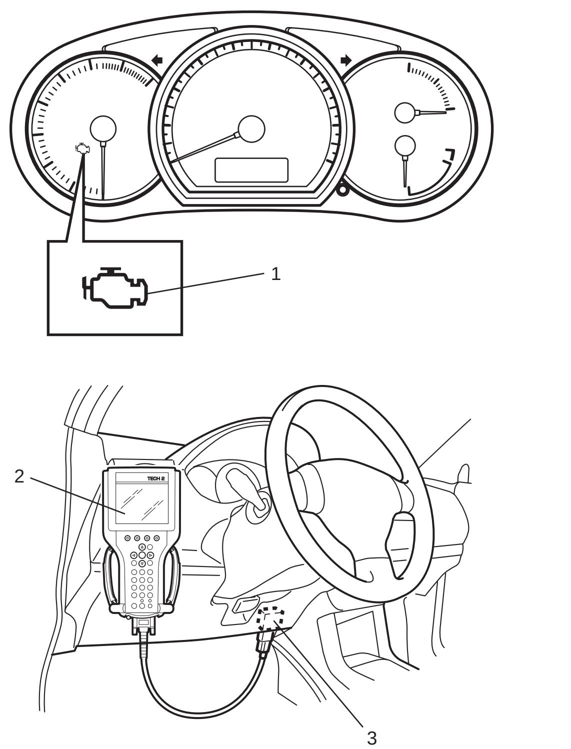
NOTE

There are two types of OBD system depending on the vehicle specification.
For details, refer to "Precaution on On-Board Diagnostic (OBD) System".

Euro OBD Model

ECM in this vehicle has the following functions.

- When the ignition switch is turned ON with the engine at a stop, malfunction indicator lamp (MIL) (1) turns ON to check the circuit of the malfunction indicator lamp (1).
- When ECM detects a malfunction which gives an adverse effect to vehicle emission while the engine is running, it makes the malfunction indicator lamp (1) in the meter cluster of the instrument panel turn ON or flash (flashing only when detecting a misfire which can cause damage to the catalyst) and stores the malfunction area in its memory.
  (If it detects that continuously 3 driving cycles are normal after detecting a malfunction, however, it makes MIL (1) turn OFF although DTC stored in its memory will remain.)
- As a condition for detecting a malfunction in some areas in the system being monitored by ECM and turning ON the malfunction indicator lamp (1) due to that malfunction, 2 driving cycle detection logic is adopted to prevent erroneous detection.
- When a malfunction is detected, engine and driving conditions then are stored in ECM memory as freeze frame data. (For the details, refer to description on "Freeze Frame Data".)
- It is possible to communicate by using not only SUZUKI scan tool (2) but also OBD generic scan tool. (Diagnostic information can be accessed by using a scan tool.)



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3. DLC

Warm-Up Cycle

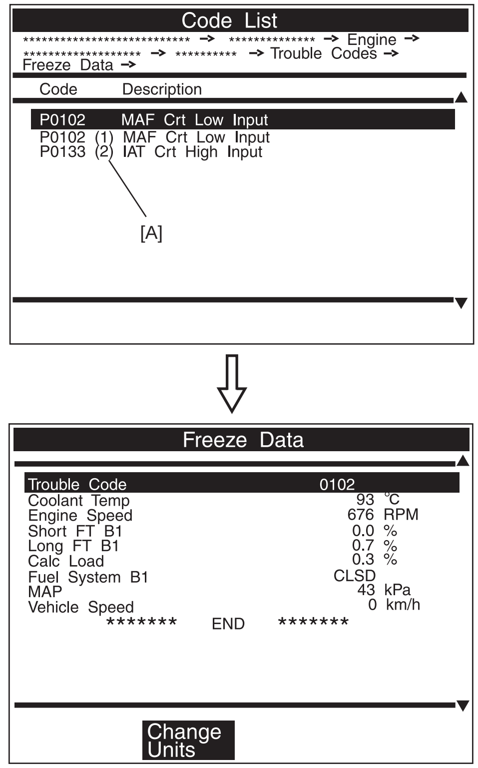
A warm-up cycle means sufficient vehicle operation such that the coolant temperature has risen by at least 22 °C (40 °F) from engine starting and reaches a minimum temperature of 70 °C (160 °F).

Driving Cycle
A “Driving Cycle” consists of engine startup and engine shutoff.

2 Driving Cycle Detection Logic
The malfunction detected in the first driving cycle is stored in ECM memory (in the form of pending DTC) but the malfunction indicator lamp does not light at this time. It lights up at the second detection of same malfunction also in the next driving cycle.

Pending DTC
Pending DTC means a DTC detected and stored temporarily at 1 driving cycle of the DTC which is detected in the 2 driving cycle detection logic.

Freeze Frame Data
ECM stores the engine and driving conditions (in the form of data as shown in the figure) at the moment of the detection of a malfunction in its memory. This data is called “Freeze frame data”.
Therefore, it is possible to know engine and driving conditions (e.g., whether the engine was warm or not, where the vehicle was running or stopped, where air/fuel mixture was lean or rich) when a malfunction was detected by checking the freeze frame data. Also, ECM has a function to store each freeze frame data for three different malfunctions in the order as each malfunction is detected. Utilizing this function, it is possible to know the order of malfunctions that have been detected. Its use is helpful when rechecking or diagnosing a trouble.



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[A]: 1st or 2nd in parentheses here represents which position in the order the malfunction is detected.

Priority of freeze frame data:
ECM has 4 frames where the freeze frame data can be stored. The first frame stores the freeze frame data of the malfunction which was detected first. However, the freeze frame data stored in this frame is updated according to the priority described. (If malfunction as described in the upper square “1” is detected while the freeze frame data in the lower square “2” has been stored, the freeze frame data “2” will be updated by the freeze frame data “1”.)

Priority	Freeze frame data in frame 1
1	Freeze frame data at initial detection of malfunction among misfire detected (P0300 – P0304), fuel system too lean (P0171) and fuel system too rich (P0172)
2	Freeze frame data when a malfunction other than those in “1” is detected

In the 2nd through the 4th frames, the freeze frame data of each malfunction is stored in the order as each malfunction is detected. These data are not updated.
Shown in the table are examples of how freeze frame data are stored when two or more malfunctions are detected.

Malfunction detected order		Frame			
		Frame 1	Frame 2	Frame 3	Frame 4
		Freeze frame data to be updated	1st freeze frame data	2nd freeze frame data	3rd freeze frame data
	No malfunction	No freeze frame data			
1	P0401 (EGR) detected	Data at P0401 detection	Data at P0401 detection	—	—
2	P0171 (Fuel system) detected	Data at P0171 detection	Data at P0401 detection	Data at P0171 detection	—
3	P0300 (Misfire) detected	Data at P0171 detection	Data at P0401 detection	Data at P0171 detection	Data at P0300 detection
4	P0301 (Misfire) detected	Data at P0171 detection	Data at P0401 detection	Data at P0171 detection	Data at P0300 detection

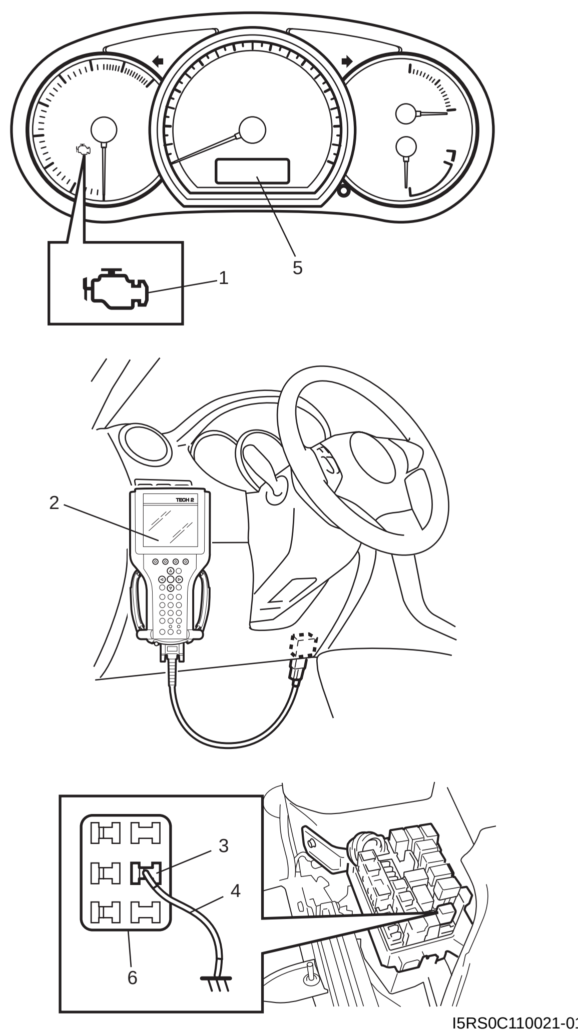
Freeze frame data clearance:
The freeze frame data is cleared at the same time as clearance of DTC.

Non-Euro-OBD
ECM diagnosis troubles which may occur in the area including the following parts when the ignition switch is ON and the engine is running, and indicates the result by turning on or flashing malfunction indicator lamp (1).

- Heated oxygen sensor
- ECT sensor
- TP sensor
- APP sensor
- MAF sensor
- IAT sensor
- MAP sensor
- CMP sensor
- CKP sensor
- Knock sensor
- Wheel speed sensor (VSS)
- CPU (Central Processing Unit) of ECM
- Oil control valve
- EGR valve
- EVAP canister purge valve
- Ignition coil
- Starter relay
- Radiator fan relay
- CAN communication
- Barometric pressure sensor
- ECM back up power supply

ECM and malfunction indicator lamp (1) operate as follows.

- Malfunction indicator lamp (1) lights when the ignition switch is turned ON (but the engine at stop) with the diagnosis switch terminal ungrounded regardless of the condition of Engine and Emission control system. This is only to check the malfunction indicator lamp (1) in the combination meter and its circuit.
- If the above areas of Engine and Emission control system is free from any trouble after the engine start (while engine is running), malfunction indicator lamp (1) turns OFF.
- When ECM detects a trouble which has occurred in the above areas, it makes malfunction indicator lamp (1) turn ON while the engine is running to warn the driver of such occurrence of trouble and at the same time it stores the trouble area in ECM back-up memory. (The memory is kept as it is even if the trouble was only temporary and disappeared immediately. And it is not erased unless the power to ECM is shut off for specified time or it is cleared by SUZUKI scan tool (2).)
  For Hong Kong model, DTC can be read by not only using SUZUKI scan tool but also displayed on odometer (5) of the combination meter. (i.e. when diagnosis switch terminal (3) is grounded with a service wire (4) and ignition switch is turned ON.) For further detail of the checking procedure, refer to “DTC Check”.



6.	Diagnosis connector

For information about the following items, refer to “Euro OBD Model: ”.

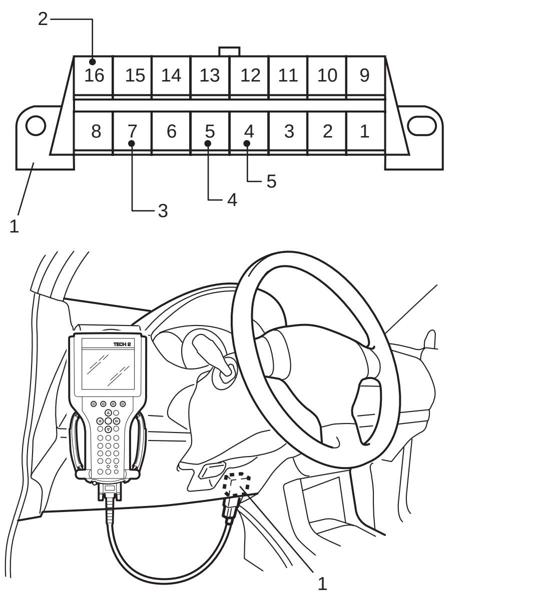
- Warm-up cycle
- Driving cycle
- 2 driving cycle detection logic
- Pending DTC

Data Link Connector (DLC)

S7RS0B1101013

DLC (1) is in compliance with SAE J1962 in the shape of connector and pin assignment.

OBD serial data line (3) (K line of ISO 9141) is used for SUZUKI scan tool or OBD generic scan tool to communicate with ECM, Air bag SDM, HVAC control module (auto A/C model), immobilizer control module (in ECM), BCM (Body electrical Control Module), TCM (Transmission Control Module (A/T model)) and ABS/ ESP® control module.



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2.	B + (Unswitched vehicle battery positive)
4.	ECM ground (Signal ground)
5.	Vehicle body ground (Chassis ground)

Engine and Emission Control System Description

S7RS0B1101004

The engine and emission control system is divided into 4 major sub-systems: air intake system, fuel delivery system, electronic control system and emission control system.

Air intake system includes air cleaner, throttle body, IAC valve and intake manifold.

Fuel delivery system includes fuel pump, delivery pipe, etc.

Electronic control system includes ECM, various sensors and controlled devices.

Emission control system includes EGR, EVAP and PCV system.

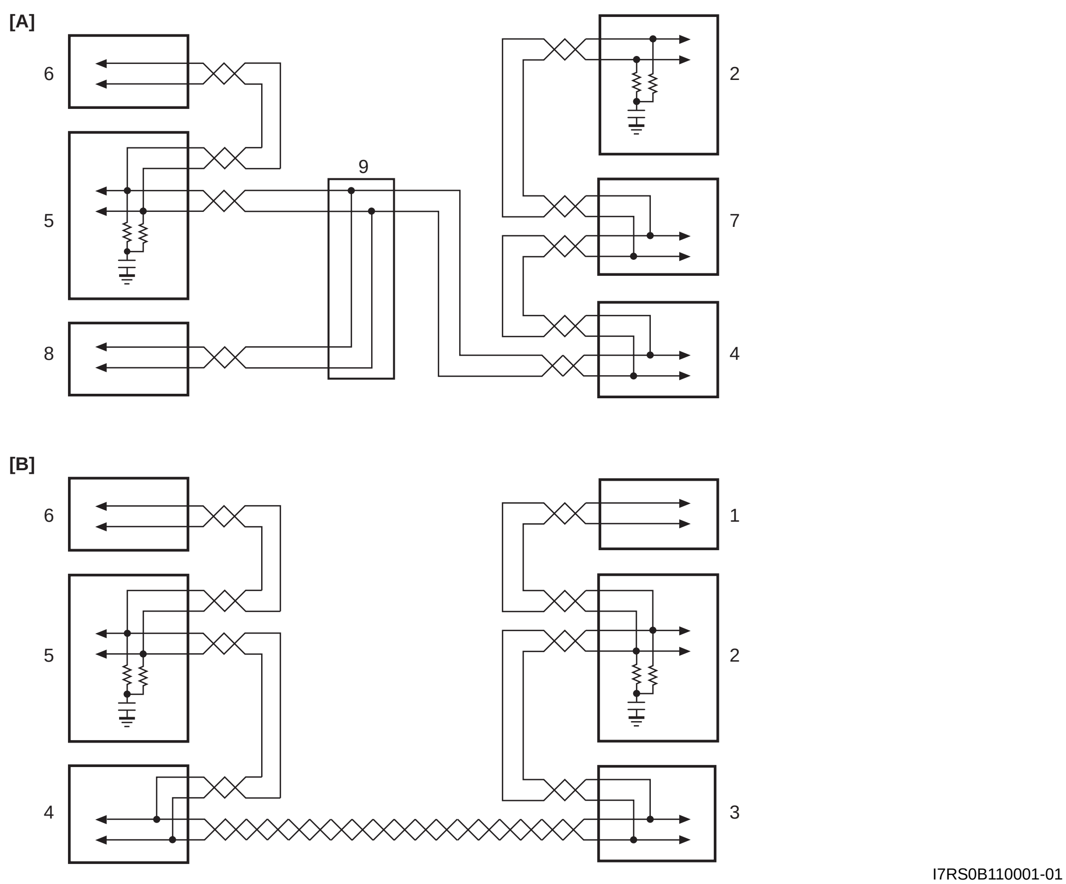
CAN Communication System Description

S7RS0B1101005

The following control modules and sensors communicate each other.

- ECM (2)
- TCM (1)
- BCM (4)
- ABS control module (3) or ESP® control module (7)
- Combination meter (5)
- Keyless start control module (6)
- Steering angle sensor (ESP® model) (8)

Communication of each control module and sensor is established by CAN (Controller Area Network) communication system.



[A]: ESP® model	[B]: Non-ESP® model	9. CAN junction connector

CAN communication system uses the serial communication in which data is transmitted at a high speed. It uses a twisted pair of two communication lines for the high-speed data transmission. As one of its characteristics, multiple control modules can communicate simultaneously. In addition, it has a function to detect a communication error automatically. Each module reads necessary data from the received data and transmits data. ECM communicates control data with each control module as follows.

ECM Transmission Data

				TCM	BCM	Combination Meter	ESP® Control Module	ABS Control Module (Non-ESP® model)	Keyless Start Control Module
ECM	Transmit	DATA	Engine torque signal	○			○		
			Accelerator pedal position signal	○			○		
			Throttle position signal	○					
			Brake pedal switch signal		○		○	○	
			A/C refrigerant pressure signal		○				
			A/C compressor clutch signal	○	○				
			Fuel consumption signal			○			
			Immobilizer indicator light control signal			○			
			MIL control signal			○			
			Diagnostic trouble code (DTC)			○*1			
			Engine coolant temperature signal	○	○	○			
			Engine speed signal	○	○	○	○		○
			Vehicle speed signal		○	○			○
			ECM-keyless start control module code						○

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NOTE

- **In communication between ECM and combination meter and between ECM and steering angle sensor (ESP® model), data is transmitted only from ECM to combination meter and steering angle sensor. (Combination meter and steering angle sensor does not transmit data to ECM.)**
- ***1: Hong Kong model only.**

ECM Reception Data

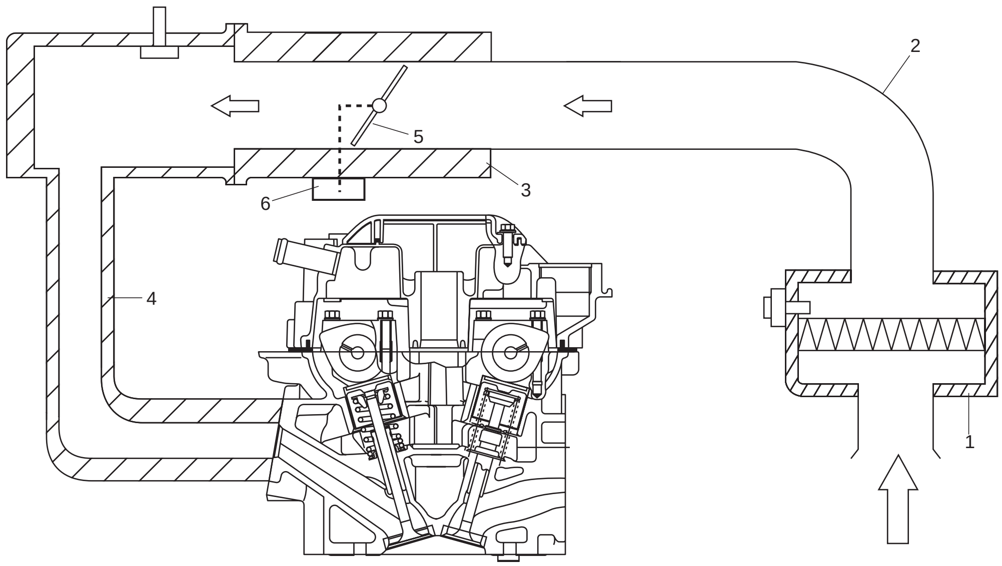
				TCM	BCM	ESP® Control Module	ABS Control Module (Non-ESP® model)	Keyless Start Control Module
ECM	Receive	DATA	Torque request signal	○		○		
			A/T select lever position signal	○				
			Transmission actual gear position signal	○				
			Transmission oil temperature signal	○				
			A/C switch ON signal		○			
			Electric load signal		○			
			ESP® status signal			○		
			ABS active signal			○	○	
			Wheel speed signal (front right)			○	○	
			Wheel speed signal (front left)			○	○	
			ECM-keyless start control module code					○
			ID code of keyless start control module					○

I7RS0B110003-02

Air Intake System Description

S7RS0B1101006

The main components of the air intake system are air cleaner (1), air cleaner outlet hose (2), electric throttle body (3) (for the details, refer to “Description of Electric Throttle Body System”.), and intake manifold (4).
The air (by the amount corresponding to throttle valve (5) opening and engine speed) is filtered by the air cleaner, distributed by the intake, and finally drawn into each combustion chamber. Electric throttle body is not equipped with IAC valve for idle speed control. Idle speed control is done by the throttle actuator (6) which opens/closes the throttle valve. (For the details, refer to “Description of Electric Throttle Body System”).



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Description of Electric Throttle Body System

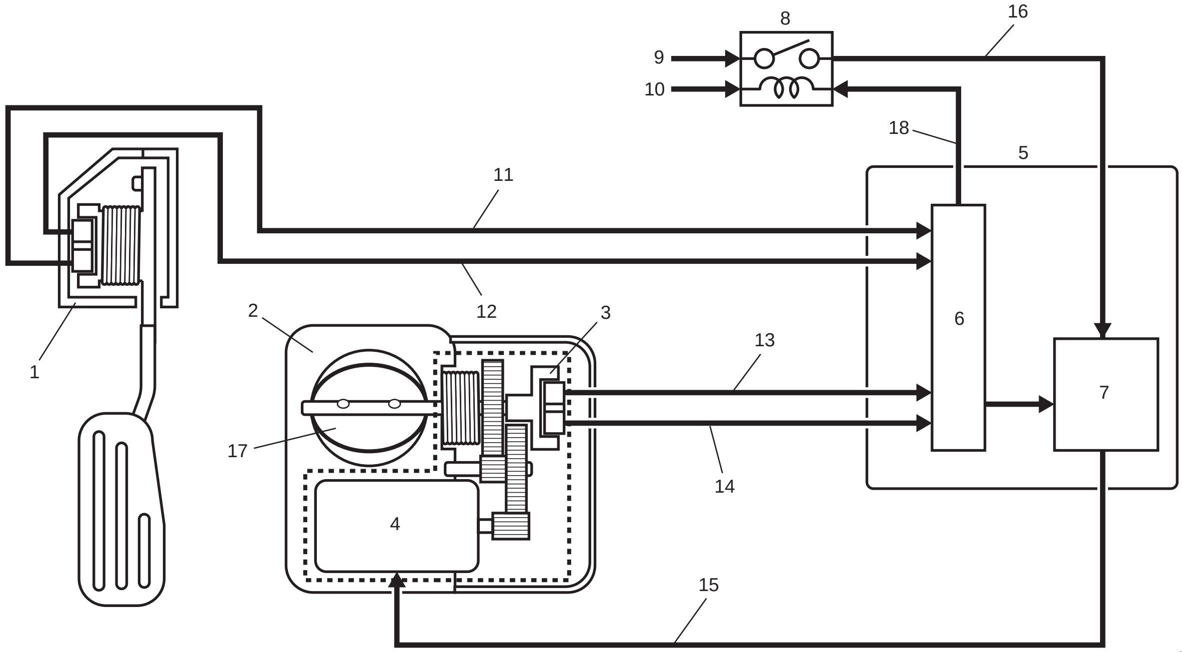
S7RS0B1101007

The Electric Throttle Body System consists of electric throttle body assembly, APP sensor assembly, ECM and throttle actuator control relay.
Among them, assembly components are as follows.

- Electric throttle body assembly: throttle valve, throttle actuator, 2 throttle position sensors
- APP sensor assembly: Accelerator pedal, 2 accelerator position sensors

Operation Description

ECM (5) detects opening (depressed extent of pedal) of the accelerator pedal based on signal voltage of the APP sensor (1) and using that data and engine operation condition, it calculates the optimum throttle valve opening. On the other hand, it detects the throttle valve opening based on the signal voltage of the throttle position sensor (3) included in the throttle body (2) and compares it with above calculated optimum throttle valve opening. When there is a difference between them, ECM controls the duty ratio (100% – 0%) according to this difference to drive the throttle actuator (motor) (4) included in the throttle body. When there is no difference, ECM controls the duty ratio to about 15% to maintain the throttle valve opening. In this way, the throttle valve (17) is opened and closed to achieve the optimum throttle valve opening.
In this system, as the throttle position sensor and APP sensor have 2 sensors (main and sub) each, highly accurate and highly reliable control and abnormality detection are assured. Also, when ECM detects an abnormality in the system, it turns off the throttle actuator control relay (8) to step controlling the throttle actuator.
When the throttle actuator control relay is turned off, the throttle valve is fixed at the specified opening below from its completely closed position (default opening) by the force of the return spring and open spring included in the throttle body.
This throttle body is not equipped with IAC valve for idle speed control. Idle speed control is done by the throttle actuator which opens/closes the throttle valve.



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6. CPU	11. APP sensor (main) signal	15. Drive signal of throttle actuator
7. Drive circuit of throttle actuator	12. APP sensor (sub) signal	16. Power supply of throttle actuator
9. From “TH MOT” fuse	13. TP sensor (main) signal	18. Control signal of throttle actuator control relay
10. From main relay	14. TP sensor (sub) signal	

Description of Electric Throttle Body System Calibration

S7RS0B1101008

ECM calculates controlled opening of the throttle valve on the basis of the completely closed throttle valve position of the electric throttle body system. The completely closed position data is saved in memory of ECM. However, the completely closed position of the throttle valve of the electric throttle body system (signal voltage from throttle position sensor when throttle is completely closed) differs one from the other depending on individual differences of the throttle valve and throttle position sensor. As such individual differences must be taken into account for controlling the throttle valve, it is necessary to register the completely closed throttle valve position data in ECM. When such data is registered in ECM, it is saved in RAM (memory) of ECM and used as the base data for controlling the throttle valve. This data is cleared, when any of the works described in “Precautions of Electric Throttle Body System Calibration” is performed.

Also, after replacement of the throttle body and/or APP sensor, the completely closed position data in memory of ECM must be cleared once and a new one must be registered, or ECM cannot judge the complete closure position properly. For the procedure to register such data, refer to “Electric Throttle Body System Calibration in Section 1C”. (After the completely closed position data is cleared, ECM, for the first time only, opens and closes the throttle valve for about 5 seconds after the ignition switch is turned ON position, for registration of the completely closed throttle valve position. If the engine is started during this registration process, such symptom as “longer cranking” or “slow rise of revolution speed immediately after start-up” may occur. However, turning OFF the ignition switch once and restarting will set correct registration.)

Fuel Cut Control Description

S7RS0B1101009

The fuel cut control in the vehicle stop is added as follows in order to prevent the over-rev.

Fuel Cut Control Table

Vehicle Condition	Operative Condition
Stop	• Engine r/min > 6,000 • Engine r/min > 4,000 for 180 seconds
Run	• Engine r/min > 7,500 (M/T model), Engine r/min > 6,800 (A/T model)

Generator Control System Description

S7RS0B1101010

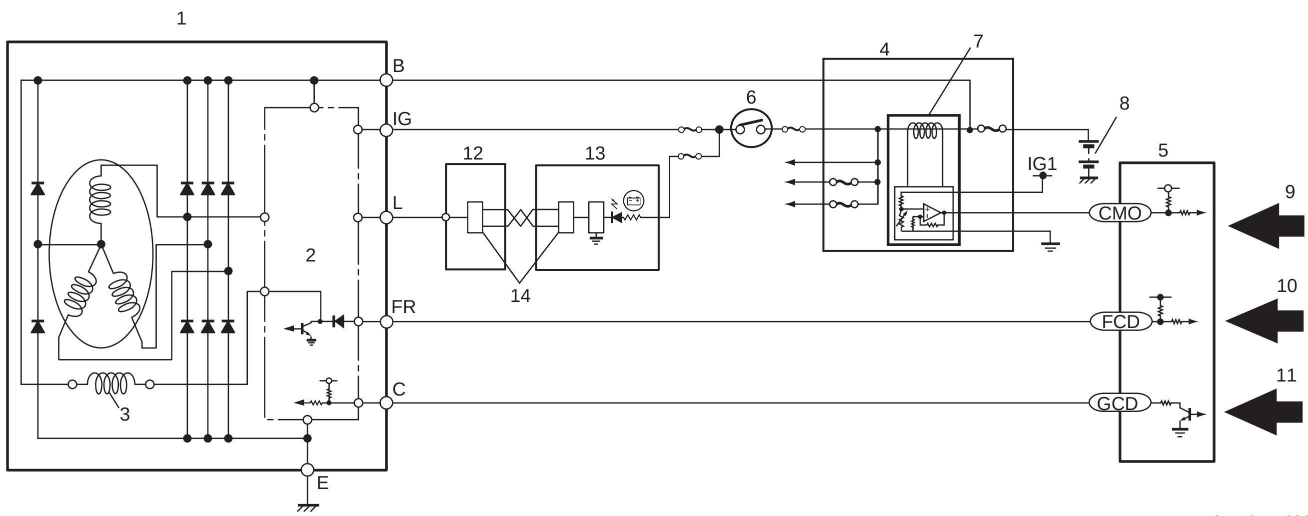
Generator Control System consists of a generator (1), electric load current sensor (7) located in the main fuse box (4) and ECM (5).
ECM controls generated electricity (adjusting voltage of IC regulator (2)) so that it is suitable for the engine and electric load conditions. When the electric load increases quickly, generation load of the generator increases quickly and causes idling to change. To prevent this, ECM makes generated electricity volume vary gradually to stabilize idling. Also, it reduces the engine load caused by temporary increase in electricity generation to cope with the engine condition (such as when accelerating).

Operation

ECM controls the generated voltage of the generator using “C” terminal (generator control terminal) duty, based on following information.

- Engine condition (ECT, vehicle speed, engine speed, TP, etc.) (9)
- Battery voltage (ECM backup power voltage) (10)
- Electric load condition (blower motor, rear defogger, head lights, radiator fan, A/C, etc.) (11)
- “FR” terminal output (field coil (3) control duty) which indicates the operation rate (electricity generation condition) of the generator.

Then the generator uses “C” terminal duty to regulate the adjusting voltage of the IC regulator with the field coil control duty so as to control its generated voltage (“B” terminal output voltage).
(For more information of the generated voltage, refer to “Charging System Specifications in Section 1J”.)
Furthermore, the generation condition of the generator is controlled to the optimum level by the electric load current sensor (7) which detects the electrical load condition (current consumption) linearly even when a sudden electrical load variation occurs and thus the engine load is reduced.



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6. Ignition switch	12. BCM	14. CAN driver
8. Battery	13. Combination meter	

Electronic Control System Description

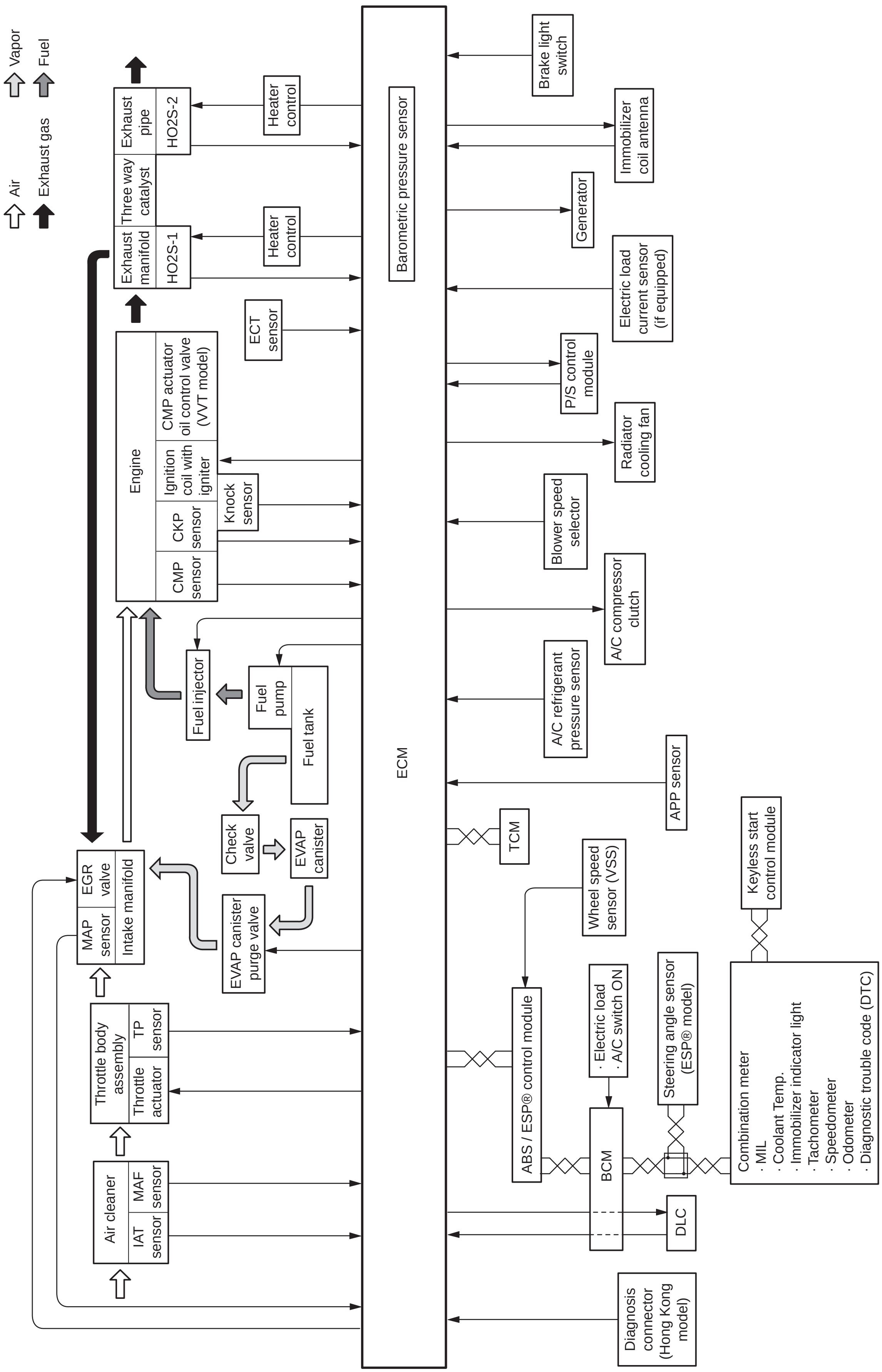
S7RS0B1101011

The electronic control system consists of 1) various sensors which detect the state of engine and driving conditions, 2) ECM which controls various devices according to the signals from the sensors and 3) various controlled devices. Functionally, it is divided into the following sub systems:

- Fuel injection control system
- Ignition control system
- Electric throttle body control system
- Fuel pump control system
- Radiator cooling fan control system
- Evaporative emission control system
- EGR system
- Oxygen sensor heater control system
- A/C control system (A/C model)
- Camshaft position control system
- Immobilizer control system
- Generator control system
- Controller (computer) communication system

Especially, ECM, BCM, combination meter, TCM (A/T model), ABS/ESP® control module, steering angle sensor (ESP® model) and keyless start control module (if equipped) intercommunicate by means of CAN communication.

Engine and Emission Control System Flow Diagram



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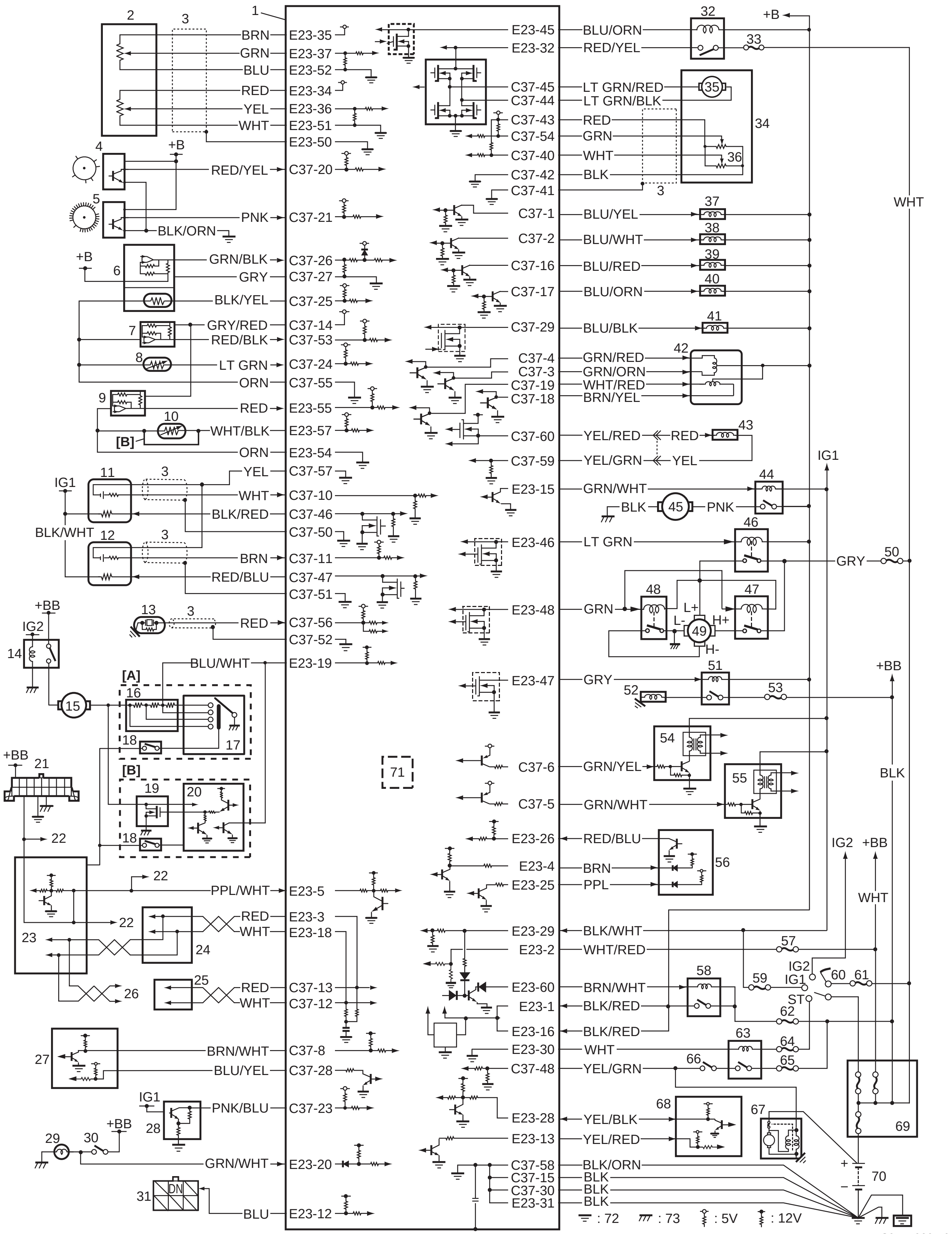
ECM Input / Output Circuit Diagram



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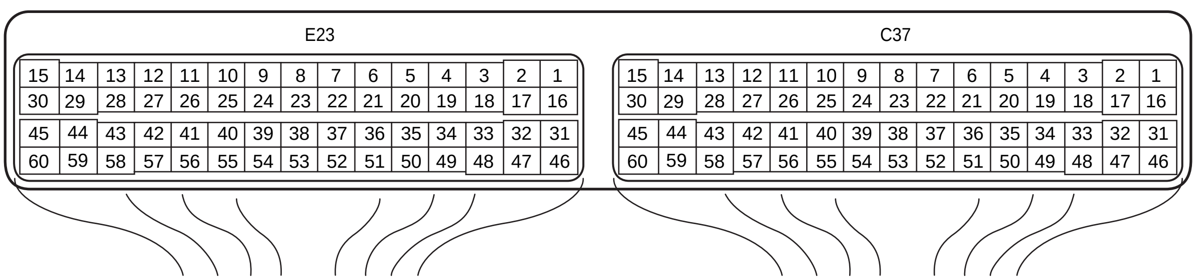
[A]: Manual A/C model	24. ABS / ESP® control module	49. Radiator cooling fan motor
[B]: Auto A/C model	25. TCM	50. “RDTR FAN” fuse
1. ECM	26. To other control module connected CAN	51. A/C compressor relay
2. APP sensor assembly	27. Generator	52. Magnet clutch of compressor (A/C model)
3. Shield wire	28. Electric load current sensor (if equipped)	53. “A/C CPRSR” fuse
4. CMP sensor	29. Brake light	54. Ignition coil assembly (for No.1 and No.4 spark plugs)
5. CKP sensor	30. Brake light switch	55. Ignition coil assembly (for No.2 and No.3 spark plugs)
6. MAF and IAT sensor	31. Diagnosis connector (Hong Kong model)	56. P/S control module
7. MAP sensor	32. Throttle actuator control relay	57. “RADIO” fuse
8. ECT sensor	33. “THR MOT” fuse	58. Main relay
9. A/C refrigerant pressure sensor	34. Throttle throttle body assembly	59. “IG COIL” fuse
10. A/C evaporator outlet air temp. sensor (Manual A/C model)	35. Throttle actuator	60. Ignition switch
11. HO2S-1	36. TP sensor	61. “IG ACC” fuse
12. HO2S-2	37. Injector No.1	62. “FI” fuse
13. Knock sensor	38. Injector No.2	63. Starting motor control relay
14. Blower motor relay	39. Injector No.3	64. “ST SIG” fuse
15. Blower motor	40. Injector No.4	65. “ST MOT” fuse
16. Blower motor resistor	41. EVAP canister purge valve	66. Transmission range switch (A/T model) or CPP switch (Hong Kong model with M/T)
17. Blower speed selector	42. EGR valve	67. Starting motor
18. A/C switch	43. Oil control valve (Camshaft position control) (VVT model)	68. Immobilizer coil antenna
19. Blower motor controller	44. Fuel pump relay	69. Main fuse box
20. HVAC control module	45. Fuel pump	70. Battery
21. Data link connector (DLC)	46. Radiator cooling fan motor relay No.1	71. Barometric pressure sensor
22. To other control module connected with DLC	47. Radiator cooling fan motor relay No.2	72. Engine ground
23. BCM	48. Radiator cooling fan motor relay No.3	73. Body ground

Terminal Arrangement of ECM Coupler (Viewed from Harness Side)



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Connector: C37

Terminal	Wire color	Circuit	Terminal	Wire color	Circuit
1	BLU/YEL	Fuel injector No.1 output	31	—	—
2	BLU/WHT	Fuel injector No.2 output	32	—	—
3	GRN/ORN	EGR valve (stepper motor coil 2) output	33	—	—
4	GRN/RED	EGR valve (stepper motor coil 1) output	34	—	—
5	GRN/WHT	Ignition coil No.2 and No.3 output	35	—	—
6	GRN/YEL	Ignition coil No.1 and No.4 output	36	—	—
7	—	—	37	—	—
8	BRN/WHT	Generator field coil monitor signal	38	—	—
9	—	—	39	—	—
10	WHT	Oxygen signal of HO2S-1	40	WHT	TP sensor (sub) signal
11	BRN	Oxygen signal of HO2S-2	41	—	Ground for shield wire of TP sensor circuit
12	WHT	CAN (low) communication line (active low signal) to TCM (A/T model)	42	BLK	Ground for TP sensor
13	RED	CAN (high) communication line (active high signal) to TCM (A/T model)	43	RED	Output for 5 V power source of TP sensor
14	GRY/RED	Output of 5 V power source for MAP sensor, A/C refrigerant pressure sensor	44	LT GRN/BLK	Output of throttle actuator
15	BLK	Ground for ECM	45	LT GRN/RED	Output of throttle actuator
16	BLU/RED	Fuel injector No.3 output	46	BLK/RED	Heater output of heated oxygen sensor-1
17	BLU/ORN	Fuel injector No.4 output	47	RED/BLU	Heater output of heated oxygen sensor-2
18	BRN/YEL	EGR valve (stepper motor coil 4) output	48	YEL/GRN	Starting motor signal
19	WHT/RED	EGR valve (stepper motor coil 3) output	49	—	—
20	RED/YEL	CMP sensor signal	50	—	Ground of ECM for shield wire
21	PNK	CKP sensor signal	51	—	Ground of ECM for shield wire
22	—	—	52	—	Ground of ECM for shield wire
23	PNK/BLU	Electric load current sensor signal	53	RED/BLK	MAP sensor signal
24	LT GRN	ECT sensor signal	54	GRN	TP sensor (main) signal
25	BLK/YEL	IAT sensor signal	55	ORN	Ground for sensors
26	GRN/BLK	MAF sensor signal	56	RED	Knock sensor signal
27	GRY	Ground for MAF sensor	57	YEL	Ground for sensors
28	BLU/YEL	Generator control signal output	58	BLK/ORN	Ground for ECM
29	BLU/BLK	EVAP canister purge valve output	59	YEL/GRN	Oil control valve ground
30	BLK	Ground for ECM	60	YEL/RED	Oil control valve output

Connector: E23

Terminal	Wire color	Circuit	Terminal	Wire color	Circuit
1	BLK/RED	Main power supply	31	BLK	Ground for ECM
2	WHT/RED	Power source for ECM internal memory	32	RED/YEL	Power supply of throttle actuator drive circuit
3	RED	CAN communication line (active high signal) for ABS/ ESP® control module, BCM, combination meter	33	—	—
4	BRN	Engine revolution signal output for P/S control module	34	RED	Output of 5 V power source for APP sensor (sub)
5	PPL/WHT	12 V serial communication line of DLC	35	BRN	Output of 5 V power source for APP sensor (main)
6	—	—	36	YEL	APP sensor (sub) signal
7	—	—	37	GRN	APP sensor (main) signal
8	—	—	38	—	—
9	—	—	39	—	—
10	—	—	40	—	—
11	—	—	41	—	—
12	BLU	Diagnosis switch terminal (Hong Kong model)	42	—	—
13	YEL/RED	Clock signal for immobilizer coil antenna	43	—	—
14	—	—	44	—	—
15	GRN/WHT	Fuel pump relay output	45	BLU/ORN	Throttle actuator control relay output
16	BLK/RED	Main power supply	46	LT GRN	Radiator cooling fan relay No.1 output
17	—	—	47	GRY	A/C compressor relay output
18	WHT	CAN communication line (active low signal) for ABS/ ESP® control module BCM, combination meter	48	GRN	Radiator cooling fan relay No.2 and No.3 output
19	BLU/WHT	Electric load signal for heater blower motor	49	—	—
20	GRN/WHT	Brake light switch signal	50	—	Ground for shield wire of APP sensor
21	—	—	51	WHT	Ground for APP sensor (sub)
22	—	—	52	BLU	Ground for APP sensor (main)
23	—	—	53	—	—
24	—	—	54	ORN	Ground for sensors
25	PPL	Vehicle speed signal output for P/S control module	55	RED	A/C refrigerant pressure sensor signal
26	RED/BLU	EPS signal	56	—	—
27	—	—	57	WHT/BLK	A/C evaporator outlet air temp. sensor signal (Manual A/C model)
28	YEL/BLK	Serial communication line for immobilizer coil antenna	58	—	—
29	BLK/WHT	Ignition switch signal	59	—	—
30	WHT	Starting motor control relay output	60	BRN/WHT	Main power supply relay output

Engine and Emission Control Input / Output Table

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INPUT \ OUTPUT		ELECTRIC CONTROL DEVICE												
		FUEL PUMP RELAY	FUEL INJECTOR	HO2S HEATER	THROTTLE ACTUATOR	IGNITION COIL WITH IGNITER	EGR VALVE	EVAP CANISTER PURGE VALVE	A/C COMPRESSOR RELAY	RADIATOR FAN RELAY	MIL	MAIN RELAY	OIL CONTROL VALVE (VVT model)	THROTTLE ACTUATOR CONTROL RELAY
SIGNAL FROM SENSOR, SWITCH AND CONTROL MODULE	BAROMETRIC PRESSURE SENSOR		○		○	○	○	○			○			
	STOP LAMP SWITCH		○		○									
	START SWITCH	○	○		○	○			○					
	IGNITION SWITCH	○	○	○	○	○	○	○	○	○	○	○	○	○
	A/C REFRIGERANT PRESSURE SENSOR		○		○				○	○				
	BLOWER SWITCH				○				○					
	A/C SWITCH		○		○			○	○	○				
	A/C EVAP OUTLET AIR TEMP. SENSOR (Manual A/C model)		○		○				○	○				
	ABS/ESP® CONTROL MODULE (Wheel Speed Signal)		○	○	○	○	○	○	○	○	○		○	
	HO2S-1		○					○			○			
	HO2S-2		○								○			
	MAF SENSOR		○	○	○	○	○	○			○		○	
	IAT SENSOR		○		○	○	○	○			○			
	ECT SENSOR		○	○	○	○	○	○	○	○	○		○	
	TP SENSOR		○	○	○	○	○	○	○		○			○
	MAP SENSOR		○			○	○				○			
	CMP SENSOR		○			○					○		○	
	CKP SENSOR	○	○	○	○	○	○	○	○		○		○	
	KNOCK SENSOR					○					○			
	ABS/ESP® CONTROL MODULE (ABS active signal / ESP® status signal)				○									
	IMMOBILIZER CONTROL MODULE (in ECM)	○	○			○					○			
	APP SENSOR				○						○			○

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Schematic and Routing Diagram

Engine and Emission Control System Diagram

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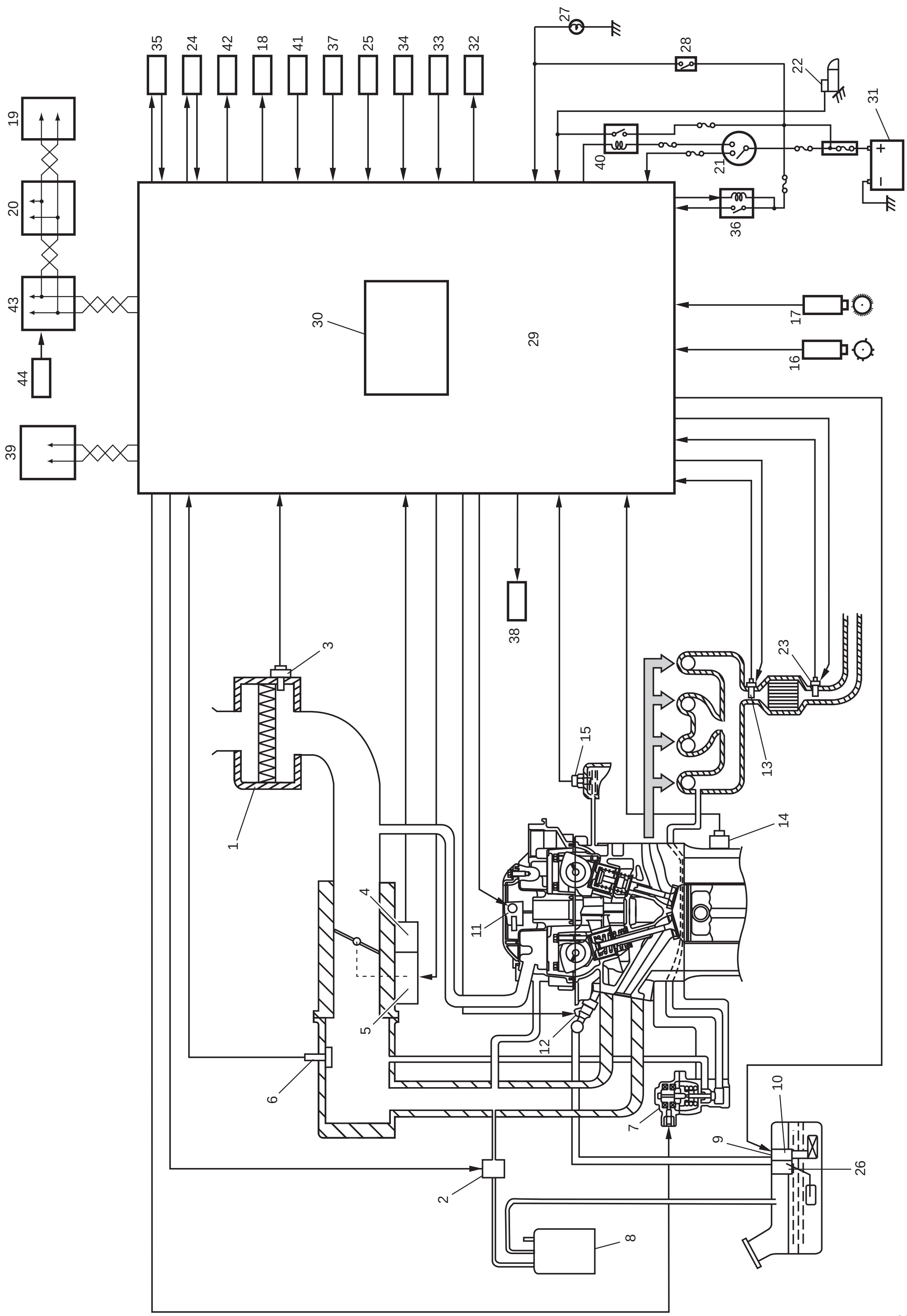

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1. Air cleaner	16. CMP sensor	31. Battery
2. EVAP canister purge valve	17. CKP sensor	32. A/C compressor relay
3. MAF and IAT sensor	18. Radiator cooling fan	33. A/C switch
4. TP sensor	19. Combination meter	34. A/C evaporator outlet air temp. sensor (manual A/C model)
5. Throttle actuator	20. BCM	35. Immobilizer coil antenna
6. MAP sensor	21. Ignition switch	36. Main relay
7. EGR valve	22. Starter magnetic switch	37. APP sensor
8. EVAP canister	23. HO2S-2	38. Oil control valve (VVT model)
9. Tank pressure control valve (built-in fuel pump)	24. DLC	39. TCM (A/T model)
10. Fuel pump (with pressure regulator)	25. Electric load	40. Starting motor control relay
11. Ignition coil assembly	26. Fuel level sensor	41. A/C refrigerant pressure sensor
12. Fuel injector	27. Brake light	42. Throttle actuator control relay
13. HO2S-1	28. Brake light switch	43. ABS/ESP® control module
14. Knock sensor	29. ECM	44. Wheel speed sensor (VSS)
15. ECT sensor	30. Barometric pressure sensor	

Component Location

Electronic Control System Components Location

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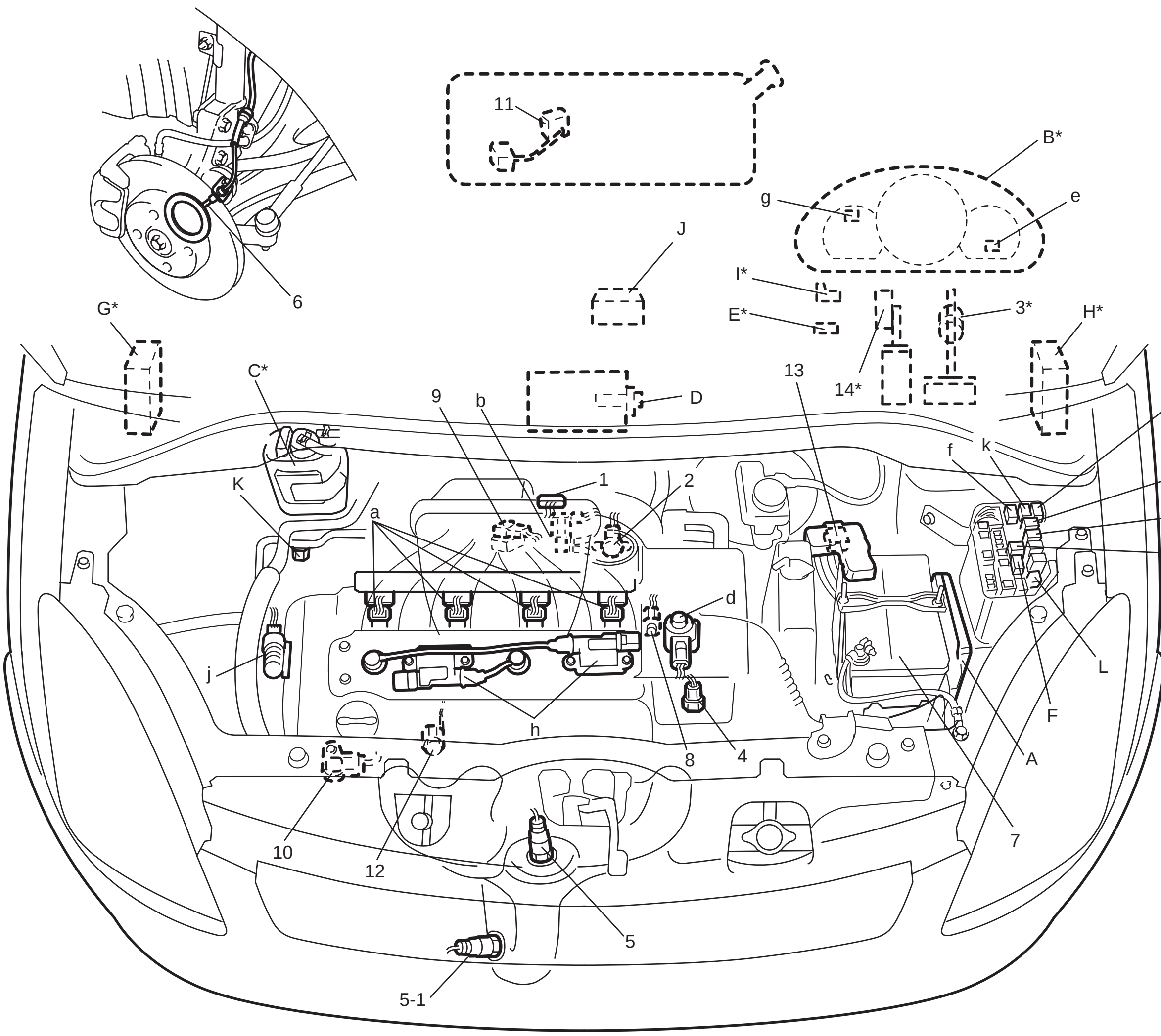
NOTE

The figure shows left-hand steering vehicle. For right-hand steering vehicle, parts with (*) are installed at the opposite side.



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Information sensors	Control devices	Others
1. MAF and IAT sensor	a: Fuel injector	A: ECM
2. TP sensor	b: EVAP canister purge valve	B: Combination meter
3. Brake light switch	c: Fuel pump relay	C: EVAP canister
4. ECT sensor	d: EGR valve	D: A/C evaporator outlet air temp. sensor (manual A/C model)
5. HO2S-1	e: MIL	E: Data link connector
5-1. HO2S-2	f: Radiator cooling fan relay No.3	F: A/C compressor relay
6. Wheel speed sensor (VSS)	g: Immobilizer indicator light	G: TCM (A/T model)
7. Battery	h: Ignition coil assembly (with ignitor)	H: BCM (included in junction block assembly)
8. CMP sensor	i: Main relay	I: Immobilizer coil antenna
9. MAP sensor	j: Oil control valve	J: EPS control module
10. CKP sensor	k: Radiator cooling fan relay No.2	K: A/C refrigerant pressure sensor
11. Fuel level sensor	l: Radiator cooling fan relay No.1	L: Diagnosis connector (Hong Kong model)
12. Knock sensor	m: Starting motor control relay	
13. Electric load current sensor		
14. APP sensor		

Diagnostic Information and Procedures

Engine and Emission Control System Check

S7RS0B1104001

Refer to the following items for the details of each step.

Step	Action	Yes	No
1	☞ **Customer complaint analysis** 1) Perform customer complaint analysis referring to "Customer Complaint Analysis". *Was customer complaint analysis performed?*	Go to Step 2.	Perform customer complaint analysis.
2	☞ **DTC / Freeze frame data check, record and clearance** 1) Check for DTC (including pending DTC) referring to "DTC / Freeze Frame Data Check, Record and Clearance". *Is there any DTC(s)?*	Print DTC and freeze frame data or write them down and clear them by referring to "DTC Clearance", and go to Step 3.	Go to Step 4.
3	☞ **Visual inspection** 1) Perform visual inspection referring to "Visual Inspection". *Is there any faulty condition?*	Repair or replace malfunction part, and go to Step 11.	Go to Step 5.
4	☞ **Visual inspection** 1) Perform visual inspection referring to "Visual Inspection". *Is there any faulty condition?*	Repair or replace malfunction part, and go to Step 11.	Go to Step 8.
5	☞ **Trouble symptom confirmation** 1) Confirm trouble symptom referring to "Trouble Symptom Confirmation". *Is trouble symptom identified?*	Go to Step 6.	Go to Step 7.
6	☞ **Rechecking and record of DTC / Freeze frame data** 1) Recheck for DTC and freeze frame data referring to "DTC Check". *Is there any DTC(s)?*	Go to Step 9.	Go to Step 8.
7	☞ **Rechecking and record of DTC / Freeze frame data** 1) Recheck for DTC and freeze frame data referring to "DTC Check". *Is there any DTC(s)?*	Go to Step 9.	Go to Step 10.
8	☞ **Engine basic inspection and engine symptom diagnosis** 1) Check and repair according to "Engine Basic Inspection" and "Engine Symptom Diagnosis". *Are check and repair complete?*	Go to Step 11.	Check and repair malfunction part(s), and go to Step 11.
9	☞ **Troubleshooting for DTC** 1) Check and repair according to applicable DTC diag. flow. *Are check and repair complete?*	Go to Step 11.	Check and repair malfunction part(s), and go to Step 11.
10	☞ **Intermittent problems check** 1) Check for intermittent problems referring to "Intermittent Problems Check". *Is there any faulty condition?*	Repair or replace malfunction part(s), and go to Step 11.	Go to Step 11.

Step	Action	Yes	No
11	☞ **Final confirmation test** 1) Clear DTC if any. 2) Perform final confirmation test referring to “Final Confirmation Test”. *Is there any problem symptom, DTC or abnormal condition?*	Go to Step 6.	End.

Step 1: Customer Complaint Analysis

Record details of the problem (failure, complaint) and how it occurred as described by the customer. For this purpose, use of such an inspection form will facilitate collecting information to the point required for proper analysis and diagnosis.

Customer problem inspection form (Example)

User name:	Model:	VIN:	
Date of issue:	Date Reg.	Date of problem:	Mileage:

PROBLEM SYMPTOMS	
☐ **Difficult Starting** ☐ No cranking ☐ No initial combustion ☐ No combustion ☐ Poor starting at (☐cold ☐warm ☐always) ☐ Other ____	☐ **Poor Driveability** ☐ Hesitation on acceleration ☐ Back fire/☐After fire ☐ Lack of power ☐ Surging ☐ abnormal knocking ☐ Other ____
☐ **Poor Idling** ☐ Poor fast idle ☐ Abnormal idling speed (☐High ☐Low) (r/min.) ☐ Unstable ☐ Hunting (r/min. to r/min.) ☐ Other ____	☐ **Engine Stall when** ☐ Immediately after start ☐ Accel. pedal is depressed ☐ Accel. pedal is released ☐ Load is applied ☐ A/C ☐Electric load ☐P/S ☐ Other ____ ☐ Other ____
☐ OTHERS:	

VEHICLE/ENVIRONMENTAL CONDITION WHEN PROBLEM OCCURS	
Environmental Condition	
Weather	☐Fair ☐Cloudy ☐Rain ☐Snow ☐Always ☐Other ____
Temperature	☐Hot ☐Warm ☐Cool ☐Cold (°F/ °C) ☐Always
Frequency	☐Always ☐Sometimes (times/ day, month) ☐Only once ☐Under certain condition
Road	☐Urban ☐Suburb ☐Highway ☐Mountainous (☐Uphill ☐Downhill) ☐Tarmacadam ☐Gravel ☐Other ____
Vehicle Condition	
Engine condition	☐Cold ☐Warming up phase ☐Warmed up ☐Always ☐Other at starting ☐Immediately after start ☐Racing without load ☐Engine speed (r/min)
Vehicle condition	During driving: ☐Constant speed ☐Accelerating ☐Decelerating ☐Right hand corner ☐Left hand corner ☐When shifting (Lever position) ☐At stop ☐Vehicle speed when problem occurs (km/h, Mile/h) ☐Other

Malfunction indicator lamp condition	☐Always ON ☐Sometimes ON ☐Always OFF ☐Good condition	
Diagnostic trouble code	First check:	☐No code ☐Malfunction code ( )
	Second check:	☐No code ☐Malfunction code ( )

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NOTE

This form is a standard sample. It should be modified according to conditions characteristic of each market.

Step 2: DTC / Freeze Frame Data Check, Record and Clearance
First, check DTC (including pending DTC), referring to “DTC Check”. If DTC is indicated, print it and freeze frame data or write them down and then clear them by referring to “DTC Clearance”. DTC indicates malfunction that occurred in the system but does not indicate whether it exists now or it occurred in the past and the normal condition has been restored now. To check which case applies, check the symptom in question according to Step 5 and recheck DTC according to Step 6 and 7. Attempt to diagnose a trouble based on DTC in this step only or failure to clear the DTC in this step will lead to incorrect diagnosis, trouble diagnosis of a normal circuit or difficulty in troubleshooting.

Step 3 and 4: Visual Inspection
As a preliminary step, be sure to perform visual check of the items that support proper function of the engine referring to “Visual Inspection”.

Step 5: Trouble Symptom Confirmation
Based on information obtained in “Step 1: Customer Complaint Analysis: ” and “Step 2: DTC / Freeze Frame Data Check, Record and Clearance: ”, confirm trouble symptoms. Also, reconfirm DTC according to “DTC Confirmation Procedure” described in each DTC diag. flow.

Step 6 and 7: Rechecking and Record of DTC / Freeze Frame Data
Refer to “DTC Check” for checking procedure.

Step 8: Engine Basic Inspection and Engine Symptom Diagnosis
Perform basic engine check according to “Engine Basic Inspection” first. When the end of the flow has been reached, check the parts of the system suspected as a possible cause referring to “Engine Symptom Diagnosis” and based on symptoms appearing on the vehicle (symptoms obtained through steps of customer complaint analysis, trouble symptom confirmation and/or basic engine check) and repair or replace faulty parts, if any.

Step 9: Troubleshooting for DTC (See each DTC Diag. Flow)
Based on the DTC indicated in Step 6 or 7 and referring to the applicable DTC diag. flow, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator, ECM or other part and repair or replace faulty parts.

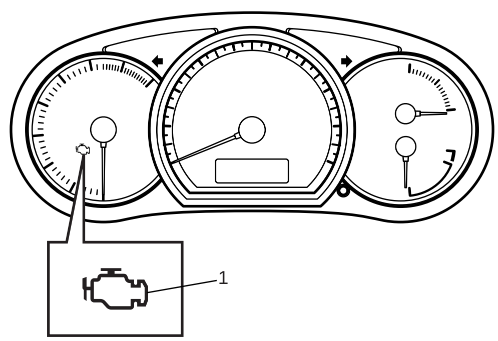
Step 10: Intermittent Problems Check
Check parts where an intermittent trouble is easy to occur (e.g., wire harness, connector, etc.), referring to “Intermittent and Poor Connection Inspection in Section 00” and related circuit of DTC recorded in Step 2.

Step 11: Final Confirmation Test
Confirm that the problem symptom has gone and the engine is free from any abnormal conditions. If what has been repaired is related to the DTC, clear the DTC once, perform DTC confirmation procedure and confirm that no DTC is indicated.

Malfunction Indicator Lamp (MIL) Check

S7RS0B1104002

1) Turn ON ignition switch (with engine at stop) and check that MIL (1) lights.
   If MIL does not light up (or MIL dims) but engine can be starting, go to “MIL Does Not Come ON with Ignition Switch ON and Engine Stop (but Engine Can Be Started)” for troubleshooting.
   If MIL does not light with ignition switch ON and engine does not start though it is cranked up, go to “ECM Power and Ground Circuit Check”.
2) Start engine and check that MIL turns OFF.
   If MIL remains ON and no DTC is stored in ECM, go to “Malfunction Indicator Lamp Remains ON after Engine Starts” for troubleshooting.



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DTC Check

S7RS0B1104003

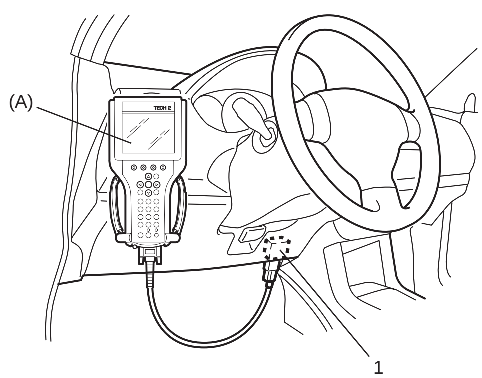
NOTE

- **There are two types of OBD system depending on the vehicle specification. For details, refer to "Precaution on On-Board Diagnostic (OBD) System".**
- **The MIL is turned on when the ECM and/or TCM detect malfunction(s). Each ECM and TCM stores diagnostic information as the diagnostic trouble code (DTC) in its memory and outputs the DTC to the scan tool.**
  Therefore, check both of the ECM and TCM for any DTC with the SUZUKI scan tool because the DTC stored in ECM and TCM is not read and displayed at a time.
  However, each of the ECM and TCM needs not to be checked with the generic scan tool because the DTC stored in ECM and TCM is read and displayed at a time.

Using Scan Tool

1) Prepare OBD generic scan tool or SUZUKI scan tool.
2) With ignition switch turned OFF, connect it to DLC (1) located on underside of instrument panel at driver's seat side.

Special tool
(A): SUZUKI scan tool



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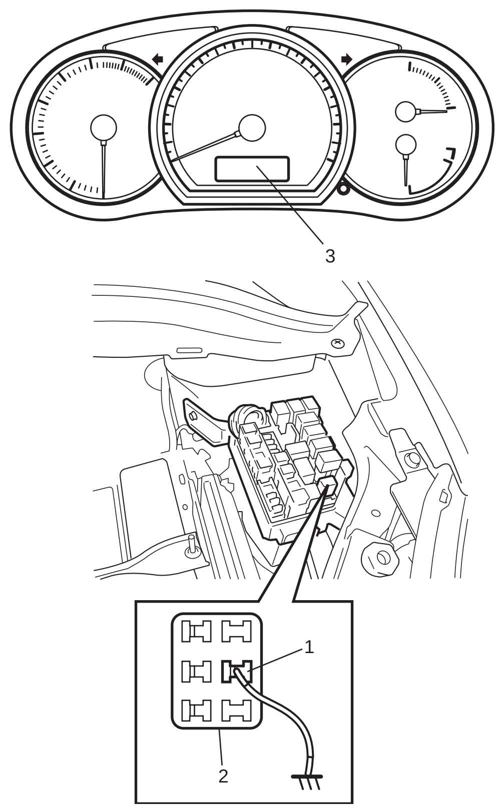
3) Turn ignition switch ON and confirm that MIL lights.
4) Read DTC, pending DTC and freeze frame data according to instructions displayed on scan tool and print them or write them down. Refer to scan tool operator's manual for further details.
   If communication between scan tool and ECM is not possible, check if scan tool is communicable by connecting it to ECM in another vehicle. If communication is possible in this case, scan tool is in good condition. Then check data link connector and serial data line (circuit) in the vehicle with which communication was not possible. If connector and circuit are OK, check that power supply and ground circuits of ECM and DLC are in good condition referring to "ECM Power and Ground Circuit Check".
5) After completing the check, turn ignition switch OFF and disconnect scan tool from data link connector.

Without Using Scan Tool (Hong Kong Model)

1) Turn ignition switch to OFF position.
2) Using service wire, ground diagnosis switch terminal (1) of diagnosis connector (2).
3) Turn ON ignition switch and check DTC displayed on odometer (3) of combination meter.
   When more than 2 DTCs are stored in memory, blinking for each DTC starts with the smallest DTC number in increasing order. Also, DTC is indicated repeatedly until the ignition switch is turned OFF or disconnect service wire.



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NOTE

When no DTC is detected, display on odometer of combination meter is "0000".

4) After completing the check, turn ignition switch to OFF position and disconnect service wire from diagnosis connector.

DTC Clearance

S7RS0B1104004

NOTE

There are two types of OBD system depending on the vehicle specification. For details, refer to "Precaution on On-Board Diagnostic (OBD) System".

Using Scan Tool

1) Connect OBD generic scan tool or SUZUKI scan tool to data link connector in the same manner as when making this connection for DTC check.
2) Turn ignition switch OFF and then ON.
3) Erase DTC and pending DTC according to instructions displayed on scan tool. Refer to scan tool operator's manual for further details.
4) After completing the clearance, turn ignition switch OFF and disconnect scan tool from data link connector.

NOTE

DTC and freeze frame data stored in ECM memory are also cleared in the following cases. Be careful not to clear them before keeping their record.

- **When power to ECM is cut off (by disconnecting battery cable, removing fuse or disconnecting ECM connectors).**
- **When the same malfunction (DTC) is not detected again during 40 engine warm-up cycles. (See "Warm-Up Cycle" of "On-Board Diagnostic System Description".)**

Without Using Scan Tool (Hong Kong Model)

1) Turn ignition switch to OFF position.
2) Disconnect battery negative cable for specified time below to erase diagnostic trouble code stored in ECM memory and reconnect it.

Time required to erase DTC

Ambient temperature	Time to cut power to ECM
Over 0 °C (32 °F)	30 sec. or longer
Under 0 °C (32 °F)	Not specifiable. Select a place with higher than 0 °C (32 °F) temperature.

DTC Table

S7RS0B1104005

NOTE

- **There are two types of OBD system depending on the vehicle specification.**
- **For details, refer to "Precaution on On-Board Diagnostic (OBD) System".**
- **For non-Euro-OBD model, some of DTC No. with delta (△) mark in the following table can not be detected by ECM depending on vehicle specification and local regulation.**
- **DTC with square (☐) mark in the following table can be detected only for Hong Kong model.**
- **DTC with circle (○) mark in the following table can be detected only for Euro OBD model and Hong Kong model.**
- **For Euro OBD model, with the generic scan tool, only star (*) marked DTC No. in the following table can be read.**
- **1 driving cycle: MIL lights up when DTC is detected during 1 driving cycle.**
- **2 driving cycles: MIL lights up when the same DTC is detected also in the next driving cycle after DTC is detected and stored temporarily in the first driving cycle.**
- ***2 driving cycles:
MIL blinks or lights up. Refer to "DTC P0300 / P0301 / P0302 / P0303 / P0304: Random / Multiple Cylinder Misfire Detected / Cylinder 1 / Cylinder 2 / Cylinder 3 / Cylinder 4 Misfire Detected" for details.**

DTC No.	Detecting item	Detecting condition (DTC will set when detecting:)	MIL
☞ *P0010	"A" camshaft position actuator circuit	Oil control valve circuit open or short.	1 driving cycle
☞ *P0011	"A" camshaft position – timing over-advanced or system performance	Actual value of advanced valve timing does not reach target value, or valve timing is advanced although ECM command is most retarding.	2 driving cycles
☞ *P0012	"A" camshaft position – timing over-retarded		2 driving cycles

DTC No.	Detecting item	Detecting condition (DTC will set when detecting:)	MIL
☞ *P0031	HO2S heater control circuit low (Sensor-1)	Heater voltage is less than specification while heater ON.	2 driving cycles
☞ *P0032	HO2S heater control circuit high (Sensor-1)	Heater voltage is more than specification while heater ON.	2 driving cycles
☞ *P0037	HO2S heater control circuit low (Sensor-2)	Heater voltage is less than specification while heater ON.	2 driving cycles
☞ *P0038	HO2S heater control circuit high (Sensor-2)	Heater voltage is more than specification while heater ON.	2 driving cycles
☞ △*P0101	Mass or volume air flow circuit range/performance	MAF sensor volume is more than specification or less than specification.	2 driving cycles
☞ *P0102	Mass or volume air flow circuit low input	Output voltage of MAF sensor is less than specification.	1 driving cycle
☞ *P0103	Mass or volume air flow circuit high input	Output voltage of MAF sensor is more than specification.	1 driving cycle
☞ △*P0106	Manifold absolute pressure/ barometric pressure circuit range/performance	Difference between Max. manifold absolute pressure value and Min. manifold pressure value is less than specification or difference between barometric pressure value and manifold pressure value is less than specification	2 driving cycles
☞ *P0107	Manifold absolute pressure/ barometric pressure circuit low input	Output voltage of MAP sensor is less than specification.	1 driving cycle
☞ *P0108	Manifold absolute pressure/ barometric pressure circuit high input	Output voltage of MAP sensor is more than specification.	1 driving cycle
☞ △*P0111	Intake air temperature sensor 1 circuit range/performance	Variation of intake air temperature from engine start is less than specification.	2 driving cycles
☞ *P0112	Intake air temperature sensor 1 circuit low	Circuit voltage of IAT sensor is less than specification.	1 driving cycle
☞ *P0113	Intake air temperature sensor 1 circuit high	Circuit voltage of IAT sensor is more than specification.	1 driving cycle
☞ △*P0116	Engine coolant temperature circuit range/performance	Engine coolant temperature is less than specified temperature for specified time from engine start.	2 driving cycles
☞ *P0117	Engine coolant temperature circuit low	Circuit voltage of ECT sensor is less than specification.	1 driving cycle
☞ *P0118	Engine coolant temperature circuit high	Circuit voltage of ECT sensor is more than specification.	1 driving cycle
☞ *P0122	Throttle/pedal position sensor/ switch “A” circuit low	Output voltage of TP sensor (main) is lower than specification.	1 driving cycle
☞ *P0123	Throttle/pedal position sensor/ switch “A” circuit high	Output voltage of TP sensor (main) is higher than specification.	1 driving cycle
☞ △*P0131	O2 sensor (HO2S) circuit low voltage (Sensor-1)	Max. output voltage of HO2S-1 is less than specification.	2 driving cycles
☞ △*P0132	O2 sensor (HO2S) circuit high voltage (Sensor-1)	Min. output voltage of HO2S-1 is more than specification.	2 driving cycles
☞ △*P0133	O2 sensor (HO2S) circuit slow response (Sensor-1)	Response time of HO2S-1 output voltage between rich and lean is longer than specification.	2 driving cycles
☞ *P0134	O2 sensor (HO2S) circuit no activity detected (Sensor-1)	Output voltage of HO2S-1 is more than specification or less than specification. (or HO2S-1 circuit open or short)	2 driving cycles
☞ △*P0137	O2 sensor (HO2S) circuit low voltage (Sensor-2)	Output voltage of HO2S-2 is less than specification while engine is idling after driving with high engine load and Max. output voltage of HO2S-2 minus Min. output voltage of HO2S-2 is less than specification.	2 driving cycles
☞ △*P0138	O2 sensor (HO2S) circuit high voltage (Sensor-2)	Output voltage of HO2S-2 is more than specification while engine is idling after driving with high engine load and Max. output voltage of HO2S-2 minus Min. output voltage of HO2S-2 is less than specification.	2 driving cycles

DTC No.	Detecting item	Detecting condition (DTC will set when detecting:)	MIL
☞ *P0140	O2 sensor (HO2S) circuit no activity detected (Sensor-2)	Output voltage of HO2S-2 is more than specification after warming up engine.	2 driving cycles
☞ ○*P0171	System too lean	Total fuel trim is larger than specification for specified time or longer. (Fuel trim toward rich side is large.)	2 driving cycles
☞ ○*P0172	System too rich	Total fuel trim is smaller than specification for specified time or longer. (Fuel trim toward lean side is large.)	2 driving cycles
☞ *P0222	Throttle/pedal position sensor (sub)/switch “B” circuit low	Output voltage of TP sensor (sub) is lower than specification	1 driving cycle
☞ *P0223	Throttle/pedal position sensor (sub)/switch “B” circuit high	Output voltage of TP sensor (sub) is higher than specification	1 driving cycle
☞ △*P0300	Random/multiple cylinder misfire detected	Misfire of such level as to cause damage to three way catalyst.	*2 driving cycles
☞ △*P0301 / △*P0302 / △*P0303 / △*P0304	Cylinder 1 misfire detected Cylinder 2 misfire detected Cylinder 3 misfire detected Cylinder 4 misfire detected	Misfire of such level as to deteriorate emission but not to cause damage to three way catalyst.	*2 driving cycles
☞ *P0327	Knock sensor 1 circuit low	Output voltage of knock sensor is less than specification.	1 driving cycle
☞ *P0328	Knock sensor 1 circuit high	Output voltage of knock sensor is more than specification.	1 driving cycle
☞ *P0335	Crankshaft position sensor “A” circuit	No signal of CKP sensor for specified time even if starting motor signal is input.	1 driving cycle
☞ *P0340	Camshaft position sensor “A” circuit	CMP sensor pulse is out of specification.	1 driving cycle
☞ ☐P0350	Ignition coil primary / secondary circuit	Ignition signal is not inputted to monitor circuit 5 times or more continuously.	1 driving cycle
☞ ○*P0401	Exhaust gas recirculation flow insufficient detected	Difference in intake manifold absolute pressure between opened EGR valve and closed EGR valve is less than specification.	2 driving cycles
☞ ○*P0402	Exhaust gas recirculation flow excessive detected	Difference in intake manifold absolute pressure between opened EGR valve and closed EGR valve is more than specification.	2 driving cycles
☞ *P0403	Exhaust gas recirculation control circuit	Output voltage is different from output command with more than one pole out of 4 poles.	1 driving cycle
☞ △*P0420	Catalyst system efficiency below threshold	Output waveforms of HO2S-1 and HO2S-2 are similar.	2 driving cycles
☞ *P0443	Evaporative emission system purge control valve circuit	Monitor signal of EVAP canister purge valve is different from command signal. (circuit open or shorted to ground)	2 driving cycles
☞ *P0480	Fan 1 (Radiator cooling fan) control circuit	Monitor signal of radiator cooling fan relay is different from command signal.	1 driving cycle
☞ *P0500	Vehicle speed sensor “A”	No VSS signal during fuel cut for specified time or longer, or VSS signal is not input even if vehicle is driving with more than specified engine speed and D-range (for A/T model).	2 driving cycles
☞ P0532	A/C refrigerant pressure sensor “A” circuit low	Output voltage of A/C refrigerant pressure sensor is less than specification.	—
☞ P0533	A/C refrigerant pressure sensor “A” circuit high	Output voltage of A/C refrigerant pressure sensor is more than specification.	—
☞ *P0601	Internal control module memory check sum error	Data write error or check sum error.	1 driving cycle
☞ P0602	Control module programming error	Data programming error.	—
☞ *P0607	Control module performance	Data programming error.	1 driving cycle
☞ △*P0616	Starter relay circuit low	Starter signal is low voltage even though engine is started with vehicle at stop.	2 driving cycles

DTC No.	Detecting item	Detecting condition (DTC will set when detecting:)	MIL
☞ △*P0617	Starter relay circuit high	Starter signal is high voltage for specified time while engine is running.	2 driving cycles
☞ P0620	Generator control circuit	Battery voltage is higher than specification even through generator control is maximum regulation, or battery voltage is lower than specification even through generator control is minimum regulation and electric load is less than 15 A.	—
☞ P0625	Generator field/F terminal circuit low	Generator field coil duty is 0% (high voltage) for more than specified time even through generator control is minimum regulation.	—
☞ P0626	Generator field/F terminal circuit high	Generator field coil duty is 100% (low voltage) for more than specified time even through generator control is maximum regulation, or generator field coil duty is 100% (low voltage) when engine is starting.	—
☞ P1501	Electric load current sensor circuit low	Electric load current is lower than specified value (electric load current sensor voltage is higher than specified value).	—
☞ P1502	Electric load current sensor circuit high	Electric load current is higher than specified value (electric load current sensor voltage is lower than specified value).	—
☞ △*P1510	ECM backup power supply malfunction	Backup power voltage is out of specification after starting engine.	1 driving cycle
☞ ☐P1603	TCM trouble code detected	When ECM receives a trouble code from TCM, which indicates that some problem occurred in sensor circuits and its calculated values used for operations such as idle speed control, engine power control and so on by TCM, this DTC is detected by ECM.	—
☞ *P1674	CAN communication (buss off error)	Transmission error that is inconsistent between transmission data and transmission monitor (CAN bus monitor) data is detected more than 7 times continuously.	1 driving cycle
☞ ☐*P1676	CAN communication (reception error for TCM)	Reception error of communication data for TCM is detected for longer than specified time continuously.	1 driving cycle
☞ P1678	CAN communication (reception error for BCM)	Reception error of communication data for BCM is detected for longer than specified time continuously.	—
☞ *P1685	CAN communication (reception error for ABS/ESP® control module)	Reception error of communication data for ABS/ESP® control module is detected for longer than specified time continuously.	1 driving cycle
☞ *P2101	Throttle actuator control motor circuit range/performance	Monitor signal of throttle actuator output (duty output) is inconsistent with throttle actuator control command.	1 driving cycle
☞ *P2102	Throttle actuator control motor circuit low	Power supply voltage of throttle actuator control circuit is lower than specification even if throttle actuator control relay turned on.	1 driving cycle
☞ *P2103	Throttle actuator control motor circuit high	Power supply voltage of throttle actuator control circuit is higher than specification even if throttle actuator control relay turned off.	1 driving cycle
☞ *P2111	Throttle actuator control system – stuck open	Throttle valve default opening is greater than specified value from complementary closed position when diagnosing throttle valve at ignition switch turned OFF.	1 driving cycle
☞ *P2112	Throttle actuator control system – stuck closed	Throttle valve default opening is smaller than specified value from complementary closed position when diagnosing throttle valve at ignition switch turned OFF.	1 driving cycle
☞ *P2119	Throttle actuator control throttle body range/performance	Difference between actual throttle valve opening angle and opening angle calculated by ECM is more than specification.	1 driving cycle
☞ *P2122	Throttle/pedal position sensor/switch “D” (main) circuit low input	Output voltage of APP sensor (main) is lower than specification.	1 driving cycle

DTC No.	Detecting item	Detecting condition (DTC will set when detecting:)	MIL
☞ *P2123	Throttle/pedal position sensor/ switch “D” (main) circuit high input	Output voltage of APP sensor (main) is higher than specification.	1 driving cycle
☞ *P2127	Throttle/pedal position sensor/ switch “E” (sub) circuit low input	Output voltage of APP sensor (sub) is lower than specification.	1 driving cycle
☞ *P2128	Throttle/pedal position sensor/ switch “E” (sub) circuit high input	Output voltage of APP sensor (sub) is higher than specification.	1 driving cycle
☞ *P2135	Throttle/pedal position sensor/ switch “A”/“B” (main / sub) voltage correlation	Difference between the opening angle based on TP sensor (main) and the opening angle based on TP sensor (sub) is more than specification.	1 driving cycle
☞ *P2138	Throttle/pedal position sensor/ switch “D”/“E” (main / sub) voltage correlation	Difference between the opening angle based on APP sensor (main) and the opening angle based on APP sensor (sub) is more than specification.	1 driving cycle
☞ △*P2227	Barometric pressure circuit range/performance	Difference of barometric pressure value and intake manifold pressure value is more than specification at engine start.	2 driving cycles
☞ *P2228	Barometric pressure circuit low	Barometric pressure sensor voltage is less than specification.	1 driving cycle
☞ *P2229	Barometric pressure circuit high	Barometric pressure sensor voltage is more than specification.	1 driving cycle
☞ P1614	Transponder response error	Refer to “Diagnostic Trouble Code (DTC) Table in Section 10C”.	—
☞ P1615	ID code does not registered (vehicle equipped with keyless start system only)		
☞ P1616	Different registration ID codes (vehicle equipped with keyless start system only)		
☞ P1618	CAN communication error (reception error for keyless start control module) (vehicle equipped with keyless start system only)		
☞ P1621	Immobilizer communication line error		
☞ P1622	EEPROM error		
☞ P1623	Unregistered transponder		
☞ P1625	Immobilizer antenna error		
☞ P1636	Immobilizer information registration failure		
☞ P1638	Immobilizer information mismatched		

Fail-Safe Table

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When any of the following DTCs is detected, ECM enters fail-safe mode as long as malfunction continues to exist but that mode is canceled when ECM detects normal condition after that.

DTC No.	Detected item	Fail-safe operation
☞ P0031	HO2S heater control circuit low (Sensor-1)	ECM stops air/fuel ratio control.
☞ P0032	HO2S heater control circuit high (Sensor-1)	
☞ P0102	Mass or volume air flow circuit low input	• ECM controls injector drive time (fuel injection volume) according to throttle valve opening (closed throttle position or not). • ECM stops EGR control.
☞ P0103	Mass or volume air flow circuit high input	
☞ P0112	Intake air temperature sensor 1 circuit low	ECM controls actuators assuming that intake air temperature is 20 °C (68 °F).
☞ P0113	Intake air temperature sensor 1 circuit high	

DTC No.	Detected item	Fail-safe operation
☞ P0117	Engine coolant temperature circuit low	• ECM controls actuators assuming that engine coolant temperature is 80 °C (176 °F). • ECM operates radiator cooling fan.
☞ P0118	Engine coolant temperature circuit high	
☞ P0122	Throttle/pedal position sensor/switch/“A” (main) circuit low	• ECM turns off throttle actuator control relay and throttle valve is fixed at the specified opening from its completely closed position (default opening). For details, refer to “Description of Electric Throttle Body System”. • ECM controls fuel cut at specified engine speed. • ECM stops air/fuel ratio control.
☞ P0123	Throttle/pedal position sensor/switch/“A” (main) circuit high	
☞ P0222	Throttle/pedal position sensor/switch/“B” (sub) circuit low	
☞ P0223	Throttle/pedal position sensor/switch/“B” (sub) circuit high	
☞ P0131	O2 sensor (HO2S) circuit low voltage (Sensor-1)	ECM stops air/fuel ratio control.
☞ P0132	O2 sensor (HO2S) circuit high voltage (Sensor-1)	
☞ P0134	O2 sensor (HO2S) circuit no activity detected (Sensor-1)	
☞ P0335	Crankshaft position sensor “A” circuit	• Ignition timing is fixed. • ECM changes injection control system from sequential injection to simultaneous one.
☞ P0340	Camshaft position sensor “A” circuit	ECM changes injection control system from sequential injection to simultaneous one.
☞ P0500	Vehicle speed sensor “A”	• ECM controls actuators assuming that vehicle speed is 0 km/h (0 mile/h). • ECM stops IAC feedback control.
☞ P2101	Throttle actuator control motor circuit range / performance	• ECM turns off throttle actuator control relay and throttle valve is fixed at the specified opening from its completely closed position (default opening). For details, refer to “Description of Electric Throttle Body System”. • ECM controls fuel cut at specified engine speed. • ECM stops air/fuel ratio control.
☞ P2102	Throttle actuator control motor circuit low	
☞ P2103	Throttle actuator control motor circuit high	ECM controls fuel cut at specified engine speed.
☞ P2111	Throttle actuator control system – stuck open	• ECM turns off throttle actuator control relay and throttle valve is fixed at the specified opening from its completely closed position (default opening). For details, refer to “Description of Electric Throttle Body System”. • ECM controls fuel cut at specified engine speed. • ECM stops air/fuel ratio control.
☞ P2112	Throttle actuator control system – stuck closed	
☞ P2119	Throttle actuator control throttle body range / performance	• ECM turns off throttle actuator control relay and throttle valve is fixed at the specified opening from its completely closed position (default opening). For details, refer to “Description of Electric Throttle Body System”. • ECM controls fuel cut at specified engine speed.

DTC No.	Detected item	Fail-safe operation
☞ P2122	Throttle/pedal position sensor/switch/“D” (main) circuit low input	• ECM turns off throttle actuator control relay and throttle valve is fixed at the specified opening from its completely closed position (default opening). For details, refer to “Description of Electric Throttle Body System”. • ECM controls fuel cut at specified engine speed. • ECM stops air/fuel ratio control.
☞ P2123	Throttle/pedal position sensor/switch/“D” (main) circuit high input	
☞ P2127	Throttle/pedal position sensor/switch/“E” (sub) circuit low input	
☞ P2128	Throttle/pedal position sensor/switch/“E” (sub) circuit high input	
☞ P2135	Throttle/pedal position sensor/switch/“A”/“B” (main) / (sub) voltage correction	
☞ P2138	Throttle pedal position sensor/switch “D”/“E” (main) / (sub) voltage correlation	
☞ P2227	Barometric pressure sensor performance problem	ECM controls actuators assuming that barometric pressure is 101.33 kPa (762 mmHg).

Scan Tool Data

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As the data values are standard values estimated on the basis of values obtained from the normally operating vehicles by using a scan tool, use them as reference values. Even when the vehicle is in good condition, there may be cases where the checked value does not fall within each specified data range. Therefore, judgment as abnormal should not be made by checking with these data alone.
Also, conditions that can be checked by the scan tool are those detected by ECM and output from ECM as commands and there may be cases where the engine or actuator is not operating (in the condition) as indicated by the scan tool.
Be sure to use the timing light to check the ignition timing.

NOTE

- **There are two types of OBD system depending on the vehicle specification.
For details, refer to “Precaution on On-Board Diagnostic (OBD) System”.**
- **With the generic scan tool, only star (*) marked data in the following table can be read.**
- **When checking the data with the engine running at idle or racing, be sure to shift M/T gear to the neutral position and A/T gear to the “Park” position and pull the parking brake fully. Also, if nothing or “no load” is indicated, turn OFF A/C (if equipped with A/C), all electric loads, P/S and all the other necessary switches.**

	Scan tool data	Vehicle condition		Normal condition / reference values
*	☞ COOLANT TEMP	At specified idle speed after warming up		80 – 100 °C, 176 – 212 °F
*	☞ INTAKE AIR TEMP.	At specified idle speed after warming up		–5 °C (23 °F) + environmental temp. to 40 °C (104 °F) + environmental temp.
*	☞ ENGINE SPEED	It idling with no load after warming up		Desired idle speed ± 50 rpm
	☞ INJ PULSE WIDTH	At specified idle speed with no load after warming up		2.0 – 4.0 msec.
		At 2500 r/min. with no load after warming up		2.0 – 3.6 msec.
	☞ DESIRED IDLE	It idling with radiator cooling fan stopped and all electrical parts turned OFF after warming up, M/T at neutral		700 rpm
*	☞ SHORT FT B1	At specified idle speed after warming up		–20 – +20%
*	☞ LONG FT B1	At specified idle speed after warming up		–20 – +20%
	☞ TOTAL FUEL TRIM B1	At specified idle speed after warming up		–35 – +35%
*	☞ MAF	At specified idle speed with no load after warming up		1.0 – 4.0 g/s 0.14 – 0.52 lb/min.
		At 2500 r/min. with no load after warming up		4.0 – 12.0 g/s 0.53 – 1.58 lb/min.
*	☞ CALC LOAD	At specified idle speed with no load after warming up		18 – 28%
		At 2500 r/min. with no load after warming up		13 – 23%
*	☞ THROTTLE POSITION	Ignition switch ON / warmed up engine stopped	Accelerator pedal released	0 – 5%
			Accelerator pedal depressed fully	90 – 100%

	Scan tool data	Vehicle condition		Normal condition / reference values
*	☞ O2S B1 S1	At specified idle speed after warming up		0.1 – 0.95 V
	☞ O2S B1 S1 ACT	At specified idle speed after warming up		ACTIVE
*	☞ O2S B1 S2	At 2000 r/min. for 3 min. or longer after warming up.		0.1 – 0.95 V
	☞ O2S B1 S2 ACT	At specified idle speed after warming up		ACTIVE
*	☞ FUEL SYSTEM B1	At specified idle speed after warming up		CLSD (closed loop)
*	☞ MAP	At specified idle speed with no load after warming up		24 – 38 kPa, 7.1 – 11.2 in.Hg
	☞ BAROMETRIC PRES	—		Barometric pressure is displayed
	☞ STEP EGR FLOW DUTY	At specified idle speed after warming up		0%
	☞ FUEL CUT	Engine at fuel cut condition		ON
		Engine at other than fuel cut condition		OFF
	☞ A/C PRESSURE	Engine running	A/C ON (A/C is operating) at ambient temperature: 30 °C (86 °F) and humidity: 50%	1350 – 1650 kPa For more details, refer to pressure of high pressure gage under “A/C System Performance Inspection in Section 7B” or “A/C Refrigerant Pressure Sensor and Its Circuit Inspection in Section 7B”.
			A/C OFF (A/C is not operating) at ambient temperature: 30 °C (86 °F) and engine coolant temperature: 90 – 100 °C (194 – 212 °F)	600 – 1000 kPa After longer than 10 min from A/C switch turned off
	☞ CLOSED THROTTLE POS	Throttle valve at idle position		ON
		Throttle valve opens larger than idle position		OFF
	☞ CANIST PRG DUTY	At specified idle speed after warming up		0%
*	☞ IGNITION ADVANCE	At specified idle speed with no load after warming up		3 – 13° BTDC
	☞ BATTERY VOLTAGE	Ignition switch ON / engine at stop		10 – 14 V
	☞ FUEL PUMP	Within 2 seconds after ignition switch ON or engine running		ON
		Engine at stop with ignition switch ON		OFF
	☞ ELECTRIC LOAD	Ignition switch ON / Headlight, small light, all turned OFF		OFF
		Ignition switch ON / Headlight, small light, turned ON		ON
	☞ BRAKE SWITCH	Ignition switch ON	Brake pedal is released	OFF
			Brake pedal is depressed	ON
	☞ RADIATOR FAN	Ignition switch ON	Engine coolant temp.: Lower than 95 °C (203 °F)	OFF
			Engine coolant temp.: 97.5 °C (208 °F) or higher	ON
	☞ BLOWER FAN	Ignition switch ON	Blower fan switch: 3rd speed position or more	ON
			Blower fan switch: under 2nd speed position	OFF
	☞ A/C SWITCH	Engine running after warming up, A/C not operating		OFF
		Engine running after warming up, A/C operating		ON
	☞ A/C COMP RELAY	Engine running	A/C switch and blower motor switch turned ON	ON
			A/C switch and blower motor switch turned OFF	OFF
*	☞ VEHICLE SPEED	At stop		0 km/h (0 mph)
	☞ VVT GAP	At specified idle speed after warming up		0 – 3°
	☞ TP SENSOR 1 VOLT	Ignition switch ON after warmed up engine	Accelerator pedal released	0.6 – 1.0 V
			Accelerator pedal depressed fully	3.37 – 4.55 V

	Scan tool data	Vehicle condition		Normal condition / reference values
	☞ TP SENSOR 2 VOLT	Ignition switch ON after warmed up engine	Accelerator pedal released	1.4 – 1.8 V
			Accelerator pedal depressed fully	3.58 – 4.76 V
	☞ APP SENSOR 1 VOLT	Ignition switch ON after warmed up engine	Accelerator pedal released	0.5 – 0.9 V
			Accelerator pedal depressed fully	3.277 – 3.915 V
	☞ APP SENSOR 2 VOLT	Ignition switch ON after warmed up engine	Accelerator pedal released	1.3 – 1.7 V
			Accelerator pedal depressed fully	4.077 – 4.715 V
	☞ ACCEL POSITION	Ignition switch ON after warmed up engine	Accelerator pedal released	0 – 5%
			Accelerator pedal depressed fully	90 – 100%
	☞ THROTTLE TARGET POSI	Ignition switch ON after warmed up engine	Accelerator pedal released	0 – 5%
			Accelerator pedal depressed fully	90 – 100%
	☞ BATTERY CURRENT	At specified idle speed with no load after warming up		5.0 – 60.0 A
	☞ GENERATOR CONT DUTY (GENERATOR CONTROL DUTY)	At specified idle speed with no load after warming up		20.0 – 100.0%
	☞ GENERATOR FIELD DUTY (GENERATOR FIELD COIL DUTY)	At specified idle speed with no load after warming up		20.0 – 100.0%

Scan Tool Data Definitions

COOLANT TEMP (ENGINE COOLANT TEMPERATURE, °C, °F)
It is detected by engine coolant temp. sensor.

INTAKE AIR TEMP. (°C, °F)
It is detected by intake air temp. sensor.

ENGINE SPEED (rpm)
It is computed by reference pulses from the camshaft position sensor.

INJ PULSE WIDTH (FUEL INJECTION PULSE WIDTH, msec.)
This parameter indicates time of the injector drive (valve opening) pulse which is output from ECM (but injector drive time of NO.1 cylinder for multiport fuel injection).

DESIRED IDLE (DESIRED IDLE SPEED, rpm)
The Desired Idle Speed is an ECM internal parameter which indicates the ECM requested idle. If the engine is not running, this number is not valid.

SHORT FT B1 (SHORT TERM FUEL TRIM, %)
Short term fuel trim value represents short term corrections to the air/fuel mixture computation. A value of 0 indicates no correction, a value greater than 0 means an enrichment correction, and a value less than 0 implies an enleanment correction.

LONG FT B1 (LONG TERM FUEL TRIM, %)
Long term fuel trim value represents long term corrections to the air/fuel mixture computation. A value of 0 indicates no correction, a value greater than 0 means an enrichment correction, and a value less than 0 implies an enleanment correction.

TOTAL FUEL TRIM B1 (%)
The value of Total Fuel Trim is obtained by calculating based on values of Short Term Fuel Trim and Long Term Fuel Trim. This value indicates how much correction is necessary to keep the air/fuel mixture stoichiometrical.

MAF (MASS AIR FLOW RATE, g/s, lb/min.)
It represents total mass of air entering intake manifold which is measured by mass air flow sensor.

CALC LOAD (CALCULATED LOAD VALUE, %)
Engine load displayed as a percentage of maximum possible load. Value is calculated mathematically using the formula: actual (current) intake air volume ÷ maximum possible intake air volume × 100%

THROTTLE POS (ABSOLUTE THROTTLE POSITION, %)
When throttle position sensor is at fully closed position, throttle opening is indicated as 0 – 5% and 90 – 100% full open position.

O2S SENSOR B1 S1 (HEATED OXYGEN SENSOR-1, V)
It indicates output voltage of HO2S-1 installed on exhaust manifold (pre-catalyst).

O2S B1 S1 ACT (HEATED OXYGEN SENSOR-1, ACTIVE / INACTIVE)
This parameter indicates activation condition of HO2S-1.
ACTIVE: Activating
INACTIVE: warming up or at stop

O2S SENSOR B1 S2 (HEATED OXYGEN SENSOR-2, V)
It indicates output voltage of HO2S-2 installed on exhaust pipe (post-catalyst). It is used to detect catalyst deterioration.

O2S B1 S2 ACT (HEATED OXYGEN SENSOR-2, ACTIVE / INACTIVE)
This parameter indicates activation condition of HO2S-2.
ACTIVE: Activating
INACTIVE: warming up or at stop

FUEL SYSTEM (FUEL SYSTEM STATUS)
Air/fuel ratio feedback loop status displayed as one of the followings.
OPEN: Open-loop has not yet satisfied conditions to go closed loop.
CLOSED: Closed-loop using oxygen sensor(s) as feedback for fuel control.
OPEN-DRIVE COND: Open-loop due to driving conditions (Power enrichment, etc.).
OPEN SYS FAULT: Open-loop due to detected system fault.

MAP (MANIFOLD ABSOLUTE PRESSURE, in.Hg, kPa)
This value indicates how much correction is necessary to keep the air/fuel mixture stoichiometrical.
It is detected by manifold absolute pressure sensor.

BAROMETRIC PRESS (kPa, in.Hg)
This parameter represents a measurement of barometric air pressure and is used for altitude correction of the fuel injection quantity and IAC valve control.

STEP EGR FLOW DUTY (%)
This parameter indicates opening rate of EGR valve which controls the amount of EGR flow.

FUEL CUT (ON/OFF)
ON: Fuel being cut (output signal to injector is stopped)
OFF: Fuel not being cut

A/C PRESSURE (A/C REFRIGERANT ABSOLUTE PRESSURE, kPa)
This parameter indicates A/C refrigerant absolute pressure calculated by ECM.

CLOSED THROTTLE POS (CLOSED THROTTLE POSITION, ON/OFF)
This parameter reads ON when throttle valve is fully closed, or OFF when it is not fully closed.

CANIST PRG DUTY (EVAP CANISTER PURGE FLOW DUTY, %)
This parameter indicates valve ON (valve open) time rate within a certain set cycle of EVAP canister purge valve which controls the amount of EVAP purge.

IGNITION ADVANCE (IGNITION TIMING ADVANCE FOR NO.1 CYLINDER, °)
Ignition timing of No.1 cylinder is commanded by ECM. The actual ignition timing should be checked by using the timing light.

BATTERY VOLTAGE (V)
This parameter indicates battery positive voltage inputted from main relay to ECM.

FUEL PUMP (ON/OFF)
ON is displayed when ECM activates the fuel pump via the fuel pump relay switch.

ELECTRIC LOAD (ON/OFF)
ON: Headlight or small light ON signal inputted.
OFF: Above electric loads all turned OFF.

BRAKE SW (ON/OFF)
This parameter indicates the state of the brake switch.

RADIATOR COOLING FAN (RADIATOR COOLING FAN CONTROL RELAY, ON/OFF)
ON: Command for radiator cooling fan control relay operation being output.
OFF: Command for relay operation not being output.

BLOWER FAN (ON/OFF)
This parameter indicates the state of the blower fan motor switch.

A/C SWITCH (ON/OFF)
ON: Command for A/C operation being output from ECM to HVAC.
OFF: Command for A/C operation not being output.

A/C COMP RELAY (A/C COMPRESSOR RELAY, ON/OFF)
This parameter indicates the state of the A/C switch.

VEHICLE SPEED (km/h, mph)
It is computed based on pulse signals from vehicle speed sensor.

VVT GAP (TARGET-ACTUAL POSITION, °)
It is calculated using the formula: target valve timing advance – actual valve timing advance.

TP SENSOR 1 VOLT (THROTTLE POSITION SENSOR (MAIN) OUTPUT VOLTAGE, V)
The TP sensor (main) reading provides throttle valve opening information in the form of voltage.

TP SENSOR 2 VOLT (THROTTLE POSITION SENSOR (SUB) OUTPUT VOLTAGE, V)
The TP sensor (sub) reading provides throttle valve opening information in the form of voltage.

APP SENSOR 1 VOLT (ACCELERATOR PEDAL POSITION (APP) SENSOR (MAIN) OUTPUT VOLTAGE, V)
The APP sensor (main) reading provides accelerator pedal opening information in the form of voltage.

APP SENSOR 2 VOLT (ACCELERATOR PEDAL POSITION (APP) SENSOR (SUB) OUTPUT VOLTAGE, V)
The APP sensor (sub) reading provides accelerator pedal opening information in the form of voltage.

ACCEL POSITION (ABSOLUTE ACCELERATOR PEDAL POSITION, %)
When accelerator pedal is at fully released position, accelerator pedal is indicated as 0 – 5% and 90 – 100% fully depressed position.

THROTTLE TARGET POSI (TARGET THROTTLE VALVE POSITION, %)
Target throttle valve position is ECM internal parameter which indicates the ECM requested throttle valve position.

BATTERY CURRENT (A)
This parameter indicates electric load value (current consumption) that detected by electric load current sensor.

GENERATOR CONT DUTY (GENERATOR CONTROL DUTY, %)
This parameter indicates generator control duty ratio that controls production electricity of generator by ECM.
100%: No limitation for the generating
0%: Maximum limitation for the generating

GENERATOR FIELD DUTY (GENERATOR FIELD COIL DUTY, %)
This parameter indicates operating rate (status of production electricity) for generator by field coil duty ratio.
100%: maximum operation.
0%: minimum operation.

Visual Inspection

S7RS0B1104008

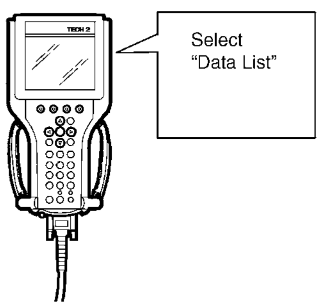
Visually check the following parts and systems.

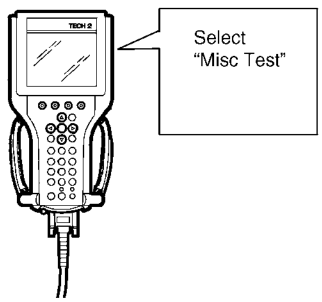
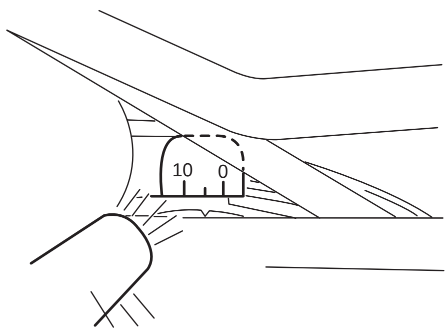
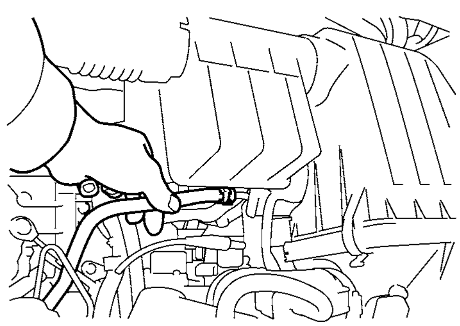
Inspection item	Reference section
• Engine oil – level, leakage	“Engine Oil and Filter Change in Section 0B”
• Engine coolant – level, leakage	“Coolant Level Check in Section 1F”
• Fuel – level, leakage	“Fuel Lines and Connections Inspection in Section 0B”
• Air cleaner element – dirt, clogging	“Air Cleaner Filter Inspection in Section 0B”
• Battery – fluid level, corrosion of terminal	“Battery Description in Section 1J”
• Water pump belt – tension damage	“Accessory Drive Belt Inspection in Section 0B”
• Throttle valve – operating sound	“Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”
• Vacuum hoses of air intake system – disconnection, looseness, deterioration, bend	“Vacuum Hose and Purge Valve Chamber Inspection in Section 1B”
• Connectors of electric wire harness – disconnection, friction	
• Fuses – burning	
• Parts – installation, bolt – looseness	
• Parts – deformation	
• Other parts that can be checked visually	
Also check the following items at engine start, if possible	
• Malfunction indicator lamp – Operation	“Malfunction Indicator Lamp (MIL) Check”
• Charge warning lamp – Operation	“Generator Symptom Diagnosis in Section 1J”
• Engine oil pressure warning lamp – Operation	“Oil Pressure Switch Inspection in Section 9C”
• Engine coolant temp. meter – Operation	“ECT Sensor Inspection in Section 1C”
• Fuel level meter – Operation	“Fuel Level Sensor Inspection in Section 9C”
• Tachometer – Operation	
• Abnormal air being inhaled from air intake system	
• Exhaust system – leakage of exhaust gas, noise	
• Other parts that can be checked visually	

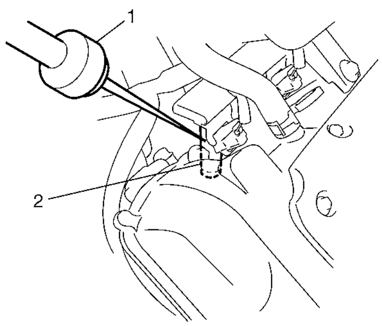
Engine Basic Inspection

S7RS0B1104009

This check is very important for troubleshooting when ECM has detected no DTC and no abnormality has been found in “Visual Inspection”.
Follow the flow carefully.

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	**Check battery voltage** *Is it 11 V or more?*	Go to Step 3.	Charge or replace battery.
3	*Is vehicle equipped with keyless start control system?*	Go to Step 4.	Go to Step 5.
4	**Check keyless start control system malfunction** 1) Check keyless start control system referring to “Keyless Start System Operation Inspection in Section 10E”. *Is check result satisfactory?*	Go to Step 5.	Keyless start control system malfunction.
5	*Is engine cranked?*	Go to Step 6.	Go to “Cranking System Symptom Diagnosis in Section 1I”.
6	*Does engine start?*	Go to Step 7.	Go to Step 9.
7	**Check idle speed** 1) Warm up engine to normal operating temperature. 2) Shift transmission to neutral position for M/T (“P” position for A/T). 3) Make sure that all electrical loads are switched off. 4) Check engine idle speed with scan tool.  I2RH01110005-01 *Is it 650 – 800 r/min.?*	Go to Step 8.	Go to “Engine Symptom Diagnosis”.

Step	Action	Yes	No
8	**Check ignition timing** 1) Using SUZUKI scan tool, select “Misc Test” mode on SUZUKI scan tool and fix ignition timing to initial one.  I2RH01110006-01 2) Using timing light (1), check initial ignition timing. **Special tool** **(A): 09930–76420**  I3RB0A180004-01 *Is it 5°± 3° BTDC at specified idle speed?*	Go to “Engine Symptom Diagnosis”.	Check ignition control related parts referring to “Ignition Timing Inspection in Section 1H”.
9	**Check immobilizer system malfunction** 1) Check immobilizer indicator lamp for flashing. *Is it flashing when ignition switch is turned to ON position?*	Go to “Diagnostic Trouble Code (DTC) Check in Section 10C”.	Go to Step 10.
10	**Check fuel supply** 1) Check to make sure that enough fuel is filled in fuel tank. 2) Turn ON ignition switch for 2 seconds and then OFF. 3) Repeat Step 2) a few times. *Is fuel pressure felt from fuel feed hose when ignition switch is turned ON?*  I3RM0A110014-01	Go to Step 12.	Go to Step 11.

Step	Action	Yes	No
11	**Check fuel pump for operation** *Was fuel pump operating sound heard from fuel filler for about 2 seconds after ignition switch ON and stop?*	Go to “Fuel Pressure Check”.	Go to “Fuel Pump and Its Circuit Check”.
12	**Check ignition spark** 1) Disconnect injector couplers. 2) Remove spark plugs and connect them to high-tension cords or ignition coil assemblies. 3) Ground spark plugs. 4) Crank engine and check if each spark plug sparks. *Is it in good condition?*	Go to Step 13.	Go to “Ignition Spark Test in Section 1H”.
13	**Check fuel injector for operation** 1) Install spark plugs and connect injector connectors. 2) Using sound scope (1), check operating sound of each injector (2) when cranking engine.  I3RM0A110015-01 *Was injector operating sound heard from all injectors?*	Go to “Engine Symptom Diagnosis”.	Go to “Fuel Injector Circuit Check”.

Engine Symptom Diagnosis

S7RS0B1104010

Perform troubleshooting referring to the followings when ECM has detected no DTC and no abnormality has been found in “Visual Inspection” and “Engine Basic Inspection”.

Condition	Possible cause	Correction / Reference Item
Hard starting (Engine cranks OK)	Faulty spark plug	*“Spark Plug Inspection in Section 1H”*
	Leaky high-tension cord	*“High-Tension Cord Inspection in Section 1H”*
	Loose connection or disconnection of high-tension cord(s) or lead wire(s)	*“High-Tension Cord Removal and Installation in Section 1H”*
	Faulty ignition coil	*“Ignition Coil Assembly (Including ignitor) Inspection in Section 1H”*
	Dirty or clogged fuel hose or pipe	*“Fuel Pressure Check”*
	Malfunctioning fuel pump	*“Fuel Pressure Check”*
	Air drawn in through intake manifold gasket or throttle body gasket	
	Faulty electric throttle body assembly	*“Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”*
	Faulty APP sensor assembly	*“APP Sensor Assembly Inspection in Section 1C”*
	Faulty ECT sensor or MAF sensor	*“ECT Sensor Inspection in Section 1C” or “MAF and IAT Sensor Inspection in Section 1C”*
	Faulty ECM	
	Low compression	*“Compression Check in Section 1D”*
	Poor spark plug tightening or faulty gasket	*“Spark Plug Removal and Installation in Section 1H”*
	Compression leak from valve seat	*“Valves and Valve Guides Inspection in Section 1D”*
	Sticky valve stem	*“Valves and Valve Guides Inspection in Section 1D”*
	Weak or damaged valve springs	*“Valve Spring Inspection in Section 1D”*
	Compression leak at cylinder head gasket	*“Cylinder Head Inspection in Section 1D”*
	Sticking or damaged piston ring	*“Cylinders, Pistons and Piston Rings Inspection in Section 1D”*
	Worn piston, ring or cylinder	*“Cylinders, Pistons and Piston Rings Inspection in Section 1D”*
	Malfunctioning PCV valve	*“PCV Valve Inspection in Section 1B”*
	Camshaft position control (VVT) system out of order	*“Oil Control Valve Inspection in Section 1D”*
	Faulty EGR system	*“EGR System Inspection in Section 1B”*
Low oil pressure	Improper oil viscosity	*“Engine Oil and Filter Change in Section 0B”*
	Malfunctioning oil pressure switch	*“Oil Pressure Switch Inspection in Section 9C”*
	Clogged oil strainer	*“Oil Pan and Oil Pump Strainer Cleaning in Section 1E”*
	Functional deterioration of oil pump	*“Oil Pump Inspection in Section 1E”*
	Worn oil pump relief valve	*“Oil Pump Inspection in Section 1E”*
	Excessive clearance in various sliding parts	
Engine noise – Valve noise ***NOTE*** ***Before checking mechanical noise, make sure that:*** • ***Specified spark plug is used.*** • ***Specified fuel is used.***	Improper valve lash	*“Camshaft, Tappet and Shim Inspection in Section 1D”*
	Worn valve stem and guide	*“Valves and Valve Guides Inspection in Section 1D”*
	Weak or broken valve spring	*“Valve Spring Inspection in Section 1D”*
	Warped or bent valve	*“Valves and Valve Guides Inspection in Section 1D”*

Condition	Possible cause	Correction / Reference Item
Engine noise – Piston, ring and cylinder noise ***NOTE*** ***Before checking mechanical noise, make sure that:*** • ***Specified spark plug is used.*** • ***Specified fuel is used.***	Worn piston, ring and cylinder bore	*"Cylinders, Pistons and Piston Rings Inspection in Section 1D"*
Engine noise – Connecting rod noise ***NOTE*** ***Before checking mechanical noise, make sure that:*** • ***Specified spark plug is used.*** • ***Specified fuel is used.***	Worn piston, ring and cylinder bore	*"Cylinders, Pistons and Piston Rings Inspection in Section 1D"*
	Worn rod bearing	*"Crank Pin and Connecting Rod Bearings Inspection in Section 1D"*
	Worn crank pin	*"Crank Pin and Connecting Rod Bearings Inspection in Section 1D"*
	Loose connecting rod nuts	*"Pistons, Piston Rings, Connecting Rods and Cylinders Removal and Installation in Section 1D"*
	Low oil pressure	*Condition "Low oil pressure"*
Engine noise – Crankshaft noise ***NOTE*** ***Before checking mechanical noise, make sure that:*** • ***Specified spark plug is used.*** • ***Specified fuel is used.***	Low oil pressure	*Condition "Low oil pressure"*
	Worn bearing	*"Main Bearings Inspection in Section 1D"*
	Worn crankshaft journal	*"Crankshaft Inspection in Section 1D"*
	Loose bearing cap bolts	*"Main Bearings, Crankshaft and Cylinder Block Removal and Installation in Section 1D"*
	Excessive crankshaft thrust play	*"Crankshaft Inspection in Section 1D"*
Engine overheating	Inoperative thermostat	*"Thermostat Inspection in Section 1F"*
	Poor water pump performance	*"Water Pump Inspection in Section 1F"*
	Clogged or leaky radiator	*"Radiator On-Vehicle Inspection and Cleaning in Section 1F"*
	Improper engine oil grade	*"Engine Oil and Filter Change in Section 0B"*
	Clogged oil filter or oil strainer	*"Oil Pressure Check in Section 1E"*
	Poor oil pump performance	*"Oil Pressure Check in Section 1E"*
	Faulty radiator cooling fan control system	*"Radiator Cooling Fan Low Speed Control System Check" or "Radiator Cooling Fan High Speed Control System Check"*
	Dragging brakes	*Condition "Dragging brakes" in "Brakes Symptom Diagnosis in Section 4A"*
	Slipping clutch	*Condition "Slipping clutch" in "Clutch System Symptom Diagnosis in Section 5C"*
	Blown cylinder head gasket	*"Cylinder Head Inspection in Section 1D"*
	Air mixed in cooling system	

Condition	Possible cause	Correction / Reference Item
Poor gasoline mileage	Leaks or loose connection of high-tension cord	*"High-Tension Cord Removal and Installation in Section 1H"*
	Faulty spark plug (improper gap, heavy deposits and burned electrodes, etc.)	*"Spark Plug Inspection in Section 1H"*
	Malfunctioning EGR valve	*"EGR Valve Inspection in Section 1B"*
	High idle speed	*Condition "Improper engine idling or engine fails to idle"*
	Poor performance of ECT sensor or MAF sensor	*"ECT Sensor Inspection in Section 1C" or "MAF and IAT Sensor Inspection in Section 1C"*
	Faulty electric throttle body assembly	*"Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C"*
	Faulty APP sensor assembly	*"APP Sensor Assembly Inspection in Section 1C"*
	Faulty fuel injector(s)	*"Fuel Injector Circuit Check"*
	Faulty ECM	
	Low compression	*"Compression Check in Section 1D"*
	Poor valve seating	*"Valves and Valve Guides Inspection in Section 1D"*
	Dragging brakes	*Condition "Dragging brakes" in "Brakes Symptom Diagnosis in Section 4A"*
	Slipping clutch	*Condition "Slipping clutch" in "Clutch System Symptom Diagnosis in Section 5C"*
	Thermostat out of order	*"Thermostat Inspection in Section 1F"*
	Improper tire pressure	*"Tires Description in Section 2D"*
	Camshaft position control (VVT) system out of order	*"Oil Control Valve Inspection in Section 1D"*
Excessive engine oil consumption – Oil leakage	Blown cylinder head gasket	*"Cylinder Head Inspection in Section 1D"*
	Leaky camshaft oil seals	*"Camshaft, Tappet and Shim Inspection in Section 1D"*
Excessive engine oil consumption – Oil entering combustion chamber	Sticky piston ring	*"Cylinders, Pistons and Piston Rings Inspection in Section 1D"*
	Worn piston and cylinder	*"Cylinders, Pistons and Piston Rings Inspection in Section 1D"*
	Worn piston ring groove and ring	*"Cylinders, Pistons and Piston Rings Inspection in Section 1D"*
	Improper location of piston ring gap	*"Pistons, Piston Rings, Connecting Rods and Cylinders Disassembly and Assembly in Section 1D"*
	Worn or damaged valve stem seal	*"Valves and Valve Guides Inspection in Section 1D"*
	Worn valve stem	*"Valves and Valve Guides Inspection in Section 1D"*

Condition	Possible cause	Correction / Reference Item
Engine hesitates – Momentary lack of response as accelerator is depressed. Can occur at all vehicle speeds. Usually most severe when first trying to make vehicle move, as from a stop sign.	Spark plug faulty	*“Spark Plug Inspection in Section 1H”*
	Leaky high-tension cord	*“High-Tension Cord Inspection in Section 1H”*
	Fuel pressure out of specification	*“Fuel Pressure Check”*
	Malfunctioning EGR valve	*“EGR Valve Inspection in Section 1B”*
	Poor performance of ECT sensor or MAF sensor	*“ECT Sensor Inspection in Section 1C” or “MAF and IAT Sensor Inspection in Section 1C”*
	Faulty electric throttle body assembly	*“Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”*
	Faulty APP sensor assembly	*“APP Sensor Assembly Inspection in Section 1C”*
	Faulty fuel injector	*“Fuel Injector Circuit Check”*
	Faulty ECM	
	Engine overheating	*Condition “Engine overheating”*
	Low compression	*“Compression Check in Section 1D”*
	Camshaft position control (VVT) system out of order	*“Oil Control Valve Inspection in Section 1D”*
Surge – Engine power variation under steady throttle or cruise. Feels like vehicle speeds up and down with no change in accelerator pedal.	Leaky or loosely connected high-tension cord	*“High-Tension Cord Removal and Installation in Section 1H”*
	Faulty spark plug (excess carbon deposits, improper gap, burned electrodes, etc.)	*“Spark Plug Inspection in Section 1H”*
	Variable fuel pressure	*“Fuel Pressure Check”*
	Kinky or damaged fuel hose and lines	
	Faulty fuel pump (clogged fuel filter)	
	Malfunctioning EGR valve	*“EGR Valve Inspection in Section 1B”*
	Poor performance of MAF sensor	*“MAF and IAT Sensor Inspection in Section 1C”*
	Faulty fuel injector	*“Fuel Injector Circuit Check”*
	Faulty electric throttle body assembly	*“Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”*
	Faulty APP sensor assembly	*“APP Sensor Assembly Inspection in Section 1C”*
	Faulty ECM	
Excessive detonation – Engine makes continuously sharp metallic knocks that change with throttle opening. Sounds like pop corn popping.	Faulty spark plug	*“Spark Plug Inspection in Section 1H”*
	Loose connection of high-tension cord	*“High-Tension Cord Removal and Installation in Section 1H”*
	Engine overheating	*Condition “Engine overheating”*
	Clogged fuel filter (faulty fuel pump) or fuel lines	*“Fuel Pressure Check” or “Fuel Pump and Its Circuit Check”*
	Air drawn in through intake manifold or throttle body gasket	
	Malfunctioning EGR valve	*“EGR Valve Inspection in Section 1B”*
	Poor performance of knock sensor, ECT sensor or MAF sensor	*“DTC P0327 / P0328: Knock Sensor 1 Circuit Low / High”, “ECT Sensor Inspection in Section 1C” or “MAF and IAT Sensor Inspection in Section 1C”*
	Faulty fuel injector(s)	*“Fuel Injector Circuit Check”*
	Faulty ECM	
	Excessive combustion chamber deposits	*“Cylinders, Pistons and Piston Rings Inspection in Section 1D” and/or “Piston Pins and Connecting Rods Inspection in Section 1D”*
	Camshaft position control (VVT) system out of order	*“Oil Control Valve Inspection in Section 1D”*

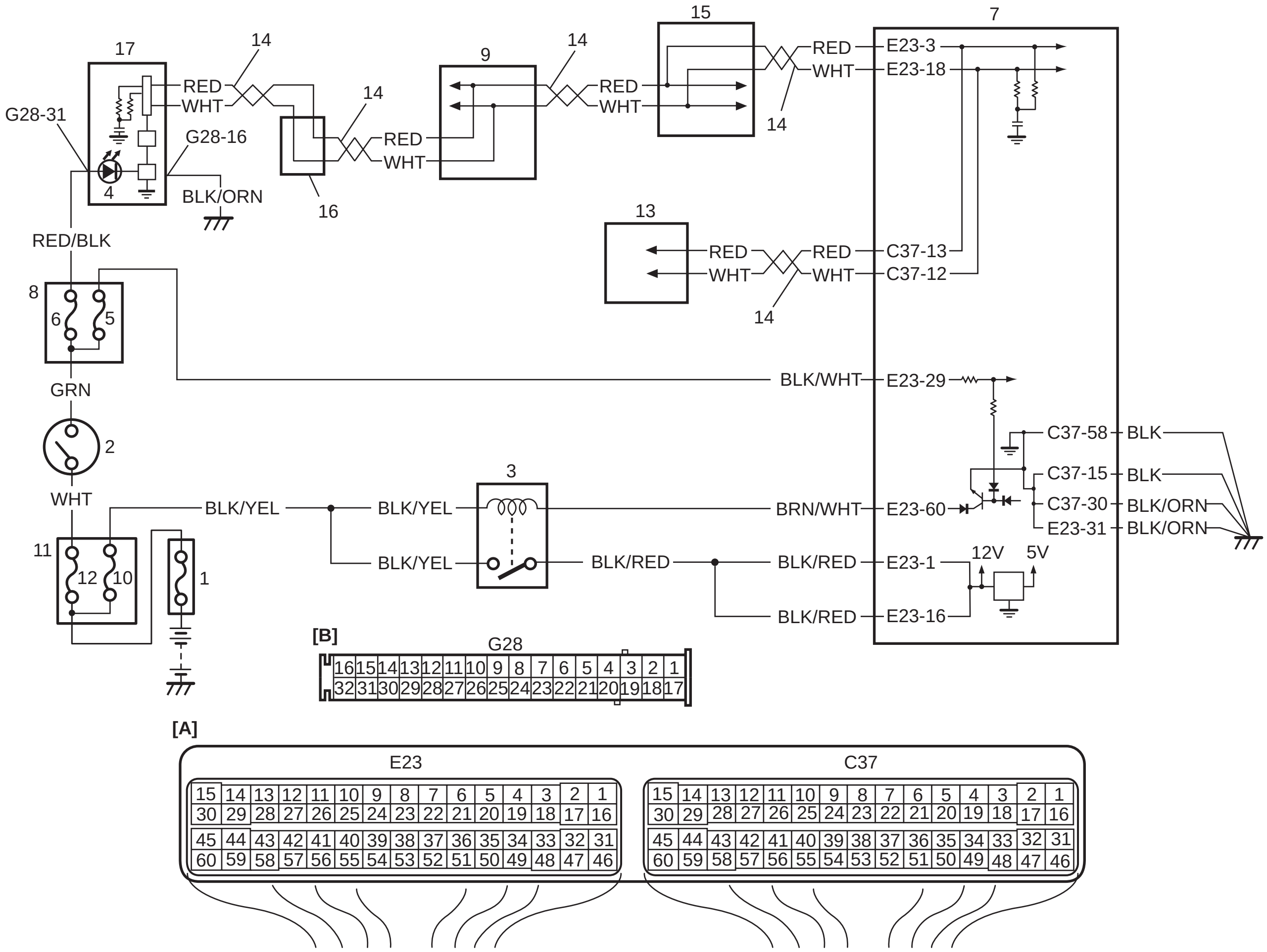
Condition	Possible cause	Correction / Reference Item
Engine has no power	Faulty spark plug	*“Spark Plug Inspection in Section 1H”*
	Faulty ignition coil with ignitor	*“Ignition Coil Assembly (Including ignitor) Inspection in Section 1H”*
	Leaks, loose connection or disconnection of high-tension cord	*“High-Tension Cord Removal and Installation in Section 1H”*
	Faulty knock sensor	*“DTC P0327 / P0328: Knock Sensor 1 Circuit Low / High”*
	Clogged fuel hose or pipe	*“Fuel Pressure Check”*
	Malfunctioning fuel pump	*“Fuel Pump and Its Circuit Check”*
	Air drawn in through intake manifold gasket or throttle body gasket	
	Engine overheating	*Condition “Engine overheating”*
	Malfunctioning EGR valve	*“EGR Valve Inspection in Section 1B”*
	Poor performance of ECT sensor or MAF sensor	*“ECT Sensor Inspection in Section 1C” or “MAF and IAT Sensor Inspection in Section 1C”*
	Faulty electric throttle body assembly	*“Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”*
	Faulty APP sensor assembly	*“APP Sensor Assembly Inspection in Section 1C”*
	Faulty fuel injector(s)	*“Fuel Injector Circuit Check”*
	Faulty ECM	
	Dragging brakes	*Condition “Dragging brakes” in “Brakes Symptom Diagnosis in Section 4A”*
	Slipping clutch	*Condition “Slipping clutch” in “Clutch System Symptom Diagnosis in Section 5C”*
	Low compression	*“Compression Check in Section 1D”*
	Camshaft position control (VVT) system out of order	*“Oil Control Valve Inspection in Section 1D”*
Improper engine idling or engine fails to idle	Faulty spark plug	*“Spark Plug Inspection in Section 1H”*
	Leaky or disconnected high-tension cord	*“High-Tension Cord Removal and Installation in Section 1H”*
	Faulty ignition coil with ignitor	*“Ignition Coil Assembly (Including ignitor) Inspection in Section 1H”*
	Fuel pressure out of specification	*“Fuel Pressure Check”*
	Leaky manifold, throttle body, or cylinder head gasket	
	Malfunctioning EGR valve	*“EGR Valve Inspection in Section 1B”*
	Faulty evaporative emission control system	*“EVAP Canister Purge Inspection in Section 1B”*
	Faulty EGR system	*“EGR System Inspection in Section 1B”*
	Faulty fuel injector(s)	*“Fuel Injector Circuit Check”*
	Poor performance of ECT sensor or MAF sensor	*“ECT Sensor Inspection in Section 1C” or “MAF and IAT Sensor Inspection in Section 1C”*
	Faulty electric throttle body assembly	*“Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”*
	Faulty APP sensor assembly	*“APP Sensor Assembly Inspection in Section 1C”*
	Faulty ECM	
	Loose connection or disconnection of vacuum hoses	
	Malfunctioning PCV valve	*“PCV Valve Inspection in Section 1B”*
	Engine overheating	*Condition “Engine overheating”*
	Low compression	*“Compression Check in Section 1D”*
	Camshaft position control (VVT) system out of order	*“Oil Control Valve Inspection in Section 1D”*

Condition	Possible cause	Correction / Reference Item
Excessive hydrocarbon (HC) emission or carbon monoxide (CO)	Faulty spark plug	*“Spark Plug Inspection in Section 1H”*
	Leaky or disconnected high-tension cord	*“High-Tension Cord Removal and Installation in Section 1H”*
	Faulty ignition coil with ignitor	*“Ignition Coil Assembly (Including ignitor) Inspection in Section 1H”*
	Low compression	*“Compression Check in Section 1D”*
	Lead contamination of three way catalytic converter	*Check for absence of filler neck restrictor.*
	Faulty evaporative emission control system	*“EVAP Canister Purge Inspection in Section 1B”*
	Fuel pressure out of specification	*“Fuel Pressure Check”*
	Closed loop system (A/F feedback compensation) fails (Faulty TP sensor, Poor performance of ECT sensor or MAF sensor)	*“Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”, “ECT Sensor Inspection in Section 1C” or “MAF and IAT Sensor Inspection in Section 1C”*
	Faulty electric throttle body assembly	*“Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”*
	Faulty APP sensor assembly	*“APP Sensor Assembly Inspection in Section 1C”*
	Faulty injector(s)	*“Fuel Injector Circuit Check”*
	Faulty ECM	
	Engine not at normal operating temperature	
	Clogged air cleaner	*“Air Cleaner Element Inspection and Cleaning in Section 1D”*
	Vacuum leaks	*“Engine Vacuum Check in Section 1D”*
	Camshaft position control (VVT) system out of order	*“Oil Control Valve Inspection in Section 1D”*
Excessive nitrogen oxides (NOx) emission	Improper ignition timing	*“Ignition Timing Inspection in Section 1H”*
	Lead contamination of catalytic converter	*Check for absence of filler neck restrictor.*
	Faulty EGR system	*“EGR System Inspection in Section 1B”*
	Fuel pressure out of specification	*“Fuel Pressure Check”*
	Closed loop system (A/F feedback compensation) fails (Faulty TP sensor, Poor performance of ECT sensor or MAF sensor)	*“Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”, “ECT Sensor Inspection in Section 1C” or “MAF and IAT Sensor Inspection in Section 1C”*
	Faulty electric throttle body assembly	*“Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”*
	Faulty APP sensor assembly	*“APP Sensor Assembly Inspection in Section 1C”*
	Faulty injector(s)	*“Fuel Injector Circuit Check”*
	Faulty ECM	
	Camshaft position control (VVT) system out of order	*“Oil Control Valve Inspection in Section 1D”*

MIL Does Not Come ON with Ignition Switch ON and Engine Stop (but Engine Can Be Started)

S7RS0B1104011

Wiring Diagram



I7RS0B110012-02

[A]:	ECM connector (viewed from harness side)	6.	"METER" fuse	13.	TCM (A/T model)
[B]:	Combination meter connector (viewed from harness side)	7.	ECM	14.	CAN communication line
1.	Main fuse box	8.	Junction block assembly	15.	ABS/ESP® control module
2.	Ignition switch	9.	BCM	16.	CAN junction connector (ESP® model)
3.	Main relay	10.	"FI" fuse	17.	Combination meter
4.	Malfunction indicator lamp in combination meter	11.	Individual circuit fuse box No.1		
5.	"IG COIL" fuse	12.	"IG ACC" fuse		

Circuit Description

When the ignition switch is turned ON, ECM causes the main relay to turn ON (close the contact point). Then, ECM being supplied with the main power, transmits indication ON signal of MIL to combination meter in order to turn MIL ON. And then, combination meter turns MIL ON. When the engine starts to run and no malfunction is detected in the system, ECM transmits MIL indication OFF signal to combination meter in order to turn MIL OFF. And then, combination meter turns MIL OFF, but if a malfunction was or is detected, MIL remains ON even when the engine is running.

Troubleshooting

NOTE

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	**MIL power supply check** 1) Turn ignition switch to ON position. *Do other warning lights come ON?*	Go to Step 2.	Go to Step 3.
2	**DTC check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch and check DTC. *Is there DTC(s) P1674, P1676, P1678 and/or P1685?*	Go to applicable DTC diag. flow.	Substitute a known-good combination meter and recheck. If MIL still remains OFF, substitute a known-good ECM and recheck.
3	**CAN communication line circuit check** 1) Check CAN communication circuit between combination meter and ECM, TCM (A/T model) referring to Step 3 of "DTC P1674: CAN Communication (Bus Off Error)" *Is circuit in good condition?*	Go to Step 4.	Repair or replace.
4	**"METER" fuse check** 1) Turn ignition switch to OFF position. 2) Check for fuse blown at "METER" fuse in junction block assembly. *Is "METER" fuse in good condition?*	Go to Step 5.	Replace "METER" fuse and check for short.
5	**Combination meter power supply check** 1) Remove combination meter referring to "Combination Meter Removal and Installation in Section 9C". 2) Check for proper connection to combination meter connector at "G28-31" and "G28-16" terminals. 3) If OK, then turn ignition switch to ON position and measure voltage between combination meter connector at "G28-31" terminal and vehicle body ground. *Is it 10 – 14 V?*	Go to Step 6.	"RED/BLK" wire is open circuit.
6	**Combination meter circuit check** 1) Turn ignition switch to OFF position. 2) Measure resistance between "G28-16" terminal of combination meter connector and vehicle body ground. *Is resistance 1 Ω or less?*	Substitute a known-good combination meter and recheck. If MIL still remains OFF, substitute a known-good ECM and recheck.	"BLK/ORN" wire is open or high resistance circuit.

Malfunction Indicator Lamp Remains ON after Engine Starts

S7RS0B1104012

Wiring Diagram and Circuit Description

Refer to "MIL Does Not Come ON with Ignition Switch ON and Engine Stop (but Engine Can Be Started)".

Troubleshooting

NOTE

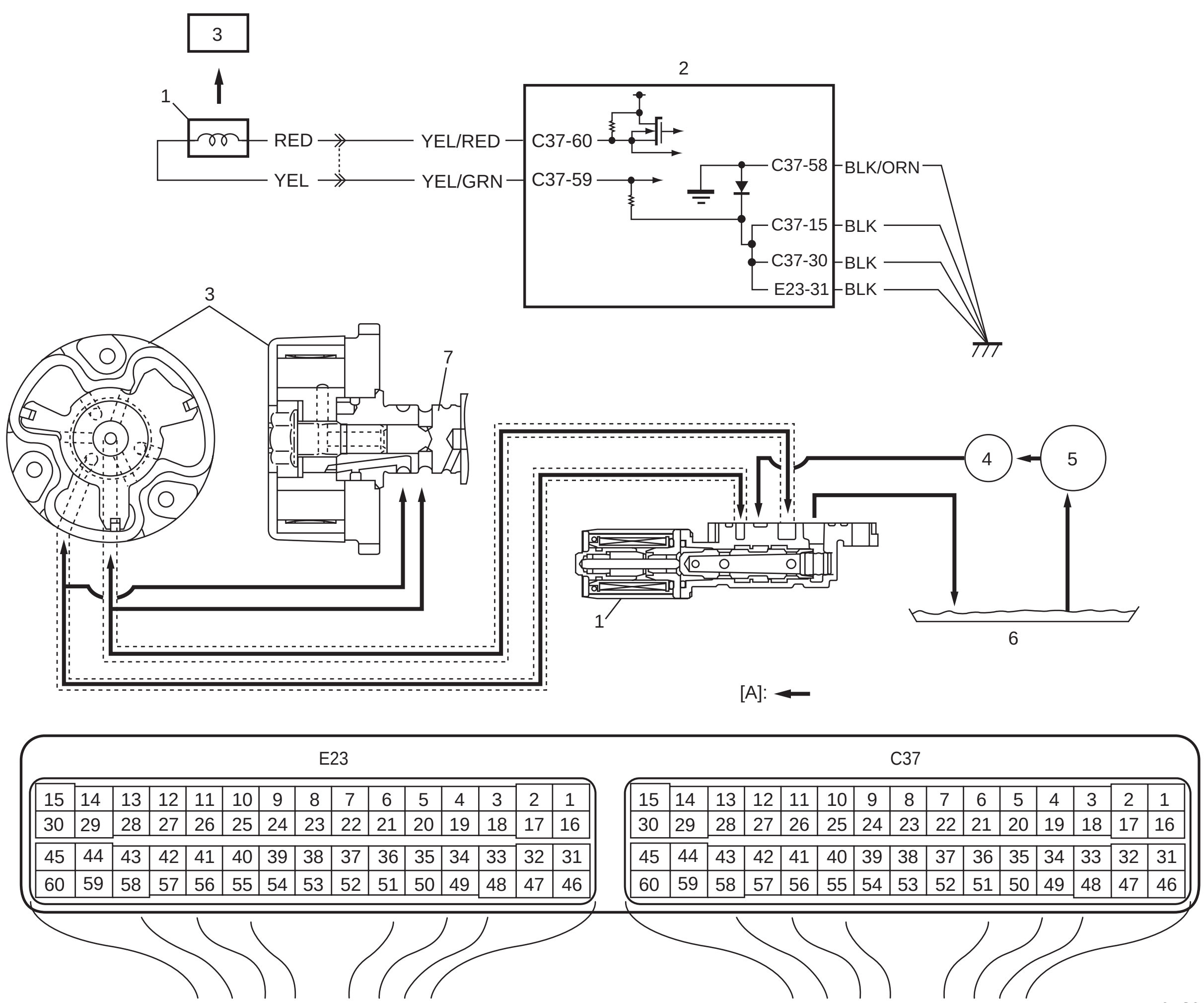
When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to “Inspection of ECM and Its Circuits”.

Step	Action	Yes	No
1	**DTC check** 1) Start engine and recheck DTC of ECM and TCM (for A/T model) while engine running. *Is there any DTC(s)?*	Go to Step 2 of “Engine and Emission Control System Check”, Step 2 of “A/T System Check in Section 5A”.	Go to Step 2.
2	**CAN communication line circuit check** 1) Check CAN communication line circuit between combination meter and ECM, TCM (for A/T model) referring to Step 3 of “DTC P1674: CAN Communication (Bus Off Error)”. *Is circuit in good condition?*	Substitute a known-good combination meter and recheck. If MIL still remains OFF, substitute a known-good ECM and recheck.	Repair or replace CAN communication circuit.

DTC P0010: “A” Camshaft Position Actuator Circuit

S7RS0B1104013

System and Wiring Diagram



I6RS0C110013-01

[A]: Oil flow	2. ECM	4. Oil filter	6. Oil pan
1. Oil control valve	3. Camshaft timing sprocket	5. Oil pump	7. Intake camshaft

Circuit Description

Actual valve timing fails to become close to target advance level of each function although advance control function or retarded advance control function is at work.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Monitor signal of oil control valve is different from command signal. (Circuit open or short) (1 driving cycle detection logic)	• Oil control valve • Oil control valve circuit • ECM

DTC Confirmation Procedure

1) Clear DTC. Refer to “DTC Clearance”.
2) Start engine and keep it at idle for 10 seconds.
3) Check DTC. Refer to “DTC Check”.

DTC Troubleshooting

NOTE

- **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	**Oil control valve electrical circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection at “C37-60” and “C37-59” terminals of ECM connector. 3) If OK, measure resistance between “C37-60” and “C37-59” terminals of ECM connector. *Is resistance below 10 Ω?*	Go to Step 3.	Go to Step 8.
3	**Oil control valve electrical circuit check** *Was resistance more than 6.5 Ω in Step 2?*	Go to Step 4.	Go to Step 7.
4	**Oil control valve electrical circuit for power short check** 1) Turn ON ignition switch. 2) Measure voltage between “C37-60” terminal of ECM connector and engine ground. *Is voltage below 1 V?*	Go to Step 5.	“RED”, “YEL/RED”, “YEL” or “YEL/GRN” wire is shorted to power supply circuit.
5	**Oil control valve electrical circuit for ground short check** 1) Disconnect connector from oil control valve with ignition switch turned OFF. 2) Measure resistance between “C37-60” terminal of ECM connector and engine ground. *Is resistance infinity?*	Go to Step 6.	“YEL/RED” wire is shorted to ground circuit.

Step	Action	Yes	No
6	**Oil control valve electrical circuit for ground short check** 1) Measure resistance between “C37-59” terminal of ECM connector and engine ground. *Is resistance infinity?*	Go to Step 9.	“YEL/GRN” wire is shorted to ground circuit.
7	**Oil control valve electrical circuit for short check** 1) Disconnect connector from oil control valve with ignition switch turned OFF. 2) Measure resistance between “C37-60” and “C37-59” terminals of ECM connector. *Is resistance infinity?*	Go to Step 9.	“YEL/RED” wire is shorted to “YEL/GRN” wire.
8	**Oil control valve electrical circuit check** 1) Disconnect connector from oil control valve with ignition switch turned OFF. 2) Measure resistance between “C37-60” terminal of ECM connector and “YEL/RED” wire terminal of oil control valve connector and between “C37-59” terminal of ECM connector and “YEL/GRN” wire terminal of oil control valve connector. *Is resistance below 1 Ω?*	Go to Step 9.	“YEL/RED” or “YEL/GRN” wire circuit is open or high resistance.
9	**Oil control valve check** Check oil control valve referring to “Oil Control Valve Inspection in Section 1D”. *Is resistance within specified value?*	Substitute a known-good ECM and recheck.	Faulty oil control valve.

DTC P0011 / P0012: "A" Camshaft Position - Timing Over-Advanced or System Performance / - Retarded

S7RS0B1104014

System Description

Actual value of advanced valve timing does not reach target value.
Valve timing is advanced although ECM command is most retarding.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Actual value of advanced valve timing does not reach target value, or valve timing is advanced although ECM command is most retarding. (2 driving cycle detection logic)	• Oil control valve • Oil galleries of timing sprocket • Intake camshaft timing sprocket (Camshaft position control (VVT) actuator) • Oil control valve circuit • ECM

DTC Confirmation Procedure

⚠ 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 tester, on a level road.**

NOTE

Check to make sure that the following conditions are satisfied when using this "DTC Confirmation Procedure".

- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Clear DTC. Refer to "DTC Clearance".
2) Start engine and drive vehicle under usual driving condition for 5 minutes or longer until engine is warmed up to normal operating temperature.
3) Stop vehicle.
4) Run engine at idle speed for 1 minute.
5) Start vehicle and increase vehicle speed up to 80 km/h (50 mile/h).
6) Keep vehicle speed at 80 km/h (50 mile/h) for 1 minute or longer at 5th gear position or D range.
7) Decrease vehicle speed gradually.
8) Stop vehicle and turn OFF ignition switch.
9) Repeat Step 4) to 7) one time.
10) Stop vehicle.
11) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

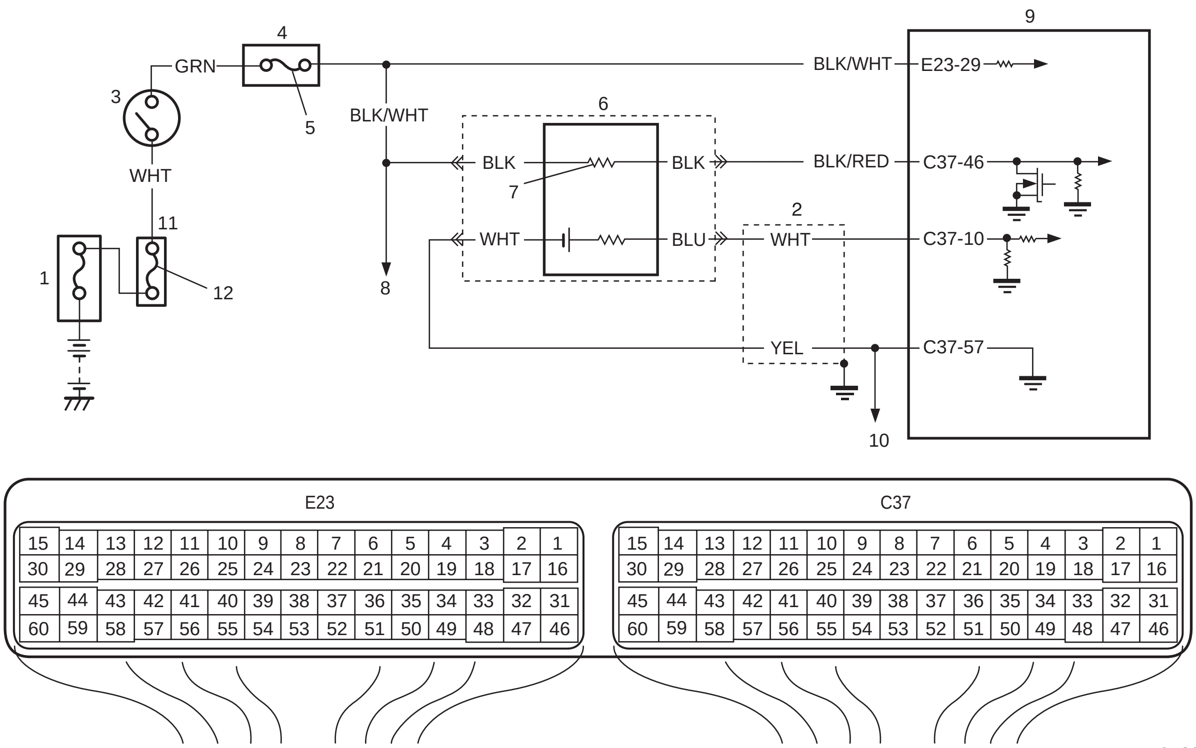
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to “Inspection of ECM and Its Circuits”.**
- **Upon completion of inspection and repair work, perform “DTC Confirmation Procedure” and confirm that the trouble has been corrected.**

Step	Action	Yes	No
1	*Is DTC P0010 detected together?*	Go to “DTC P0010: “A” Camshaft Position Actuator Circuit”.	Go to Step 2.
2	*Do you have SUZUKI scan tool?*	Go to Step 3.	Go to Step 5.
3	**Camshaft position control check** 1) With ignition switch turned OFF, connect SUZUKI scan tool to DLC. 2) Start engine and warm up to normal operating temperature. 3) Select menu to DATA LIST. 4) Check that “VVT GAP” displayed on SUZUKI scan tool is 0 – 5°. *Is it OK?*	Go to Step 4.	Check valve timing referring to “Timing Chain and Chain Tensioner Removal and Installation in Section 1D”. If OK, go to Step 5.
4	**Camshaft position control check** 1) Drive vehicle under following conditions. • Vehicle speed at 80 km/h (50 mile/h). • Gear position at 5th or D range. 2) Check that “VVT GAP” displayed on SUZUKI scan tool is 0 – 5°. *Is it OK?*	Substitute a known-good ECM and recheck.	Go to Step 5.
5	**Oil control circuit visual inspection** 1) Remove cylinder head cover referring to “Cylinder Head Cover Removal and Installation in Section 1D”. 2) Check oil pressure leakage from oil control circuit. *Is it in good condition?*	Go to Step 6.	Repair or replace.
6	**Oil control valve and oil gallery pipe check** 1) Remove oil control valve referring to “Oil Control Valve Removal and Installation in Section 1D”. 2) Remove oil gallery pipe referring to “Timing Chain Cover Removal and Installation in Section 1D”. 3) Check oil gallery pipe and oil control valve for clog or sludge. *Are they in good condition?*	Go to Step 7.	Clean oil control valve and oil gallery pipe. Replace oil control valve if a problem is not solved after cleaning oil control valve and oil gallery pipe.
7	**Oil control valve electrical circuit check** 1) Check that oil control valve circuit is in good condition referring to “DTC P0010: “A” Camshaft Position Actuator Circuit”. *Is circuit in good condition?*	Go to Step 8.	Repair circuit.
8	**Oil control valve check** 1) Check oil control valve referring to “Oil Control Valve Inspection in Section 1D”. *Is it in good condition?*	Replace camshaft timing sprocket.	Replace oil control valve.

DTC P0031 / P0032: HO2S Heater Control Circuit Low / High (Sensor-1)

S7RS0B1104015

Wiring Diagram



I6RS0C110006-03

1. Main fuse box	4. Junction block assembly	7. Heater	10. To HO2S-2
2. Shield wire	5. “IG COIL” fuse	8. To HO2S-2 heater	11. Individual circuit fuse box No.1
3. Ignition switch	6. HO2S-1	9. ECM	12. “IG ACC” fuse

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
HO2S-1 heater voltage is more than specified value or lower than specified value for 5 seconds continuously. (2 driving cycle detection logic)	• HO2S-1 heater circuit • HO2S-1 heater • 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) Start engine and warm up to normal operating temperature.
4) Run engine at idle speed for 1 min. or more.
5) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

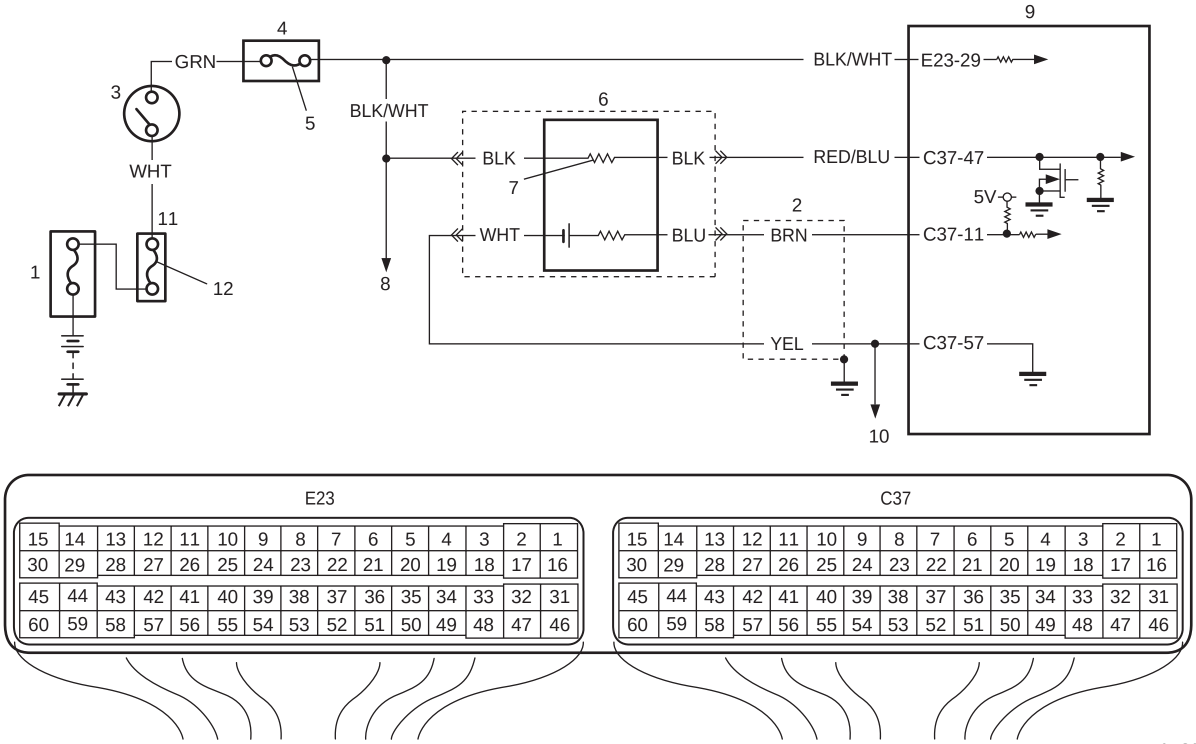
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to “Inspection of ECM and Its Circuits”.**
- **Upon completion of inspection and repair work, perform “DTC Confirmation Procedure” and confirm that 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	**HO2S-1 heater power circuit check** 1) Disconnect connector from HO2S-1 with ignition switch turned OFF. 2) Check for proper connection to HO2S-1 at “BLK/WHT” and “BLK/RED” wire terminals. 3) If wire and connection are OK, measure voltage between “BLK/WHT” wire terminal and engine ground with ignition switch turned ON. *Is voltage over 10 V?*	Go to Step 3.	“BLK/WHT” wire is open circuit or shorted to ground circuit.
3	**HO2S-1 heater power circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “BLK/WHT” wire terminal of HO2S-1 connector and “E23-29” terminal of ECM connector. *Is resistance below 5 Ω?*	Go to Step 4.	“BLK/WHT” wire is high resistance circuit.
4	**HO2S-1 heater drive circuit check** 1) Measure resistance between “C37-46” terminal of ECM connector and vehicle body ground. *Is resistance infinity?*	Go to Step 5.	“BLK/RED” wire is shorted to ground circuit.
5	**HO2S-1 heater drive circuit check** 1) Turn ON ignition switch. 2) Measure voltage between “C37-46” terminal of ECM connector and vehicle body ground. *Is voltage 0 V?*	Go to Step 6.	“BLK/RED” wire is shorted to power circuit.
6	**HO2S-1 heater drive circuit check** 1) Connect connector to HO2S-1 with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Measure voltage between “C37-46” terminal of ECM connector and vehicle body ground with connector disconnected from ECM. *Is voltage over 10 V?*	Go to Step 7.	“BLK/RED” wire is open circuit.
7	**HO2S-1 heater check** 1) Disconnect HO2S-1 connector with ignition switch turned OFF. 2) Check HO2S-1 heater resistance referring to “HO2S-1 and HO2S-2 Heater On-Vehicle Inspection in Section 1C”. *Is resistance within specified value range?*	Go to Step 8.	Replace HO2S-1.
8	**HO2S-1 heater power circuit check** 1) Connect connector to HO2S-1 with ignition switch turned OFF. 2) Measure resistance between “E23-29” and “C37-46” terminals of ECM connector. *It resistance below 12 Ω?*	Substitute a known-good ECM and recheck.	“BLK/WHT”, “BLK/RED” and / or “BLK” wire is high resistance circuit.

DTC P0037 / P0038: HO2S Heater Control Circuit Low / High (Sensor-2)

S7RS0B1104016

Wiring Diagram



I6RS0C110007-01

1. Main fuse box	4. Junction block assembly	7. Heater	10. To HO2S-1
2. Shield wire	5. “IG COIL” fuse	8. To HO2S-1 heater	11. Individual circuit fuse box No.1
3. Ignition switch	6. HO2S-2	9. ECM	12. “IG ACC” fuse

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
HO2S-2 heater voltage is more than specified value or less than specified value for 5 seconds continuously (2 driving cycle detection logic)	• HO2S-2 heater • HO2S-2 heater circuit • 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) Start engine and warm up to normal operating temperature.
4) Run engine at idle speed for 1 min.
5) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

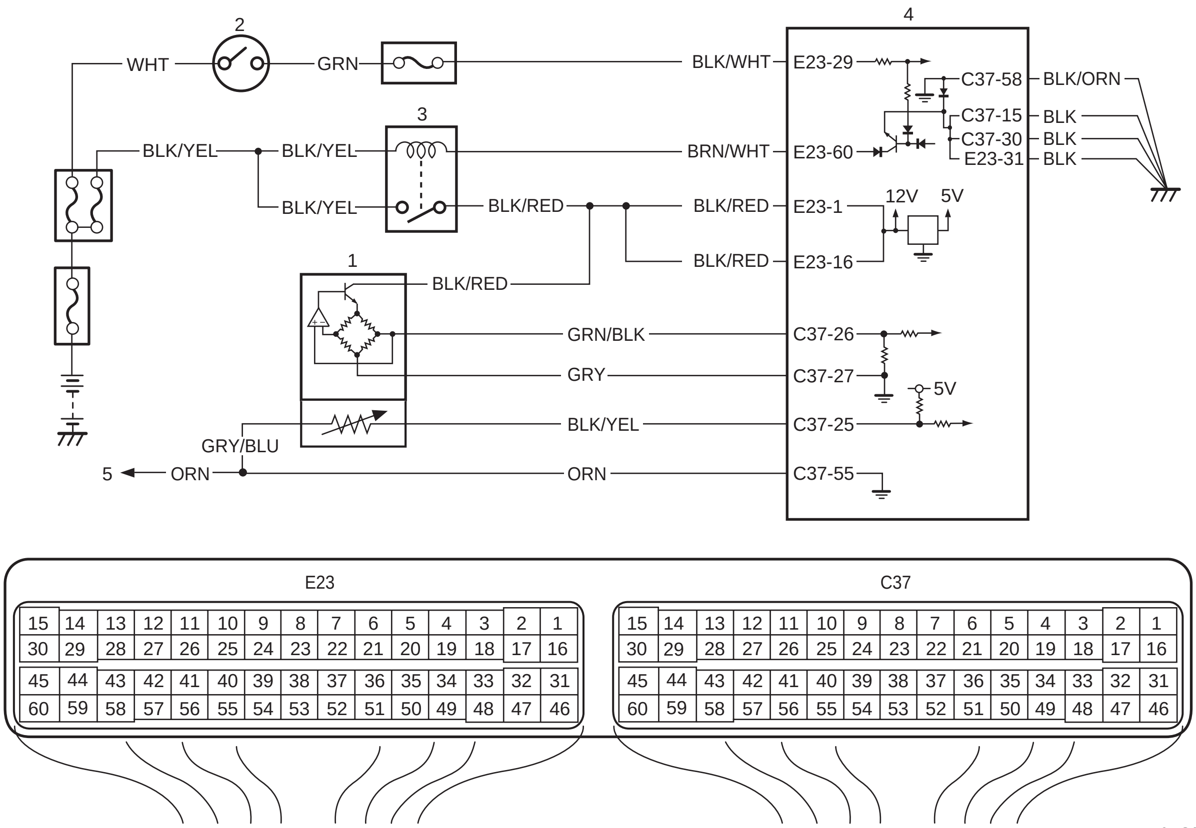
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to “Inspection of ECM and Its Circuits”.**
- **Upon completion of inspection and repair work, perform “DTC Confirmation Procedure” and confirm that 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	**HO2S-2 heater power circuit check** 1) Disconnect connector from HO2S-2 with ignition switch turned OFF. 2) Check for proper connection to HO2S-2 at "BLK/WHT" and "RED/BLU" wire terminals. 3) If wire and connection are OK, measure voltage between "BLK/WHT" wire terminal of HO2S-2 connector and engine ground with ignition switch turned ON. *Is voltage over 10 V?*	Go to Step 3.	"BLK/WHT" wire is open circuit or shorted to ground circuit.
3	**HO2S-2 heater power circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between "BLK/WHT" wire terminal of HO2S-2 connector and "E23-29" terminal wire of ECM connector. *Is resistance below 5 Ω?*	Go to Step 4.	"BLK/WHT" wire is high resistance circuit.
4	**HO2S-2 heater drive circuit check** 1) Measure resistance between "RED/BLU" wire terminal of HO2S-2 connector and vehicle body ground. *Is resistance infinity?*	Go to Step 5.	"RED/BLU" wire is shorted to ground circuit.
5	**HO2S-2 heater drive circuit check** 1) Turn ON ignition switch. 2) Measure voltage between "RED/BLU" wire terminal of HO2S-2 connector and vehicle body ground. *Is voltage 0 V?*	Go to Step 6.	"RED/BLU" wire is shorted to power circuit.
6	**HO2S-2 heater drive circuit check** 1) Connect connector to HO2S-2 with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Measure voltage between "C37-47" terminal of disconnected ECM connector and vehicle body ground. *Is voltage over 10 V?*	Go to Step 7.	"RED/BLU" wire is open circuit.
7	**HO2S-2 heater check** 1) Disconnect HO2S-2 connector with ignition switch turned OFF. 2) Check HO2S-2 heater resistance referring to "HO2S-1 and HO2S-2 Heater On-Vehicle Inspection in Section 1C". *Is resistance within specified value?*	Go to Step 8.	Replace HO2S-2.
8	**HO2S-2 heater power circuit check** 1) Connect connector to HO2S-2 with ignition switch turned OFF. 2) Measure resistance between "E23-29" and "C37-47" terminals of ECM connector. *Is resistance below 30 Ω?*	Substitute a known-good ECM and recheck.	"RED/BLU" wire is high resistance circuit.

DTC P0101: Mass or Volume Air Flow Circuit Range / Performance

S7RS0B1104017

Wiring Diagram



I6RS0C110014-01

1. MAF and IAT sensor	3. Main relay	5. To other sensors
2. Ignition switch	4. ECM	

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
• MAF volume is greater than 20 g/sec even if engine revolution is less than 900 rpm and intake manifold pressure is less than 40 kPa (5.80 psi) with TP less than 1.5°. • MAF volume is lower than 10 g/sec even if engine revolution is more than 2500 rpm and intake manifold pressure is more than 60 kPa (8.70 psi) with TP more than 12°. (2 driving cycle detection logic)	• Air intake system (clog or leakage) • MAF sensor circuit • MAF sensor • TP sensor and/or its circuit • MAP sensor and/or its circuit • ECM

DTC Confirmation Procedure

⚠ 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.**

NOTE

Check to make sure that the following conditions are satisfied when using this "DTC Confirmation Procedure".

- **Intake air temperature at engine start: –10 °C (14°F) to 80 °C (176 °F)**
- **Intake air temperature: –10 °C (14 °F) to 70 °C (158 °F)**
- **Engine coolant temperature: 70 °C (158 °F) to 150 °C (302 °F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

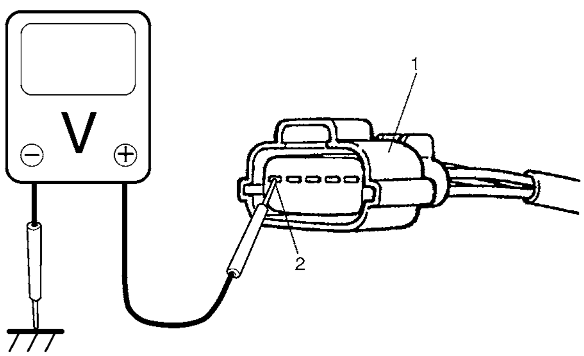
1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature. (ECT approx. 90 – 95 °C, 194 – 203 °F)
4) Drive vehicle with engine speed: more than 2500 rpm for 1 min.
5) Increase vehicle speed to 80 km/h (45 mile/h) at 5th gear or D range.
6) Release accelerator pedal to decrease vehicle speed to 40 km/h (25 mile/h).
7) Stop vehicle and run it idle for 1 min.
8) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **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	**Visual inspection** Check MAF sensor and air intake system for: • Objects which block measuring duct and resistor of MAF sensor. • Other air flow which does not pass the MAF sensor. *Are they in good condition?*	Go to Step 3.	Repair or replace.
3	**MAF sensor and its circuit check** 1) With ignition switch turned OFF, connect scan tool. 2) Start engine and warm up to normal operation temperature. 3) Check MAF value using scan tool. (Refer to "Scan Tool Data" for normal value.) *Is each value within specified range?*	Go to Step 11.	Go to Step 4.

Step	Action	Yes	No
4	**MAF sensor output voltage check** 1) Turn OFF ignition switch. 2) Remove ECM from its bracket with ECM connectors connected. 3) Measure voltage between "C37-26" and "C37-27" terminals of ECM connector referring to "MAF and IAT Sensor On-Vehicle Inspection in Section 1C". *Is each value within specified range?*	Poor "C37-26" and/or "C37-27" terminal connection. If OK, substitute a known-good ECM and recheck.	Go to Step 5.
5	**MAF sensor power supply voltage check** 1) Disconnect connector from MAF and IAT sensor with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between engine ground and "BLK/RED" wire terminal (2) of MAF and IAT sensor connector (1).  I4RS0A110020-01 *Is voltage 10 – 14 V?*	Go to Step 6.	"BLK/RED" wire is open circuit.
6	**MAF sensor ground circuit check** 1) Turn OFF ignition switch, measure resistance between "GRY" wire terminal of MAF and IAT sensor connector and engine ground. *Is resistance below 5 Ω?*	Go to Step 8.	Go to Step 7.
7	**Ground circuit check** 1) Measure resistance between "C37-27" terminal of ECM connector and vehicle body ground. *Is resistance below 5 Ω?*	"GRY" wire is open or high resistance circuit.	ECM grounds "E23-31", "C37-58", "C37-15" and/or "C37-30" circuit is open or high resistance. If wires are OK, substitute a known-good ECM and recheck.
8	**MAF sensor signal circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between "GRN/BLK" wire terminal of MAF and IAT sensor connector and engine ground. *Is voltage 0 V?*	Go to Step 9.	"GRN/BLK" wire is shorted to other circuit.
9	**MAF sensor signal circuit check** 1) Turn OFF ignition switch, measure resistance between "GRN/BLK" wire terminal of MAF and IAT sensor connector and engine ground. *Is resistance infinity?*	Go to Step 10.	"GRN/BLK" wire is shorted to ground circuit.

Step	Action	Yes	No
10	**MAF sensor signal circuit check** 1) Measure resistance between “GRN/BLK” wire terminal of MAF and IAT sensor connector and “C37-26” terminal of ECM connector. *Is resistance below 3 Ω?*	Faulty MAF and IAT sensor.	“GRN/BLK” wire is open or high resistance circuit.
11	*Is DTC P2135 detected?*	Go to “DTC P2135: Throttle / Pedal Position Sensor / Switch “A”/“B” (Main / Sub) Voltage Correlation”.	Go to Step 12.
12	*Is DTC P0106 displayed?*	Go to “DTC P0106: Manifold Absolute Pressure / Barometric Pressure Circuit Range / Performance”.	Substitute a known-good ECM and recheck.

DTC P0102: Mass or Volume Air Flow Circuit Low Input

S7RS0B1104018

Wiring Diagram

Refer to “DTC P0101: Mass or Volume Air Flow Circuit Range / Performance”.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
MAF sensor output voltage is less than 0.15 V for 0.5 seconds continuously (1 driving cycle detection logic)	• Open or short in MAF sensor circuit • MAF sensor • 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) Start engine and run it for 10 sec.
4) Check DTC.

DTC Troubleshooting

NOTE

- **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	**MAF sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Start engine and check MAF value displayed on scan tool. (Refer to “Scan Tool Data” for normal value.) *Is normal value indicated?*	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”.	Go to Step 3.

Step	Action	Yes	No
3	**MAF sensor power supply voltage check** 1) Disconnect connector from MAF and IAT sensor with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between engine ground and “BLK/RED” wire terminal of MAF and IAT sensor connector. *Is voltage 10 – 14 V?*	Go to Step 4.	“BLK/RED” wire is open circuit.
4	**MAF sensor ground circuit check** 1) Turn OFF ignition switch, measure resistance between “GRY” wire terminal of MAF and IAT sensor connector and engine ground. *Is resistance below 5 Ω?*	Go to Step 6.	Go to Step 5.
5	**Ground circuit check** 1) Remove ECM from its bracket with ECM connectors connected. 2) Measure resistance between “C37-27” terminal of ECM connector and engine ground. *Is resistance below 5 Ω?*	“GRY” wire is open or high resistance circuit.	ECM grounds “E23-31”, “C37-58”, “C37-15” and/or “C37-30” circuit is open or high resistance. If wires are OK, substitute a known-good ECM and recheck.
6	**MAF sensor signal circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure voltage between “GRN/BLK” wire terminal of MAF and IAT sensor connector and engine ground with ignition switch turned ON. *Is voltage 0 V?*	Go to Step 7.	“GRN/BLK” wire is shorted to other circuit.
7	**MAF sensor signal circuit check** 1) Measure resistance between “GRN/BLK” wire terminal of MAF and IAT sensor connector and engine ground with ignition switch turned OFF. *Is resistance infinity?*	Go to Step 8.	“GRN/BLK” wire is shorted to ground circuit.
8	**MAF sensor signal circuit check** 1) Measure resistance between “GRN/BLK” wire terminal of MAF and IAT sensor connector and “C37-26” terminal of ECM connector. *Is resistance below 3 Ω?*	Go to Step 9.	“GRN/BLK” wire is open or high resistance circuit.
9	**MAF sensor output signal check** 1) Connect connectors to MAF and IAT sensor and ECM with ignition switch turned OFF. 2) Measure voltage between “C37-26” and “C37-27” terminals of ECM connector referring to “MAF and IAT Sensor On-Vehicle Inspection in Section 1C”. *Is each value within specified range?*	Substitute a known-good ECM and recheck.	Faulty MAF and IAT sensor.

DTC P0103: Mass or Volume Air Flow Circuit High Input

S7RS0B1104019

Wiring Diagram

Refer to “DTC P0101: Mass or Volume Air Flow Circuit Range / Performance”.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
MAF sensor output voltage is higher than 4.85 V for 0.5 seconds continuously. (1 driving cycle detection logic)	• Open or short in MAF sensor circuit • MAF sensor • 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) Start engine and run it for 10 sec.
4) Check DTC.

DTC Troubleshooting

NOTE

- **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.**

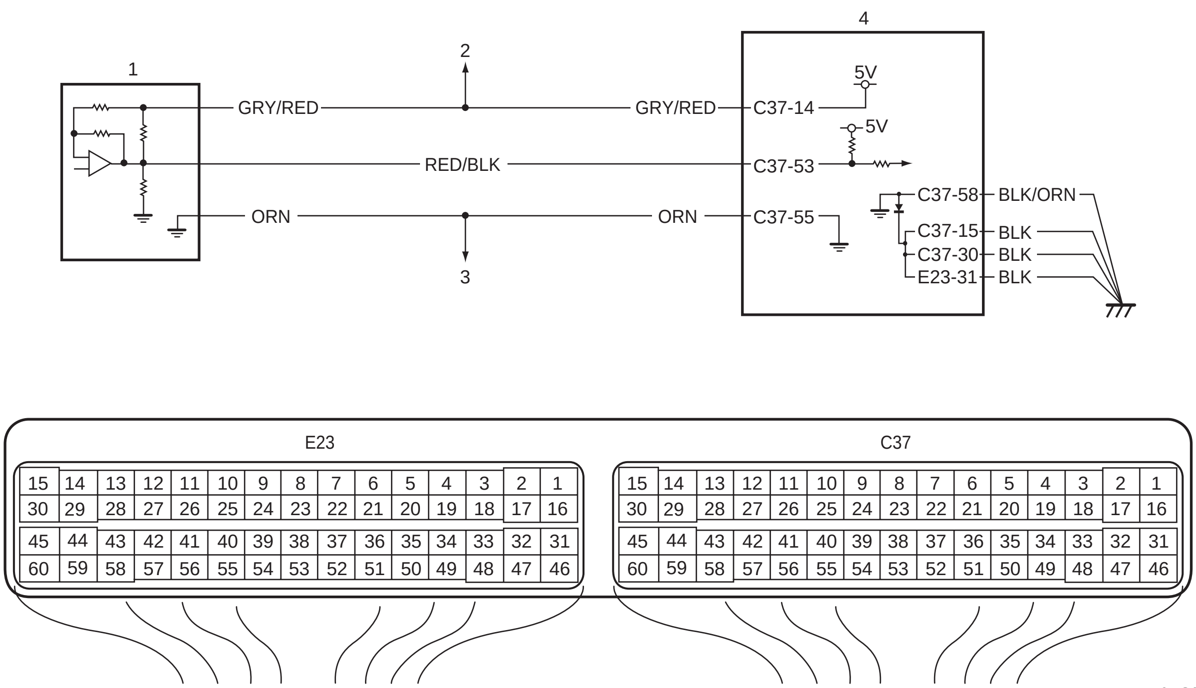
Step	Action	Yes	No
1	*Was “Engine and Emission Control System Check” performed?*	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	**MAF sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Start engine and check MAF value displayed on scan tool. (Refer to “Scan Tool Data” for normal value.) *Is normal value indicated?*	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”.	Go to Step 3.
3	**MAF sensor power supply voltage check** 1) Disconnect connector from MAF and IAT sensor with ignition switch tuned OFF. 2) Turn ON ignition switch, measure voltage between engine ground and “BLK/RED” wire terminal of MAF and IAT sensor connector. *Is voltage 10 – 14 V?*	Go to Step 4.	“BLK/RED” wire is open circuit.
4	**MAF sensor ground circuit check** 1) Turn OFF ignition switch, measure resistance between “GRY” wire terminal of MAF and IAT sensor connector and engine ground. *Is resistance below 5 Ω?*	Go to Step 6.	Go to Step 5.
5	**Ground circuit check** 1) Remove ECM from its bracket with ECM connectors connected. 2) Measure resistance between “C37-27” terminal of ECM connector and engine ground. *Is resistance below 5 Ω?*	“GRY” wire is open or high resistance circuit.	ECM grounds “E23-31”, “C37-58”, “C37-15” and/or “C37-30” circuit are open or high resistance. If wires are OK, substitute a known-good ECM and recheck.

Step	Action	Yes	No
6	**MAF sensor signal circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure voltage between “GRY/BLK” wire terminal of MAF and IAT sensor connector and engine ground. *Is voltage 0 V?*	Go to Step 7.	“GRY/BLK” wire is shorted to other circuit.
7	**MAF sensor output signal check** 1) Connect connector to MAF and IAT sensor and ECM with ignition switch turned OFF. 2) Measure voltage between “C37-26” and “C37-27” terminal of ECM connector referring to “MAF and IAT Sensor On-Vehicle Inspection in Section 1C”. *Is each value within specified range?*	Substitute a known-good ECM and recheck.	Faulty MAF and IAT sensor.

DTC P0106: Manifold Absolute Pressure / Barometric Pressure Circuit Range / Performance

S7RS0B1104020

Wiring Diagram



I6RS0C110008-02

1. Manifold absolute pressure sensor	3. To other sensors
2. To A/C refrigerant pressure sensor (if equipped with A/C)	4. ECM

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
• Difference between Max. manifold absolute pressure value and Min. manifold pressure value is less than 1.3 kPa (0.19 psi) when engine running at idle speed. • Difference between barometric pressure value and manifold pressure value is less than 33.3 kPa (4.83 psi) for 5 sec. at 2000 r/mini. or more. (2 driving cycle detection logic)	• Manifold absolute pressure sensor • Manifold absolute pressure sensor vacuum passage • Air intake system • ECM

DTC Confirmation Procedure

NOTE

Check to make sure that the following conditions are satisfied when using this “DTC Confirmation Procedure”.

- **Intake air temperature at engine start: –10 °C (14 °F) to 80 °C (176 °F)**
- **Intake air temperature: –10 °C (14 °F) to 70 °C (158 °F)**
- **Engine coolant temperature: 70 °C (158 °F) to 150 °C (302 °F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch OFF.
2) Turn ON ignition switch and clear DTC using scan tool and warm up engine completely.
3) Increase engine speed up to 2000 rpm or more for 10 seconds.
4) Run engine at idle speed for 1 min.
5) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **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	**MAP sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check DTC. *Is there DTC P0107 or DTC P0108?*	Go to applicable DTC diag. flow.	Go to Step 3.
3	**MAP sensor output signal check** 1) Check MAP sensor according to “MAP Sensor Inspection in Section 1C”. *Is it in good condition?*	Go to Step 4.	Faulty MAP sensor.
4	**MAP sensor circuit check** 1) Check MAP sensor circuit referring to Step 3 to 6 of “DTC P0107: Manifold Absolute Pressure / Barometric Pressure Circuit Low Input” or Step 3 to 8 of “DTC P0108: Manifold Absolute Pressure / Barometric Pressure Circuit High Input”. *Is circuit in good condition?*	Go to Step 5.	Repair or replace.
5	**Air intake system check** 1) Check air intake system for clog or leak. *Is it in good condition?*	Substitute a known-good ECM and recheck.	Repair or replace.

DTC P0107: Manifold Absolute Pressure / Barometric Pressure Circuit Low Input

S7RS0B1104021

Wiring Diagram

Refer to "DTC P0106: Manifold Absolute Pressure / Barometric Pressure Circuit Range / Performance"

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Manifold absolute pressure sensor output voltage is lower than specified value for specified time continuously. (1 driving cycle detection logic)	• Manifold absolute pressure sensor circuit • Manifold absolute pressure sensor • A/C refrigerant pressure sensor (if equipped with A/C) • ECM

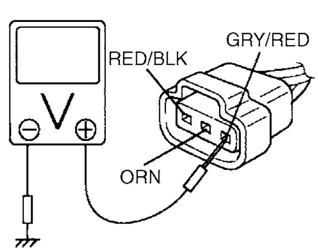
DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Run engine at idle speed for 1 min.
4) Check DTC.

DTC Troubleshooting

NOTE

- **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	**MAP sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check intake manifold pressure displayed on scan tool. *Is it 0 kPa (0 in.Hg)?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection in Section 00".
3	**MAP sensor power supply voltage check** 1) Disconnect connector from MAP sensor with ignition switch turned OFF. 2) Check for proper connection of MAP sensor at "GRY/RED", "RED/BLK" and "ORN" wire terminals. 3) Turn ON ignition switch, measure voltage between engine ground and "GRY/RED" wire terminal of MAP sensor connector.  I4RS0B110019-03 *Is voltage 4 – 6 V?*	Go to Step 5.	Go to Step 4.

Step	Action	Yes	No
4	**MAP sensor power supply circuit check** 1) Disconnect connectors from A/C refrigerant pressure sensor (if equipped with A/C) with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between engine ground and “GRY/RED” wire terminal of MAP sensor connector. *Is voltage 4 – 6 V?*	Faulty A/C refrigerant pressure sensor (if equipped with A/C).	“GRY/RED” wire is shorted to ground circuit. If wires are OK, substitute a known-good ECM and recheck.
5	**MAP sensor signal circuit check** 1) Measure voltage between “RED/BLK” wire terminal of MAP sensor connector and engine ground. *Is voltage 4 – 6 V?*	Go to Step 7.	Go to Step 6.
6	**MAP sensor signal circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “C37-53” terminal of ECM connector and vehicle body ground. *Is resistance infinity?*	Go to Step 7.	“RED/BLK” wire is shorted to ground circuit.
7	**MAP sensor output signal check** 1) Check MAP sensor according to “MAP Sensor Inspection in Section 1C”. *Is it in good condition?*	Substitute a known-good ECM and recheck.	Faulty MAP sensor.

DTC P0108: Manifold Absolute Pressure / Barometric Pressure Circuit High Input

S7RS0B1104022

Wiring Diagram

Refer to “DTC P0106: Manifold Absolute Pressure / Barometric Pressure Circuit Range / Performance”

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Manifold absolute pressure sensor output voltage is higher than specified value for specified time continuously. (1 driving cycle detection logic)	• Manifold absolute pressure sensor circuit • Manifold absolute pressure sensor • A/C refrigerant pressure sensor (if equipped with A/C) • ECM

NOTE

When DTC P0113 and P0118 are indicated together, it is possible that “ORN” wire circuit is open.

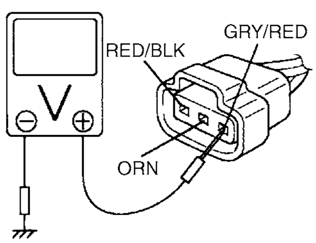
DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Run engine at idle speed for 1 min.
4) Check DTC.

DTC Troubleshooting

NOTE

- **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.**

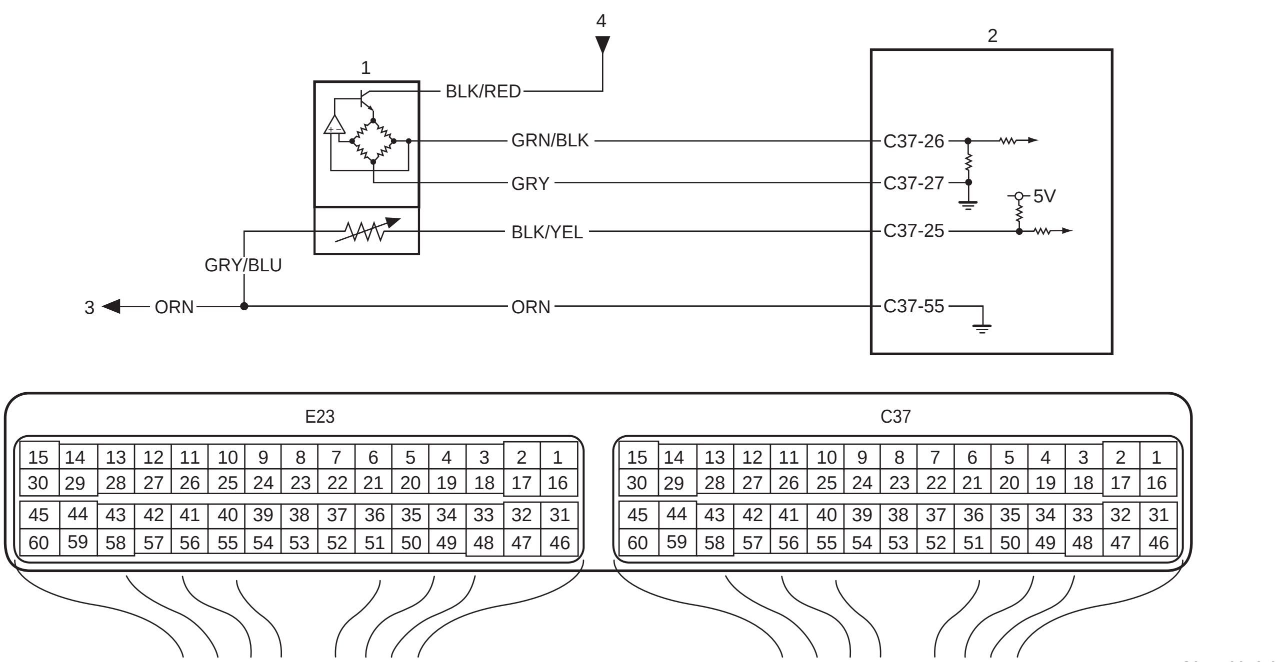
Step	Action	Yes	No
1	*Was “Engine and Emission Control System Check” performed?*	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	**MAP sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON. 3) Check intake manifold pressure displayed on scan tool. *Is it 127 kPa (37.5 in.Hg)?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”.
3	**MAP sensor power supply voltage check** 1) Disconnect connector from MAP sensor with ignition switch turned OFF. 2) Check for proper connection of MAP sensor at “GRY/RED”, “RED/BLK” and “ORN” wire terminals. 3) Turn ON ignition switch, measure voltage between engine ground and “GRY/RED” wire terminal of MAP sensor connector.  I4RS0B110019-03 *Is voltage 4 – 6 V?*	Go to Step 5.	Go to Step 4.
4	**MAP sensor power supply circuit check** 1) Disconnect connectors from A/C refrigerant pressure sensor (if equipped with A/C) with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between engine ground and “GRY/RED” wire terminal of MAP sensor connector. *Is voltage 4 – 6 V?*	Faulty A/C refrigerant pressure sensor (if equipped with A/C).	“GRY/RED” wire is open or shorted to power circuit.
5	**MAP sensor ground circuit check** 1) Measure resistance between “ORN” wire terminal of MAP sensor connector and engine ground with ignition switch turned OFF. *Is resistance below 5 Ω?*	Go to Step 7.	Go to Step 6.

Step	Action	Yes	No
6	**Ground circuit check** 1) Measure resistance between "C37-55" terminal of ECM connector and vehicle body ground. *Is resistance below 5 Ω?*	"ORN" wire is open or high resistance circuit.	ECM grounds "E23-31", "C37-58", "C37-15" and/or "C37-30" circuit are open or high resistance. If wires are OK, substitute a known-good ECM and recheck.
7	**MAP sensor signal circuit check** 1) Turn ON ignition switch. 2) Measure voltage between "RED/BLK" wire terminal of MAP sensor connector and engine ground. *Is voltage 4 – 6 V?*	Go to Step 9.	Go to Step 8.
8	**MAP sensor signal circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between "RED/BLK" wire terminal of MAP sensor connector and "C37-53" terminal of ECM connector. *Is resistance below 2 Ω?*	"RED/BLK" wire is shorted to power supply circuit.	"RED/BLK" wire is open or high resistance circuit.
9	**MAP sensor output signal check** 1) Check MAP sensor according to "MAP Sensor Inspection in Section 1C". *Is it in good condition?*	Substitute a known-good ECM and recheck.	Faulty MAP sensor.

DTC P0111: Intake Air Temperature Sensor 1 Circuit Range / Performance

S7RS0B1104023

Wiring Diagram



1. MAF and IAT sensor	3. To other sensors
2. ECM	4. From main relay

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Difference of maximum IAT minus minimum IAT is less than 0.3 °C (32.5 °F) while ECT is over 70 °C (158 °F) after 10 min from cold engine start (ECT is lower than 30°C (86 °F) at engine start). (2 driving cycle detection logic)	• High resistance circuit • MAF and IAT sensor • ECM

DTC Confirmation Procedure

NOTE

Check to make sure that following conditions are satisfied when using this “DTC Confirmation Procedure”.

- **Intake air temperature at engine start: –10 °C (14 °F) to 80 °C (176 °F)**
- **Intake air temperature: –10 °C (14 °F) to 70 °C (158 °F)**
- **Engine coolant temperature at engine start: less than 30 °C (86 °F)**
- **Engine coolant temperature: 70 °C (158 °F) to 150 °C (302 °F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

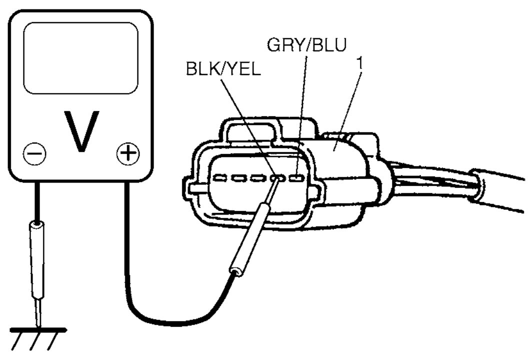
1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch, clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature. (ECT approx. 90 – 95 °C, 194 – 203 °F)
4) Run engine at idle speed for 10 min. or more.
5) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **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	**IAT sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ignition switch to ON position. 3) Check intake air temp. displayed on scan tool. *Is –40 °C (–40 °F) or 119 °C (246 °F) indicated?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”.

Step	Action	Yes	No
3	**Wire harness check** 1) Disconnect MAF and IAT sensor connector (1) with ignition switch turned OFF. 2) Check for proper connection to MAF and IAT sensor connector (1) at “BLK/YEL” wire terminal. 3) If OK, then with ignition switch turned ON, measure voltage between “BLK/YEL” wire terminal of MAF and IAT sensor connector and vehicle body ground.  I4RS0B110020-01 *Is measured voltage applied to “BLK/YEL” wire terminal about 4 – 6 V?*	Go to Step 8.	Go to Step 4.
4	**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 “C37-25” terminal. 4) If OK, then turn ON ignition switch, measure voltage between “C37-25” terminal of ECM connector and vehicle body ground. *Is voltage about 4 – 6 V at terminal?*	“BLK/YEL” wire is open circuit. If wire and connection are OK, go to Step 5.	Go to Step 5.
5	**Wire circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “BLK/YEL” wire terminal of MAF and IAT sensor connector and vehicle body ground. *Is resistance infinity?*	Go to Step 6.	“BLK/YEL” wire is shorted to ground or other circuit. If wire is OK, substitute a known-good ECM and recheck.
6	**Wire circuit check** 1) Turn ignition switch to ON position. 2) Measure voltage between “BLK/YEL” wire terminal of MAF and IAT sensor connector and vehicle body ground. *Is voltage about 0 V?*	Go to Step 7.	“BLK/YEL” wire shorted to other circuit. If wire is OK, substitute a known-good ECM and recheck.
7	**Wire circuit check** 1) Measure resistance between “C37-25” terminal of ECM connector and “BLK/YEL” wire terminal of MAF and IAT sensor connector with ignition switch turned OFF. *Is resistance below 3 Ω?*	Go to Step 8.	“BLK/YEL” wire is high resistance circuit.

Step	Action	Yes	No
8	**Ground circuit check** 1) Connect connectors to ECM. 2) Check for proper connection of MAF and IAT sensor connector at “GRY/BLU” wire terminal. 3) Measure resistance between “GRY/BLU” wire terminal of MAF and IAT sensor connector and vehicle body ground with ignition switch turned OFF. *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) Measure resistance between “C37-55” terminal of ECM connector and vehicle body ground. *Is resistance below 3 Ω?*	“GRY/BLU” wire and/or “ORN” wire is open or high resistance circuit. Poor “C37-55” connection.	Faulty ECM ground circuit. If circuit is OK, substitute a known-good ECM and recheck.
10	**IAT sensor check** 1) Check IAT sensor according to “MAF and IAT Sensor Inspection in Section 1C”. *Is it in good condition?*	Substitute a known-good ECM and recheck.	Replace MAF and IAT sensor.

DTC P0112: Intake Air Temperature Sensor 1 Circuit Low

S7RS0B1104024

Wiring Diagram

Refer to “DTC P0111: Intake Air Temperature Sensor 1 Circuit Range / Performance”.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
IAT sensor output voltage is less than 0.15 V for 0.5 seconds continuously. (High intake air temperature (low voltage/low resistance)) (1 driving cycle detection logic)	• IAT sensor circuit • IAT sensor • ECM

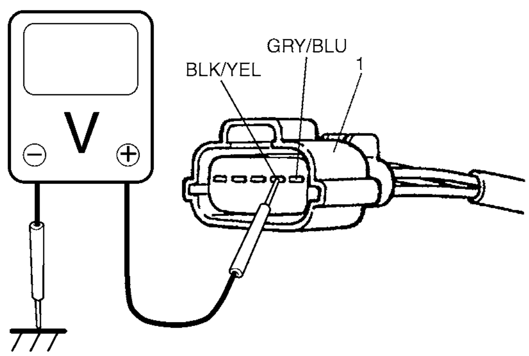
DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 10 sec.
4) Check DTC.

DTC Troubleshooting

NOTE

- **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	**IAT sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check intake air temp. displayed on scan tool. *Is 119 °C (246 °F) indicated?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”.
3	**ECM voltage check** 1) Disconnect connector from MAF and IAT sensor with ignition switch turned OFF. 2) Check for proper connection to MAF and IAT sensor at “BLK/YEL” and “GRY/BLU” wire terminals. 3) If OK, then turn ON ignition switch, measure voltage between “BLK/YEL” wire terminal of MAF and IAT sensor connector (1) and vehicle body ground.  I4RS0B110020-01 *Is voltage about 4 – 6 V?*	Go to Step 6.	Go to Step 4.
4	**IAT short circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “BLK/YEL” wire terminal of MAF and IAT sensor connector and vehicle body ground. *Is resistance infinity?*	Go to Step 5.	“BLK/YEL” wire is shorted to ground circuit. If wire is OK, substitute a known-good ECM and recheck.
5	**IAT short circuit check** 1) Turn ON ignition switch. 2) Measure voltage between “BLK/YEL” wire terminal of MAF and IAT sensor connector and vehicle body ground. *Is voltage about 0 V?*	Go to Step 6.	“BLK/YEL” wire is shorted to other circuit. If wire is OK, substitute a known-good ECM and recheck.
6	**IAT sensor for performance check** 1) Check IAT sensor according to “MAF and IAT Sensor Inspection in Section 1C”. *Is it in good condition?*	Substitute a known-good ECM and recheck.	Replace MAF and IAT sensor.

DTC P0113: Intake Air Temperature 1 Sensor Circuit High

S7RS0B1104025

Wiring Diagram

Refer to “DTC P0111: Intake Air Temperature Sensor 1 Circuit Range / Performance”.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
IAT sensor output voltage is higher than 4.85 V for 0.5 seconds continuously. (Low intake air temperature (high voltage/high resistance)) (1 driving cycle detection logic)	• IAT sensor circuit • IAT sensor • ECM

NOTE

When DTC P0108 and P0118 are indicated together, it is possible that “ORN” wire circuit is open.

DTC Confirmation Procedure

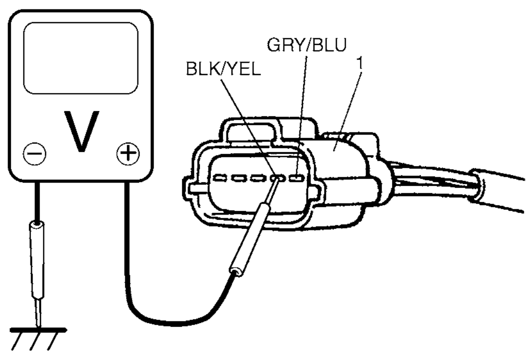
1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 10 sec.
4) Check DTC.

DTC Troubleshooting

NOTE

- **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	**IAT sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check intake air temp. displayed on scan tool. *Is –40 °C (–40 °F) indicated?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”.

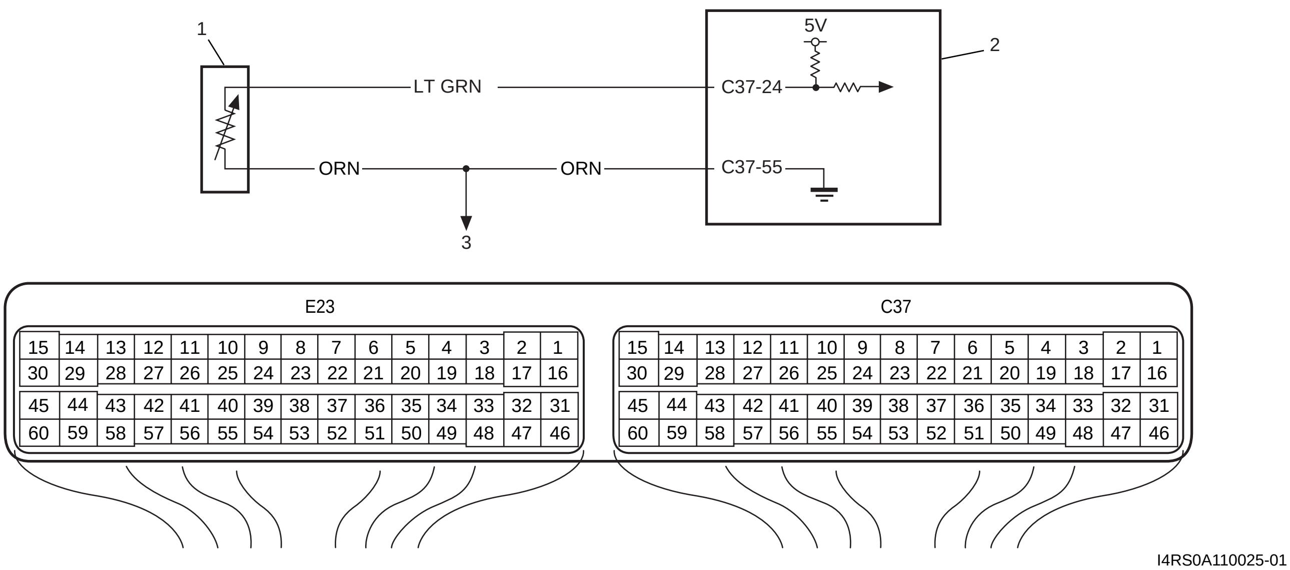
Step	Action	Yes	No
3	**IAT sensor voltage check** 1) Disconnect connector from MAF and IAT sensor with ignition switch turned OFF. 2) Check for proper connection to MAF and IAT sensor at “BLK/YEL” and “GRY/BLU” wire terminals. 3) If OK, then turn ON ignition switch, measure voltage between “BLK/YEL” wire terminal of MAF and IAT sensor connector (1) and vehicle body ground.  I4RS0B110020-01 *Is voltage about 4 – 6 V?*	Go to Step 7.	Go to Step 4.
4	**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 “C37-25” terminal. 4) If OK, then turn ON ignition switch, measure voltage between “C37-25” terminal of ECM connector and vehicle body ground. *Is voltage about 4 – 6 V?*	“BLK/YEL” wire is open circuit. If wire and connection are OK, go to Step 5.	Go to Step 5.
5	**Wire circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Measure voltage between “BLK/YEL” wire terminal of MAF and IAT sensor connector and vehicle body ground. *Is voltage about 0 V?*	Go to Step 6.	“BLK/YEL” wire is shorted to other circuit. If wire is OK, substitute a known-good ECM and recheck.
6	**Wire circuit check** 1) Measure resistance between “C37-25” terminal of ECM connector and “BLK/YEL” wire terminal of MAF and IAT sensor connector with ignition switch turned OFF. *Is resistance below 5 Ω?*	Go to Step 7.	“BLK/YEL” wire is high resistance circuit.
7	**Ground circuit check** 1) Connect connectors to ECM. 2) Measure resistance between “GRY/BLU” wire terminal of MAF and IAT sensor connector and vehicle body ground with ignition switch turned OFF. *Is resistance below 5 Ω?*	Go to Step 9.	Go to Step 8.

Step	Action	Yes	No
8	**Ground circuit check** 1) Remove ECM from its bracket with ECM connectors connected. 2) Measure resistance between "C37-55" terminal of ECM connector and vehicle body ground. *Is resistance below 5 Ω?*	"GRY/BLU" wire and/or "ORN" wire is open circuit or high resistance circuit. Poor "C37-55" connection.	Faulty ECM ground circuit. If circuit is OK, substitute a known-good ECM and recheck.
9	**IAT sensor for performance check** 1) Check IAT sensor according to "MAF and IAT Sensor Inspection in Section 1C". *Is it in good condition?*	Substitute a known-good ECM and recheck.	Replace MAF and IAT sensor.

DTC P0116: Engine Coolant Temperature Circuit Range / Performance

S7RS0B1104026

Wiring Diagram



1. ECT sensor	2. ECM	3. To other sensors

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
ECT sensor values is less than –5 °C, 23 °F while engine is running under more than specified engine load (more than 1000 rpm) for 2 to 1116 min (depending on ECT at engine start) continuously from engine start. (*2 driving cycle detecting logic, monitoring once per driving cycle)	• ECT sensor • ECT sensor circuit • Thermostat • ECM

DTC Confirmation Procedure

⚠ 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 tester, on a level road.**

NOTE

Check to make sure that following conditions are satisfied when using this "DTC Confirmation Procedure".

- **Intake air temperature at engine start: –10 °C (14 °F) to 80 °C (176 °F)**
- **Intake air temperature: –10 °C (14 °F) to 70 °C (158 °F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

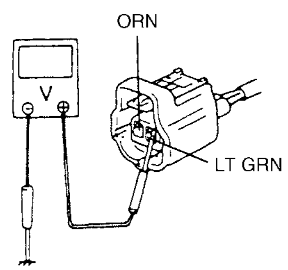
1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch, clear DTC.
3) Start engine.
4) Drive vehicle at 40 mph (60 km/h) or higher for 20 min. or more.
5) Stop vehicle.
6) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **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	**DTC check** 1) With ignition switch turned OFF, install scan tool to DLC. 2) Turn ON ignition switch and check DTC with scan tool. *Is DTC P0118 displayed?*	Go to "DTC P0118: Engine Coolant Temperature Circuit High".	Go to Step 3.
3	**Engine coolant temp. check** 1) Turn ON ignition switch and check engine coolant temp. displayed on scan tool. 2) Warm up engine to normal operating temp. and check engine coolant temp. displayed on scan tool. *Does engine coolant temp. vary more than 1 °C (1 °F) and rise higher than 70 °C (158 °F)?*	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection in Section 00".	Go to Step 4.
4	**Thermostat check** *Is there a symptom due to thermostat remaining open (it takes a long time before vehicle heater becomes effective or before engine is warmed to normal operating temp., etc.)?*	Check thermostat referring to "Thermostat Inspection in Section 1F".	Go to Step 5.

Step	Action	Yes	No
5	**Wire harness check** 1) Disconnect ECT sensor connector with ignition switch turned OFF. 2) Check for proper connection to ECT sensor connector at “ORN” and “LT GRN” wire terminals. 3) If OK, then with ignition switch ON, measure voltage between “LT GRN” wire terminal of ECT sensor connector and vehicle body ground.  I2RH01110067-01 *Is measured voltage applied to “LT GRN” wire terminal about 4 – 6 V?*	Go to Step 9.	Go to Step 6.
6	**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 “C37-24” terminal. 4) If OK, then turn ON ignition switch, measure voltage between “C37-24” terminal of ECM connector and vehicle body ground. *Is voltage about 4 – 6 V?*	“LT GRN” wire is open circuit. If wire and connection are OK, go to Step 7.	Go to Step 7.
7	**Wire circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Turn ignition switch to ON position. 3) Measure voltage between “LT GRN” wire terminal of ECT sensor connector and body ground. *Is voltage about 0 V?*	Go to Step 8.	“LT GRN” wire is shorted to other circuit. If wire is OK, substitute a known-good ECM and recheck.
8	**Wire circuit check** 1) Measure resistance between “C37-24” terminal of ECM connector and “LT GRN” wire terminal of ECT sensor connector with ignition switch turned OFF. *Is resistance below 5 Ω?*	Go to Step 9.	“LT GRN” wire is high resistance circuit.
9	**Ground circuit check** 1) Connect connectors to ECM. 2) Check for proper connection of ECT sensor connector at “ORN” wire terminal. 3) Measure resistance between “ORN” wire terminal of ECT sensor connector and vehicle body ground. *Is resistance below 5 Ω?*	Go to Step 11.	Go to Step 10.

Step	Action	Yes	No
10	**Ground circuit check** 1) Remove ECM from its bracket with ECM connectors connected. 2) Measure resistance between “C37-55” terminal of ECM connector and vehicle body ground. *Is resistance below 5 Ω?*	“ORN” wire is high resistance circuit. Poor “C37-55” connection.	Faulty ECM ground circuit. If circuit is OK, substitute a known-good ECM and recheck.
11	**ECT sensor check** 1) Check ECT sensor according to “ECT Sensor Inspection in Section 1C”. *Is it in good condition?*	Substitute a known-good ECM and recheck.	Replace ECT sensor.

DTC P0117: Engine Coolant Temperature Circuit Low

S7RS0B1104027

Wiring Diagram

Refer to “DTC P0116: Engine Coolant Temperature Circuit Range / Performance”

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
ECT sensor output voltage is less than 0.15 V for 0.5 seconds continuously. (High engine coolant temperature (low voltage / low resistance)) (1 driving cycle detection logic)	• ECT sensor circuit • ECT sensor • ECM

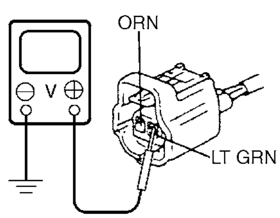
DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 10 sec. or more.
4) Check DTC.

DTC Troubleshooting

NOTE

- **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	**ECT sensor and its circuit check** 1) Connect scan tool with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check engine coolant temp. displayed on scan tool. *Is 119 °C (246 °F) indicated?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection in Section 00".
3	**ECM voltage check** 1) Disconnect connector from ECT sensor with ignition switch turned OFF. 2) Check for proper connection to ECT sensor at "LT GRN" and "ORN" wire terminals. 3) If OK, then turn ON ignition switch, measure voltage between "LT GRN" wire terminal of ECT sensor connector and vehicle body ground.  I4RS0A110026-01 *Is voltage about 4 – 6 V?*	Go to Step 6.	Go to Step 4.
4	**ECT sensor short circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between "LT GRN" wire terminal of ECT sensor connector and vehicle body ground. *Is resistance infinity?*	Go to Step 5.	"LT GRN" wire is shorted to ground circuit. If wire is OK, substitute a known-good ECM and recheck.
5	**ECT sensor short circuit check** 1) Turn ON ignition switch. 2) Measure voltage between "LT GRN" wire terminal of ECT sensor connector and vehicle body ground. *Is voltage about 0 V?*	Go to Step 6.	"LT GRN" wire is shorted to other circuit. If wire is OK, substitute a known-good ECM and recheck.
6	**ECT sensor for performance check** 1) Check ECT sensor according to "ECT Sensor Inspection in Section 1C". *Is it in good condition?*	Substitute a known-good ECM and recheck.	Replace ECT sensor.

DTC P0118: Engine Coolant Temperature Circuit High

S7RS0B1104028

Wiring Diagram

Refer to “DTC P0116: Engine Coolant Temperature Circuit Range / Performance”.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
ECT sensor output voltage is higher than 4.85 V for 0.5 seconds continuously. (Low engine coolant temperature (high voltage/high resistance)) (1 driving cycle detection logic)	• ECT sensor circuit • ECT sensor • ECM

NOTE

When DTC P0108 and P0113 are indicated together, it is possible that “ORN” wire circuit open.

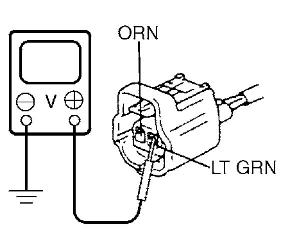
DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 10 sec. or more.
4) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **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.**

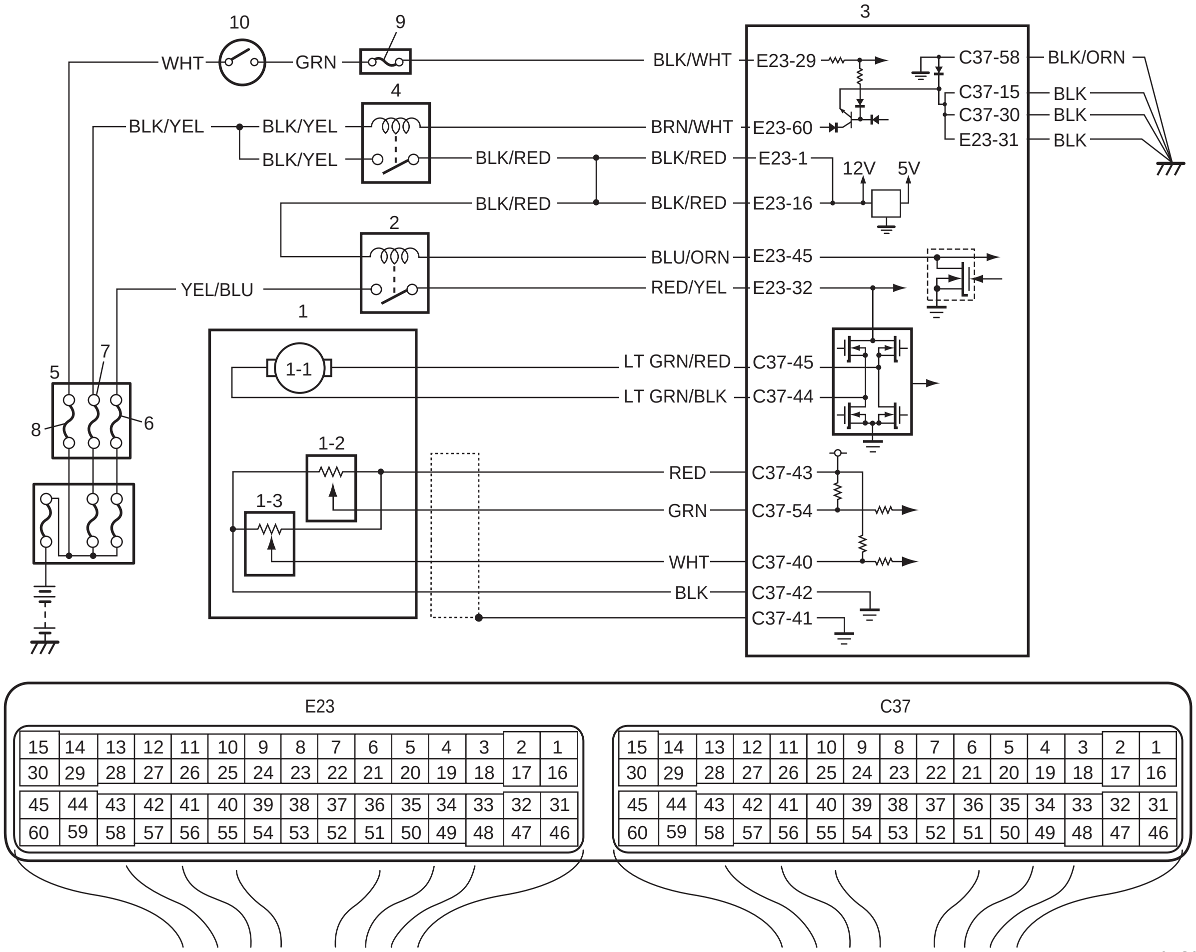
Step	Action	Yes	No
1	*Was “Engine and Emission Control System Check” performed?*	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	**ECT sensor and its circuit check** 1) Connect scan tool with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Check engine coolant temp. displayed on scan tool. *Is –40 °C (–40 °F) indicated?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”.
3	**ECT voltage check** 1) Disconnect connector from ECT sensor with ignition switch turned OFF. 2) Check for proper connection to ECT sensor at “LT GRN” and “ORN” wire terminals. 3) If OK, then turn ON ignition switch, measure voltage between “LT GRN” wire terminal of ECT sensor connector and vehicle body ground.  I4RS0A110026-01 *Is voltage about 4 – 6 V?*	Go to Step 6.	Go to Step 4.

Step	Action	Yes	No
4	**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 "C37-24" terminal. 4) If OK, then turn ON ignition switch, measure voltage between "C37-24" wire terminal of ECM connector and vehicle body ground. *Is voltage about 4 – 6 V?*	"LT GRN" wire is open circuit. If wire and connection are OK, go to Step 5.	Go to Step 5.
5	**ECT sensor harness voltage check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Measure voltage between "LT GRN" wire terminal of ECT sensor connector and vehicle body ground. *Is voltage about 0 V?*	Go to Step 6.	"LT GRN" wire is shorted to other circuit. If wire is OK, substitute a known-good ECM and recheck.
6	**ECT sensor harness resistance check** 1) Measure resistance between "C37-24" terminal of ECM connector and "LT GRN" wire terminal of ECT sensor connector with ignition switch turn OFF. *Is resistance below 5 Ω?*	Go to Step 7.	"LT GRN" wire is high resistance circuit.
7	**ECT sensor ground circuit check** 1) Connect connectors to ECM. 2) Check for proper connection of ECT sensor connector at "ORN" wire terminal. 3) Measure resistance between "ORN" wire terminal of ECT sensor connector and vehicle body ground. *Is resistance below 5 Ω?*	Go to Step 9.	Go to Step 8.
8	**ECT sensor ground circuit check** 1) Measure resistance between "C37-55" terminal of ECM connector and vehicle body ground. *Is resistance below 5 Ω?*	"ORN" wire is open circuit or high resistance circuit. Poor "C37-55" connection.	Faulty ECM ground circuit. If circuit is OK, substitute a known-good ECM and recheck.
9	**ECT sensor for performance check** 1) Check ECT sensor according to "ECT Sensor Inspection in Section 1C". *Is it in good condition?*	Substitute a known-good ECM and recheck.	Replace ECT sensor.

DTC P0122: Throttle / Pedal Position Sensor / Switch "A" (Main) Circuit Low

S7RS0B1104029

Wiring Diagram



I6RS0C110015-01

1.	Electric throttle body assembly	3.	ECM	8.	"IG ACC" fuse
1-1.	Throttle actuator	4.	Main relay	9.	"IG COIL" fuse
1-2.	TP sensor (main)	5.	Individual circuit fuse box No.1	10.	Ignition switch
1-3.	TP 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
Output voltage of TP sensor (main) is less than specified value for specified time continuously. (1 driving detection logic)	• TP sensor (main) circuit • Electric throttle body assembly • ECM

NOTE

When DTC P0122 and P0222 are indicated together, it is possible that "RED" wire open circuit.

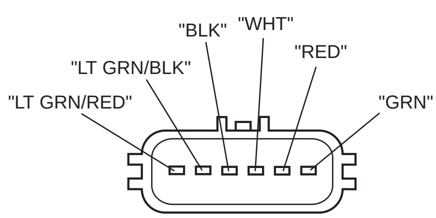
DTC Confirmation Procedure

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

- **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	**TP sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch, check “TP Sensor 1 Volt” displayed on scan tool when accelerator pedal is idle position and fully depressed. *Is displayed 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 with ignition switch turned OFF. 2) Check for proper connection to electric throttle body at “RED”, “GRN” and “BLK” wire terminals.  I4RS0B110022-02 3) If OK, measure voltage between “RED” wire terminal of electric throttle body connector and engine ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	Go to Step 6.	Go to Step 4.
4	**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 “C37-43” terminal. 4) If OK, measure voltage between “C37-43” 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 5.
5	**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?*	Substitute a known-good ECM and check.	“RED” wire is shorted to ground circuit.

Step	Action	Yes	No
6	**Wire harness check** 1) Measure voltage between “GRN” wire terminal of electric throttle body connector and engine ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	Go to Step 9.	Go to Step 7.
7	**Wire harness check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection of ECM connector at “C37-54” and “C37-42” terminals. 3) If OK, measure resistance between “GRN” and “BLK” wire terminals of electric throttle body connector. *Is resistance infinity?*	Go to Step 8.	“GRN” wire is shorted to “BLK” wire.
8	**Wire harness check** 1) Measure resistance between “GRN” wire terminal of electric throttle body connector and engine ground with ignition switch turned OFF. *Is resistance infinity?*	Substitute a known-good ECM and recheck.	“GRN” wire is shorted to ground circuit.
9	**Electric throttle body check** 1) Check TP sensor referring to “Throttle Position Sensor Performance Check” under “Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”. *Is output voltage within specified value?*	Substitute a known-good ECM and recheck.	Replace electric throttle body.

DTC P0123: Throttle / Pedal Position Sensor / Switch “A” (Main) Circuit High

S7RS0B1104030

Wiring Diagram

Refer to “DTC P0122: Throttle / Pedal Position Sensor / Switch “A” (Main) Circuit Low”.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Output voltage of TP sensor (main) is more than specified value for specified time continuously. (1 driving detection logic)	• TP sensor (main) circuit • Electric throttle body assembly • ECM

NOTE

When DTC P0123 and P0223 are indicated together, it is possible that “RED” wire shorted to power circuit and/or “BLK” wire open.

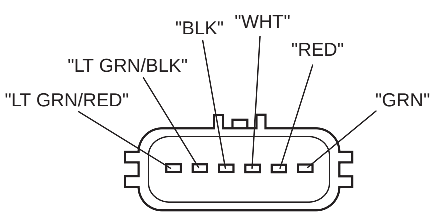
DTC Confirmation Procedure

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

- **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.**

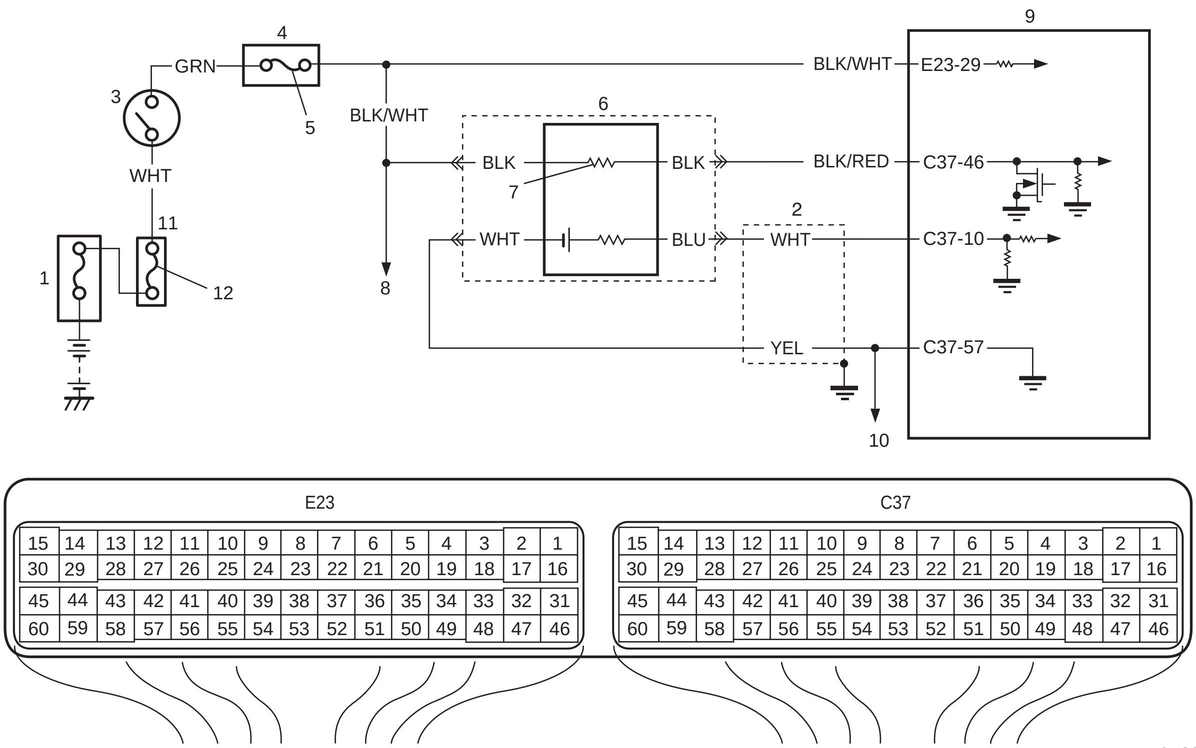
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check".
2	**TP sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch, check "TP Sensor 1 Volt" displayed on scan tool when accelerator pedal is idle position and fully depressed. *Is displayed 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 with ignition switch turned OFF. 2) Check for proper connection to electric throttle body at "RED", "GRN" and "BLK" wire terminals.  I4RS0B110022-02 3) If OK, measure voltage between "RED" wire terminal of electric throttle body connector and engine ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	Go to Step 5.	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 "C37-43" terminal. 3) Measured 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 power circuit.
5	**Wire harness check** 1) Measure voltage between "GRN" wire terminal of electric throttle body connector and engine ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	Go to Step 9.	Go to Step 6.

Step	Action	Yes	No
6	**Wire harness 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 “C37-43” and “C37-54” terminals. 4) If OK, measure voltage between “C37-54” terminal of ECM connector and engine ground with ignition switch turned ON. *Is voltage 4 -6 V?*	“GRN” wire is open or high resistance circuit.	Go to Step 7.
7	**Wire harness check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “GRN” and “RED” wire terminals of electric throttle body connector. *Is resistance infinity?*	Go to Step 8.	“GRN” wire is shorted to “RED” wire.
8	**Wire harness check** 1) Turn ON ignition switch. 2) Measure voltage between “C37-54” terminal of ECM connector and engine ground. *Is voltage 0 V?*	Substitute a known-good ECM and recheck.	“GRN” wire is shorted to power circuit.
9	**Ground circuit check** 1) Turn OFF ignition switch. 2) Measure resistance between “BLK” wire terminal of electric throttle body connector and engine ground. *Is resistance below 5 Ω?*	Go to Step 11.	Go to Step 10.
10	**Ground circuit check** 1) Remove ECM from its bracket with ECM connectors connected. 2) Check for proper connection of ECM connector at “C37-42” terminal. 3) Measure resistance between “C37-42” terminal of ECM connector and engine ground with ignition switch turned OFF. *Is resistance below 5 Ω?*	“BLK” wire is open or high resistance circuit.	Faulty ECM ground circuit. If circuit is OK, substitute a known-good ECM and recheck.
11	**Electric throttle body check** 1) Check TP sensor referring to “Throttle Position Sensor Performance Check” under “Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”. *Is output voltage within specified value?*	Substitute a known-good ECM and recheck.	Replace electric throttle body.

DTC P0131 / P0132: O2 Sensor (HO2S) Circuit Low Voltage / High Voltage (Sensor-1)

S7RS0B1104031

Wiring Diagram



I6RS0C110006-03

1. Main fuse box	4. Junction block assembly	7. Heater	10. To HO2S-2
2. Shield wire	5. “IG COIL” fuse	8. To HO2S-2 heater	11. Individual circuit fuse box No.1
3. Ignition switch	6. HO2S-1	9. ECM	12. “IG ACC” fuse

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
DTC P0131: Maximum HO2S voltage is less than 0.6 V (*2 driving cycle detection logic, monitoring once per driving cycle) **DTC P0132:** Minimum HO2S voltage is 0.3 V or more (*2 driving cycle detection logic, monitoring once per driving cycle)	• HO2S-1 circuit • HO2S-1 • Fuel system • ECM • Fuel shortage • Exhaust system • Air intake system

DTC Confirmation Procedure

⚠ 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.**

NOTE

Check to make sure that following conditions are satisfied when using this "DTC Confirmation Procedure".

- **Intake air temperature at engine start: –10 °C (14 °F) to 80 °C (176 °F)**
- **Intake air temperature: –10 °C (14 °F) to 70 °C (158 °F)**
- **Engine coolant temperature: 70 °C (158 °F) to 150 °C (302 °F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature.
4) Drive vehicle at 40 mph (60 km/h) or higher. (engine speed: 2500 – 3000 r/min.)
5) Keep above vehicle speed for 6 min. or more. (Throttle valve opening is kept constant in this step.)
6) Release accelerator pedal and with engine brake applied, keep vehicle coasting (with fuel cut for 3 sec. or more) and then stop vehicle.
7) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **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 there DTC(s) other than HO2S-1?*	Go to applicable DTC diag. flow.	Go to Step 3.
3	**HO2S-1 signal check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously to enrich A/F mixture and take foot off from pedal to enlean it). *Does HO2S-1 output voltage deflect between below 0.3 V and over 0.6 V repeatedly?*	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection in Section 00". If check result is OK, go to Step 9.	Go to Step 4.

Step	Action	Yes	No
4	**HO2S-1 ground check** 1) Disconnect connector from HO2S-1 with ignition switch turned OFF. 2) Check for proper connection to HO2S-1 connector at "BLK/RED", "WHT", "BLK/WHT" and "YEL" wire terminals. 3) If connections are OK, measure resistance between "YEL" wire terminal of HO2S-1 connector and engine ground. *Is measured resistance less than 5 Ω?*	Go to Step 5.	"YEL" wire is open or high resistance circuit. Poor "C37-57" terminal connection. Faulty ECM ground. If they are OK, substitute a known-good ECM and recheck.
5	**Wire circuit check** 1) Turn OFF ignition switch. 2) Remove ECM from its bracket with ECM connectors connected. 3) Measure resistance between "WHT" wire terminal of HO2S-1 connector and "C37-10" terminal of ECM connector. *Is resistance less than 5 Ω?*	Go to Step 6.	"WHT" wire is high resistance circuit or open circuit. Poor "C37-10" terminal connection. Faulty ECM ground. If they are OK, substitute a known-good ECM and recheck.
6	**Wire circuit check** 1) Disconnect connectors from ECM with ignition switch turn OFF. 2) Measure resistance between "WHT" wire terminal of HO2S-1 connector and vehicle body ground. *Is resistance infinity?*	Go to Step 7.	"WHT" wire is shorted to ground circuit.
7	**HO2S-1 signal circuit check** 1) Measure voltage between "WHT" wire terminal of HO2S-1 connector and vehicle body ground. *Is voltage 0 V?*	Go to Step 8.	"WHT" wire is shorted to other circuit.
8	**HO2S-1 heater circuit check** 1) Check HO2S-1 heater circuit referring to "DTC P0031 / P0032: HO2S Heater Control Circuit Low / High (Sensor-1)". *Is circuit in good condition?*	Go to Step 9.	Repair HO2S-1 circuit.
9	**Exhaust system check** 1) Check exhaust system for exhaust gas leakage. *Is it OK?*	Go to Step 4 in "DTC P0171 / P0172: Fuel System Too Lean / Rich". If it is in good condition, go to Step 10.	Repair leakage of exhaust system.
10	**Air intake system check** 1) Check air intake system for clog or leak. *Is it OK?*	Check HO2S-1 referring to "HO2S-1 and HO2S-2 Heater On-Vehicle Inspection in Section 1C". If it is in good condition, substitute a known-good ECM and recheck.	Repair or replace air intake system.

DTC P0133: O2 Sensor (HO2S) Circuit Slow Response (Sensor-1)

S7RS0B1104032

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Response time (time to change from lean to rich or from rich to lean) of HO2S-1 output voltage is about 1 sec. at minimum or average time of 1 cycle is 5 sec. at minimum. (*2 driving cycle detection logic, monitoring once per driving cycle)	Heated oxygen sensor-1

DTC Confirmation Procedure

⚠ 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.**

NOTE

Check to make sure that following conditions are satisfied when using this “DTC Confirmation Procedure”.

- **Intake air temperature at engine start: –10 °C (14 °F) to 80 °C (176 °F)**
- **Intake air temperature: –10 °C (14 °F) to 70 °C (158 °F)**
- **Engine coolant temperature: 70 °C (158 °F) to 150 °C (302 °F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature.
4) Drive vehicle at 40 mph (60 km/h) or higher. (engine speed: 2500 – 3000 r/min.)
5) Keep above vehicle speed for 6 min. or more. (Throttle valve opening is kept constant in this step.)
6) Release accelerator pedal and with engine brake applied, keep vehicle coasting (with fuel cut for 3 sec. or more) and then stop vehicle.
7) Check if DTC and pending DTC exist by using scan tool. If not, check if oxygen sensor monitoring test has been completed by using scan tool. If not in both of above checks (i.e., no DTC and pending DTC and oxygen sensor monitoring test not completed), check vehicle condition (environmental) and repeat Step 3) through 6).

DTC Troubleshooting

NOTE

- **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 there DTC(s) other than HO2S-1 (DTC P0133)?*	Go to applicable DTC diag. flow.	Replace HO2S-1.

DTC P0134: O2 Sensor (HO2S) Circuit No Activity Detected (Sensor-1)

S7RS0B1104033

Wiring Diagram

Refer to “DTC P0131 / P0132: O2 Sensor (HO2S) Circuit Low Voltage / High Voltage (Sensor-1)”

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
HO2S voltage is higher than 0.6 V for more than 1 min continuously after warming up engine or HO2S voltage is lower than 0.3 V for more than 1 min continuously after warming up engine. (2 driving cycle detection logic)	• HO2S-1 • HO2S-1 circuit • Exhaust gas leakage • ECM • Air intake system

DTC Confirmation Procedure

⚠ 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.**

NOTE

Check to make sure that following conditions are satisfied when using this “DTC Confirmation Procedure”.

- **Intake air temperature at engine start: –10 °C (14 °F) to 80 °C (176 °F)**
- **Intake air temperature: –10 °C (14 °F) to 70 °C (158 °F)**
- **Engine Coolant temperature: 70 °C (158 °F) to 150 °C (302 °F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature.
4) Drive vehicle at 40 mph (60 km/h) or higher. (engine speed: 2500 – 3000 r/min.)
5) Keep above vehicle speed for 6 min. or more. (Throttle valve opening is kept constant in this step.)
6) Release accelerator pedal and with engine brake applied, keep vehicle coasting (with fuel cut for 3 sec. or more) and then stop vehicle.
7) Check if DTC and pending DTC exist by using scan tool. If not, check if oxygen sensor monitoring test has been completed by using scan tool. If not in both of above checks (i.e., no DTC and pending DTC and oxygen sensor monitoring test not completed), check vehicle condition (environmental) and repeat Step 3) through 6).

DTC Troubleshooting

NOTE

- **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.**

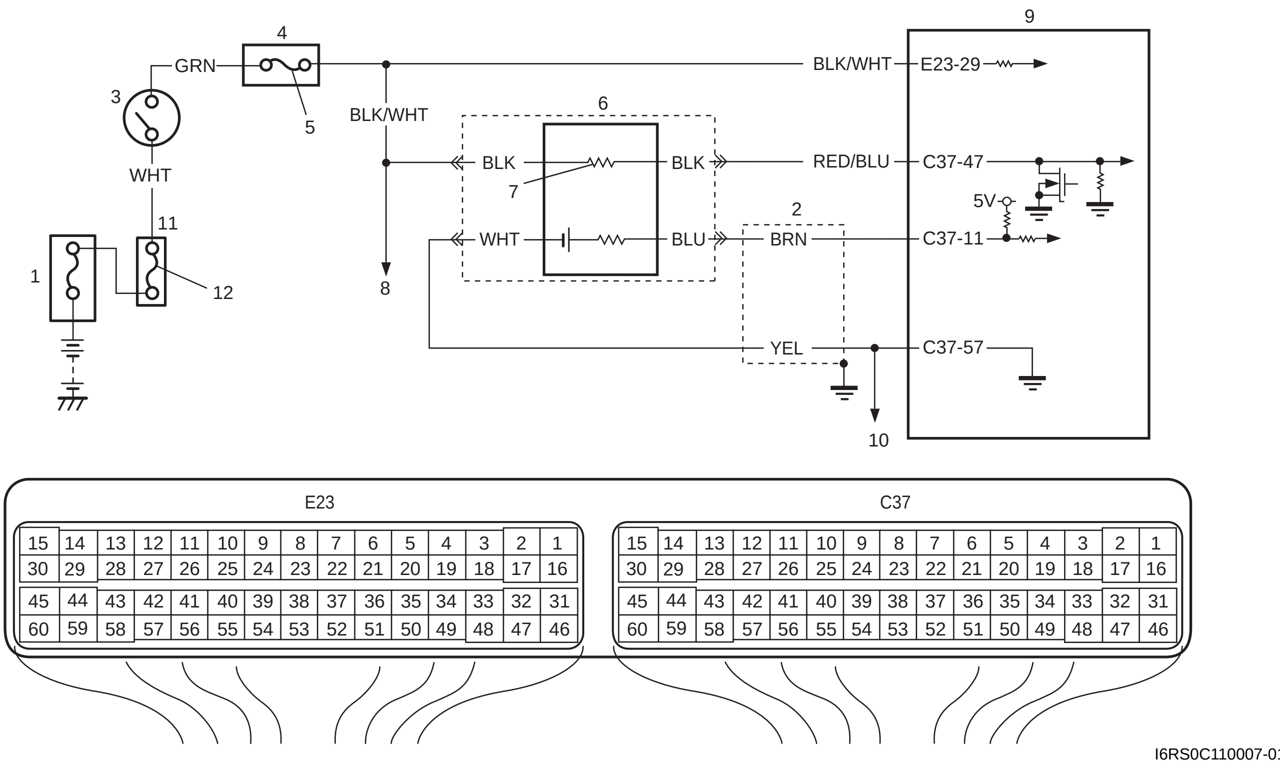
Step	Action	Yes	No
1	*Was “Engine and Emission Control System Check” performed?*	Go to Step 2.	Go to “Engine and Emission Control System Check”.

Step	Action	Yes	No
2	**HO2S-1 output voltage check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously to enrich A/F mixture and take foot off from pedal to enlean it) and check HO2S output voltages displayed on scan tool. *Is over 0.6 V and below 0.3 V indicated?*	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”. If check result is OK, go to Step 3.	Go to Step 3.
3	**HO2S-1 ground check** 1) Disconnect connector from HO2S-1 with ignition switch turned OFF. 2) Check for proper connection to HO2S-1 at “BLK/RED”, “WHT”, “BLK/WHT” and “YEL” wire terminals. 3) If wire and connection are OK, measure resistance between “YEL” wire terminal of HO2S-1 connector and engine ground. *Is resistance less than 5 Ω?*	Go to Step 4.	“YEL” wire is open or high resistance circuit. Poor “C37-57” terminal connection. Faulty ECM ground. If they are OK, substitute a known-good ECM and recheck.
4	**Wire circuit check** 1) Turn OFF ignition switch. 2) Remove ECM from its bracket with ECM connectors connected. 3) Measure resistance between “WHT” wire terminal of HO2S-1 connector and “C37-10” terminal of ECM connector. *Is resistance less than 5 Ω?*	Go to Step 5.	“WHT” wire is high resistance circuit or open circuit. Poor “C37-10” terminal connection of ECM connector. Faulty ECM ground. If they are OK, substitute a known-good ECM and recheck.
5	**Wire circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “WHT” wire terminal of HO2S-1 connector and vehicle body ground. *Is resistance infinity?*	Go to Step 6.	“WHT” wire is shorted to ground circuit.
6	**HO2S-1 heater circuit check** 1) Check HO2S-1 heater circuit referring to “DTC P0031 / P0032: HO2S Heater Control Circuit Low / High (Sensor-1)”. *Is it in good condition?*	Go to Step 7.	Repair HO2S-1 circuit.
7	**Exhaust system check** 1) Check exhaust system for exhaust gas leakage. *Is it OK?*	Go to Step 4 in “DTC P0171 / P0172: Fuel System Too Lean / Rich”. If it is in good condition, go to Step 8.	Repair leakage of exhaust system.
8	**Air intake system check** 1) Check air intake system for clog or leak. *Is it OK?*	Check HO2S-1 referring to “HO2S-1 and HO2S-2 Heater On-Vehicle Inspection in Section 1C”. If it is in good condition, substitute a known-good ECM and recheck.	Repair or replace air intake system.

DTC P0137 / P0138: O2 Sensor (HO2S) Circuit Low Voltage / High Voltage (Sensor-2)

S7RS0B1104034

Wiring Diagram



1. Main fuse box	4. Junction block assembly	7. Heater	10. To HO2S-1
2. Shield wire	5. "IG COIL" fuse	8. To HO2S-1 heater	11. Individual circuit fuse box No.1
3. Ignition switch	6. HO2S-2	9. ECM	12. "IG ACC" fuse

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
DTC P0137: HO2S-2 voltage is lower than 0.4 V while engine is idling after driving with high engine load (high speed) for specified time. And HO2S-2 max. voltage minus HO2S-2 min. voltage is less than 0.1 V for 40 sec continuously. (2 driving cycle detection logic) **DTC P0138:** HO2S-2 voltage is higher than 0.95 V while engine is idling after driving with high engine load (high speed) for specified time. And HO2S-2 max. voltage minus HO2S-2 min. voltage is less than 0.1 V for 40 sec continuously. (2 driving cycle detection logic)	• HO2S-2 • HO2S-2 circuit • Fuel system • ECM • Fuel shortage • Exhaust system • Air intake system

DTC Confirmation Procedure

⚠ 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.**

NOTE

Check to make sure that following conditions are satisfied when using this “DTC Confirmation Procedure”.

- **Intake air temperature at engine start: –10 °C (14 °F) to 80 °C (176 °F)**
- **Intake air temperature: –10 °C (14 °F) to 70 °C (158 °F)**
- **Engine Coolant temperature: 70 °C (158 °F) to 150 °C (302°F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature.
4) Increase vehicle speed to 70 – 80 km/h (43 – 50 mile/h) at 5th gear or D range.
5) Release accelerator pedal and with engine brake applied, keep vehicle coasting (with fuel cut for 4 sec. or more), then stop vehicle and run engine at idle speed for 60 sec. or more.
6) Repeat Step 4).
7) Keep above vehicle speed for 8 min. or more. (Throttle valve opening is kept constant in this step.)
8) Repeat Step 5).
9) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **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 there DTC(s) other than fuel system (DTC P0171 / P0172) and HO2S-2 (DTC P0140)?*	Go to applicable DTC diag. flow.	Go to Step 3.
3	**HO2S-2 and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Warm up engine to normal operating temperature and keep it at 2000 r/min. for 60 sec. 3) Repeat racing engine (Repeat depressing accelerator pedal 5 to 6 times continuously to enrich A/F mixture and take foot off from pedal to enlean it). *Does HO2S-2 output voltage indicate deflection between over 0.35 V and below 0.25 V?*	Go to “DTC P0171 / P0172: Fuel System Too Lean / Rich”.	Go to Step 4.

Step	Action	Yes	No
4	**HO2S-2 ground check** 1) Disconnect connector from HO2S-2 with ignition switch turned OFF. 2) Check for proper connection to HO2S-2 connector at “RED/BLU”, “BRN”, “YEL” and “BLK/WHT” wire terminals. 3) If connections are OK, measure resistance between “YEL” wire terminal of HO2S-2 connector and engine ground. *Is resistance less than 5 Ω?*	Go to Step 5.	“YEL” wire is open or high resistance circuit. Poor “C37-57” terminal connection. Faulty ECM ground. If they are OK, substitute a known-good ECM and recheck.
5	**Wire circuit check** 1) Turn OFF ignition switch. 2) Remove ECM from its bracket with ECM connectors connected. 3) Measure resistance between “BRN” wire terminal of HO2S-2 connector and “C37-11” terminal of ECM connector. *Is resistance less than 5 Ω?*	Go to Step 6.	“BRN” wire is high resistance circuit or open circuit. Poor “C37-11” terminal connection. If they are OK, substitute a known-good ECM and recheck.
6	**Wire circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “BRN” wire terminal of HO2S-2 connector and vehicle body ground. *Is resistance infinity?*	Go to Step 7.	“BRN” wire is shorted to ground circuit.
7	**HO2S-2 signal circuit check** 1) Measure voltage between “BRN” wire terminal of HO2S-2 connector and vehicle body ground. *Is voltage 0 V?*	Go to Step 8.	“BRN” wire is shorted to other circuit.
8	**HO2S-2 heater circuit check** 1) Check HO2S-2 heater circuit referring to “DTC P0037 / P0038: HO2S Heater Control Circuit Low / High (Sensor-2)”. *Is circuit in good condition?*	Go to Step 9.	Repair HO2S-2 circuit.
9	**Exhaust system check** 1) Check exhaust system for exhaust gas leakage. *Is it OK?*	Go to Step 4 in “DTC P0171 / P0172: Fuel System Too Lean / Rich”. If it is in good condition, go to Step 10.	Repair leakage of exhaust system.
10	**Air intake system check** 1) Check air intake system for clog or leak. *Is it OK?*	Check HO2S-2 referring to “HO2S-1 and HO2S-2 Heater On-Vehicle Inspection in Section 1C”. If it is in good condition, substitute a known-good ECM and recheck.	Repair or replace air intake system.

DTC P0140: O2 Sensor (HO2S) Circuit No Activity Detected (Sensor-2)

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Wiring Diagram

Refer to "DTC P0137 / P0138: O2 Sensor (HO2S) Circuit Low Voltage / High Voltage (Sensor-2)"

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
HO2S-2 voltage is higher than specified value after warming up engine (circuit open). (2 driving cycle detection logic)	• HO2S-2 • HO2S-2 circuit • ECM • Exhaust gas leakage • Air intake system

DTC Confirmation Procedure

⚠ 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) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature.
4) Increase vehicle speed to 60 – 80 km/h (37 – 50 mile/h) at 5th gear or D range.
5) Release accelerator pedal and with engine brake applied, keep vehicle coasting (with fuel cut for 4 sec. or more), then stop vehicle and run engine at idle speed for 60 sec. or more.
6) Check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **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	**HO2S-2 ground check** 1) Disconnect connector from HO2S-2 with ignition switch turned OFF. 2) Check for proper connection to HO2S-2 connector at "RED/BLU", "BRN", "YEL" and "BLK/WHT" wire terminals. 3) If connections are OK, measure resistance between "YEL" wire terminal of HO2S-2 connector and engine ground. *Is resistance less than 5 Ω?*	Go to Step 3.	"YEL" wire is open or high resistance circuit. Poor "C37-57" terminal connection. Faulty ECM ground. If they are OK, substitute a known-good ECM and recheck.

Step	Action	Yes	No
3	**Wire circuit check** 1) Turn OFF ignition switch. 2) Remove ECM from its bracket with ECM connectors connected. 3) Measure resistance between “BRN” wire terminal of HO2S-2 connector and “C37-11” terminal of ECM connector. *Is resistance less than 5 Ω?*	Go to Step 4.	“BRN” wire is high resistance circuit or open circuit. Poor “C37-11” terminal connection. If they are OK, substitute a known-good ECM and recheck.
4	**HO2S-2 signal circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure voltage between “BRN” wire terminal of HO2S-2 connector and vehicle body ground. *Is voltage 0 V?*	Go to Step 5.	“BRN” wire is shorted to other circuit.
5	**HO2S-2 heater circuit check** 1) Check HO2S-2 heater circuit referring to “DTC P0037 / P0038: HO2S Heater Control Circuit Low / High (Sensor-2)”. *Is circuit in good condition?*	Go to Step 6.	Repair HO2S-2 circuit. If circuit is OK, substitute a known-good ECM and recheck.
6	**HO2S-2 check** 1) Check HO2S-2 referring to “HO2S-1 and HO2S-2 Heater On-Vehicle Inspection in Section 1C”. *Is it in good condition?*	Substitute a known-good ECM and recheck.	Replace HO2S-2.

DTC P0171 / P0172: Fuel System Too Lean / Rich

S7RS0B1104036

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
DTC P0171: Total fuel trim is higher than 35% or short term fuel trim is higher than 20% for more than 1 min. continuously. (2 driving cycle detection logic) **DTC P0172:** Total fuel trim is lower than –35% or short term fuel trim is lower than –20% for more than 1 min. continuously. (2 driving cycle detection logic)	• Vacuum leakage • Exhaust gas leakage • Fuel pressure out of specification • Fuel injector malfunction • Heated oxygen sensor-1 malfunction • MAF sensor malfunction • ECT sensor malfunction

DTC Confirmation Procedure

⚠ 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.**

NOTE

Check to make sure that following conditions are satisfied when using this “DTC Confirmation Procedure”.

- **Intake air temperature at engine start: –10 °C (14 °F) to 80 °C (176 °F)**
- **Intake air temperature: –10 °C (14 °F) to 70 °C (158 °F)**
- **Engine coolant temperature: 40 °C (104 °F) to 120 °C (248 °F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and print Freeze Frame Data or write them down using scan tool.
3) Clear DTC using scan tool.
4) Start engine and warm up to normal operating temperature.
5) Operate vehicle with condition as noted freeze frame data for 5 min.
6) Stop vehicle and check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **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.**

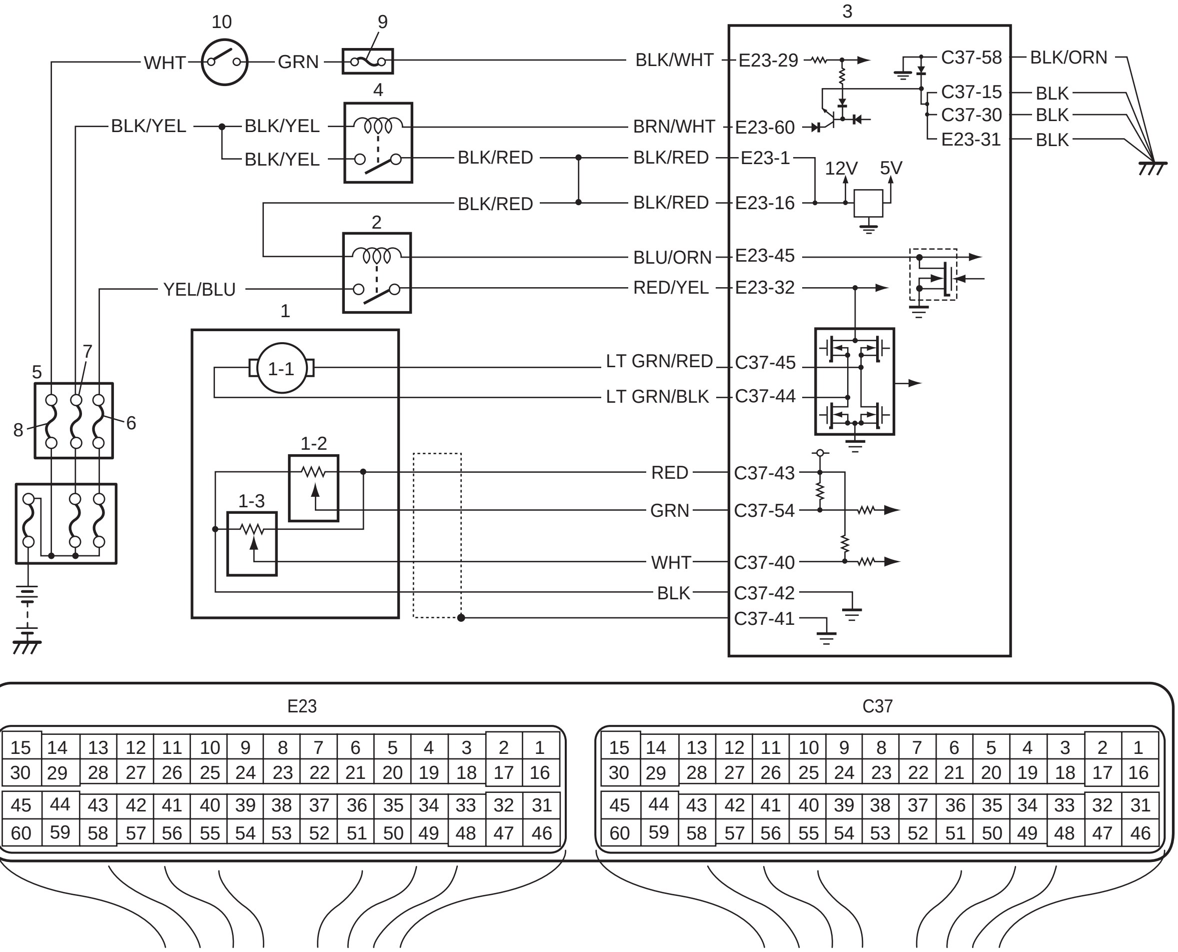
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check".
2	*Is there DTC(s) other than fuel system (DTC P0171 / P0172)?*	Go to applicable DTC diag. flow.	Go to Step 3.
3	**Intake system and exhaust system for leakage check** *Are intake system and exhaust system in good condition?*	Go to Step 4.	Repair or replace defective part.
4	**Fuel pressure check** 1) Check fuel pressure referring to "Fuel Pressure Check". *Is check result satisfactory?*	Go to Step 5.	Repair or replace defective part.
5	**Fuel injectors and its circuit check** 1) Check fuel injectors referring to "Fuel Injector Inspection in Section 1G". *Is check result satisfactory?*	Go to Step 6.	Faulty injector(s) or its circuit.
6	**Visual inspection** 1) Check MAF sensor and air intake system. • Objects which block measuring duct and resistor of MAF sensor. • Other air flow which does not pass MAF sensor. *Are they in good condition?*	Go to Step 7.	Repair or replace defective part.
7	**MAF sensor for performance check** 1) With ignition switch turned OFF, install scan tool. 2) Start engine and warm up to normal operating temperature. 3) Check MAF value using scan tool (Refer to "Scan Tool Data" for normal value.). *Is each value within specified range?*	Go to Step 8.	Go to "DTC P0101: Mass or Volume Air Flow Circuit Range / Performance".
8	**ECT sensor for performance check** 1) Check ECT sensor referring to Step 3 and 4 of "DTC P0118: Engine Coolant Temperature Circuit High". *Is check result satisfactory?*	Go to Step 9.	Faulty ECT sensor or its circuit.

Step	Action	Yes	No
9	**HO2S-1 for performance check** 1) Check HO2S-1 referring to Step 3 of “DTC P0131 / P0132: O2 Sensor (HO2S) Circuit Low Voltage / High Voltage (Sensor-1)”. *Is check result satisfactory?*	Substitute a known-good ECM and recheck.	Faulty HO2S-1 or its circuit.

DTC P0222: Throttle / Pedal Position Sensor / Switch “B” (Sub) Circuit Low

S7RS0B1104037

Wiring Diagram



I6RS0C110015-01

1. Electric throttle body assembly	3. ECM	8. “IG ACC” fuse
1-1. Throttle actuator	4. Main relay	9. “IG COIL” fuse
1-2. TP sensor (main)	5. Individual circuit fuse box No.1	10. Ignition switch
1-3. TP 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
Output voltage of throttle position sensor (sub) is less than specified value for specified time continuously. (1 driving detection logic)	• Throttle position sensor (sub) circuit • Electric throttle body assembly • ECM

NOTE

When DTC P0122 and P0222 are indicated together, it is possible that “RED” wire open circuit.

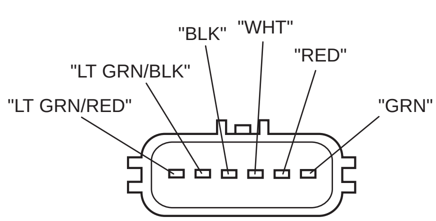
DTC Confirmation Procedure

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

- **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	**TP sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch, check “TP Sensor 2 Volt” displayed on scan tool when accelerator pedal is idle position and fully depressed. *Is displayed 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 with ignition switch turned OFF. 2) Check for proper connection to electric throttle body at “RED”, “WHT” and “BLK” wire terminals.  I4RS0B110022-02 3) If OK, measure voltage between “RED” wire terminal of electric throttle body connector and engine ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	Go to Step 6.	Go to Step 4.

Step	Action	Yes	No
4	**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 “C37-43” terminal. 4) If OK, measure voltage between “C37-43” 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 5.
5	**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?*	Substitute a known-good ECM and recheck.	“RED” wire is shorted to ground circuit.
6	**Wire harness check** 1) Measure voltage between “WHT” wire terminal of electric throttle body connector and engine ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	Go to Step 9.	Go to Step 7.
7	**Wire harness check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection of ECM connector at “C37-40” and “C37-42” terminals. 3) If OK, measure resistance between “WHT” and “BLK” wire terminals of electric throttle body connector. *Is resistance infinity?*	Go to Step 8.	“WHT” wire is shorted to “BLK” wire.
8	**Wire harness check** 1) Measure resistance between “WHT” wire terminal of electric throttle body connector and engine ground with ignition switch turned OFF. *Is resistance infinity?*	Substitute a known-good ECM and recheck.	“WHT” wire is shorted to ground circuit.
9	**Electric throttle body check** 1) Check TP sensor referring to “Throttle Position Sensor Performance Check” under “Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”. *Is output voltage within specified value?*	Substitute a known-good ECM and recheck.	Replace electric throttle body.

DTC P0223: Throttle / Pedal Position Sensor / Switch “B” (Sub) Circuit High

S7RS0B1104038

Wiring Diagram

Refer to “DTC P0222: Throttle / Pedal Position Sensor / Switch “B” (Sub) Circuit Low”.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Output voltage of throttle position sensor (sub) is more than specified value for specified time continuously. (1 driving detection logic)	• Throttle position sensor (sub) circuit • Electric throttle body assembly • ECM

NOTE

When DTC P0123 and P0223 are indicated together, it is possible that "RED" wire shorted to power circuit and/or "BLK" wire open.

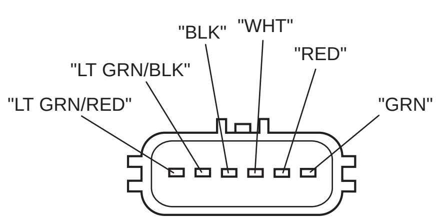
DTC Confirmation Procedure

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

- **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	**TP sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch, check "TP Sensor 2 Volt" displayed on scan tool when accelerator pedal is idle position and fully depressed. *Is displayed 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 with ignition switch turned OFF. 2) Check for proper connection to electric throttle body at "RED", "WHT" and "BLK" wire terminals.  I4RS0B110022-02 3) If OK, measure voltage between "RED" wire terminal of electric throttle body connector and engine ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	Go to Step 6.	Go to Step 4.

Step	Action	Yes	No
4	**Wire harness check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection of ECM connector at “C37-43” terminal. 3) 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 power circuit.
5	**Wire harness check** 1) Measure voltage between “WHT” wire terminal of electric throttle body connector and engine ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	Go to Step 9.	Go to Step 6.
6	**Wire harness 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 “C37-43” and “C37-40” terminals. 4) If OK, measure voltage between “C37-40” terminal of ECM connector and engine ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	“WHT” wire is open or high resistance circuit.	Go to Step 7.
7	**Wire harness check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “WHT” and “RED” wire terminals of electric throttle body assembly connector. *Is resistance infinity?*	Go to Step 8.	“WHT” wire is shorted to “RED” wire.
8	**Wire harness check** 1) Turn ON ignition switch. 2) Measure voltage between “C37-40” terminal of ECM connector and engine ground. *Is voltage 0 V?*	Substitute a known-good ECM and recheck.	“WHT” wire is shorted to power circuit.
9	**Ground circuit check** 1) Turn OFF ignition switch. 2) Measure resistance between “BLK” wire terminal of electric throttle body connector and engine ground. *Is resistance below 5 Ω?*	Go to Step 11.	Go to Step 10.
10	**Ground circuit check** 1) Remove ECM from its bracket with ECM connectors connected. 2) Check for proper connection of ECM connector at “C37-42” terminal. 3) Measure resistance between “C37-42” terminal of ECM connector and engine ground with ignition switch turned OFF. *Is resistance below 5 Ω?*	“BLK” wire is open or high resistance circuit.	Faulty ECM ground circuit. If circuit is OK, substitute a known-good ECM and recheck.

Step	Action	Yes	No
11	**Electric throttle body check** 1) Check TP sensor referring to "Throttle Position Sensor Performance Check" under "Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C". *Is output voltage within specified value?*	Substitute a known-good ECM and recheck.	Replace electric throttle body.

DTC P0300 / P0301 / P0302 / P0303 / P0304: Random / Multiple Cylinder Misfire Detected / Cylinder 1 / Cylinder 2 / Cylinder 3 / Cylinder 4 Misfire Detected

S7RS0B1104039

System Description

ECM measures the angle of the crankshaft based on the pulse signal from the CKP sensor and CMP sensor for each cylinder. If it detects a large change in the angle speed of the crankshaft, it concludes occurrence of a misfire. When the number of misfire is counted by ECM beyond the DTC detecting condition, it determines the cylinder where the misfire occurred and output it as DTC.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
DTC P0300: • Misfire, which causes catalyst to overheat during 200 engine revolutions, is detected at 2 or more cylinders. (MIL flashes as long as this misfire occurs continuously.) or • Misfire, which affects exhaust emission adversely during 1000 engine revolution, is detected at 2 or more cylinders. (2 driving cycle detection logic)	• Ignition system • Fuel injector and its circuit • Fuel pressure • EGR system • Abnormal air drawn in • Engine compression • Valve lash adjuster • Valve timing • Fuel shortage • Exhaust system • Fuel of poor quality
DTC P0301, P0302, P0303, P0304: • Misfire, which causes catalyst to overheat during 200 engine revolutions, is detected at 1 cylinder. (MIL flashes as long as this misfire occurs continuously.) or • Misfire, which affects exhaust emission adversely during 1000 engine revolution, is detected at 1 cylinder. (2 driving cycle detection logic)	

DTC Confirmation Procedure

⚠ 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.**

NOTE

Check to make sure that following conditions are satisfied when using this "DTC Confirmation Procedure".

- **Intake air temperature at engine start: –10 °C (14 °F) to 80 °C (176 °F)**
- **Intake air temperature: –10 °C (14 °F) to 70 °C (158 °F)**
- **Engine coolant temp.: –10 °C, 14 °F or higher**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and print Freeze Frame Data or write them down using scan tool.
3) Clear DTC using scan tool.
4) Drive vehicle under freeze frame data condition as noted for 1 min. or more.
5) Stop vehicle and check DTC and pending DTC.

DTC Troubleshooting

NOTE

- **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.**

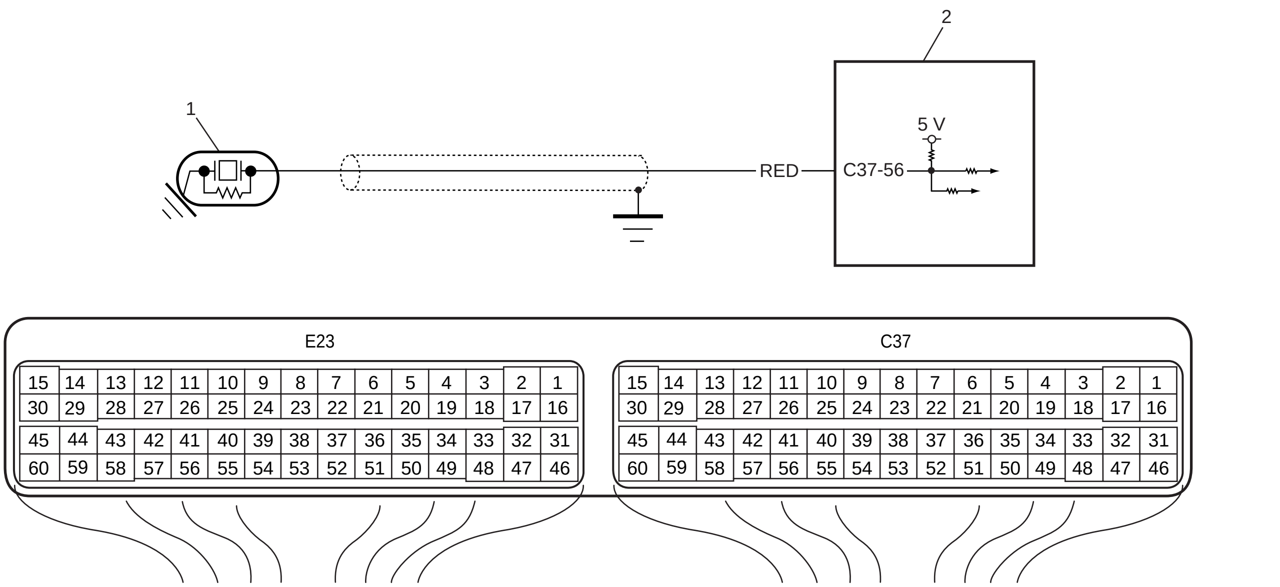
Step	Action	Yes	No
1	*Was “Engine and Emission Control System Check” performed?*	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	*Does fuel level meter indicate “E” level (empty)?*	Add fuel and recheck.	Go to Step 3.
3	**Fuel quality check** 1) Check that there is fuel of good quality in the fuel tank. *Is it OK?*	Go to Step 4.	Clean in fuel system circuit and change fuel.
4	**Ignition system check** 1) Check spark plug and ignition spark of cylinder where misfire occurs, referring to “Spark Plug Inspection in Section 1H” and “Ignition Spark Test in Section 1H”. *Are they in good condition?*	Go to Step 5.	Faulty ignition coil, wire harness, spark plug or other system parts.
5	**Fuel injector circuit check** 1) Using sound scope, check each injector operating sound at engine cranking or idling. *Do all injectors make operating sound?*	Go to Step 6.	Check coupler connection and wire harness of injector not making operating sound and injector itself. If OK, substitute a known-good ECM and recheck.
6	**Fuel pressure check** 1) Check fuel pressure referring to “Fuel Pressure Check”. *Is check result satisfactory?*	Go to Step 7.	Repair or replace fuel system.
7	**Fuel injector check** 1) Check fuel injector(s) referring to “Fuel Injector Inspection in Section 1G”. *Is check result satisfactory?*	Go to Step 8.	Replace defective injector.
8	**Ignition timing check** 1) Check ignition timing referring to “Ignition Timing Inspection in Section 1H”. *Is check result satisfactory?*	Go to Step 9.	Check related sensors.
9	**EGR system check** 1) Check EGR system referring to “EGR System Inspection in Section 1B”. *Is check result satisfactory?*	Go to Step 10.	Repair or replace EGR system.
10	**Exhaust system check** 1) Check exhaust system for exhaust gas clogged. *Is it OK?*	Go to Step 11.	Repair clogged of exhaust system.

Step	Action	Yes	No
11	**Engine mechanical system check** 1) Check engine mechanical parts or system which can cause engine rough idle or poor performance. • Engine compression (Refer to "Compression Check in Section 1D".) • Valve lash (Refer to "Valve Lash (Clearance) Inspection in Section 1D".) • Valve timing (Refer to "Timing Chain and Chain Tensioner Removal and Installation in Section 1D".) *Are they in good condition?*	Check wire harness and connection of ECM ground, ignition system and fuel injector for intermittent open and short.	Repair or replace defective part.

DTC P0327 / P0328: Knock Sensor 1 Circuit Low / High

S7RS0B1104040

Wiring Diagram



1. Knock sensor	2. ECM

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
DTC P0327: Voltage of knock sensor is less than 1.23 V for 0.5 seconds continuously. (1 driving cycle detection logic) **DTC P0328:** Voltage of knock sensor is 3.91 V or more for 0.5 seconds continuously (1 driving cycle detection logic)	• Knock sensor circuit (open or short) • Knock sensor • ECM

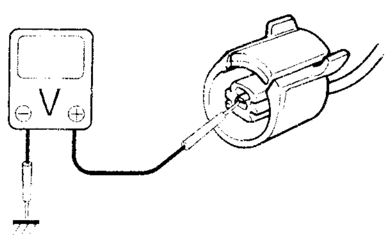
DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch and clear DTC by using scan tool.
3) Start engine and run it for 10 sec.
4) Check DTC by using scan tool.

DTC Troubleshooting

NOTE

- **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.**

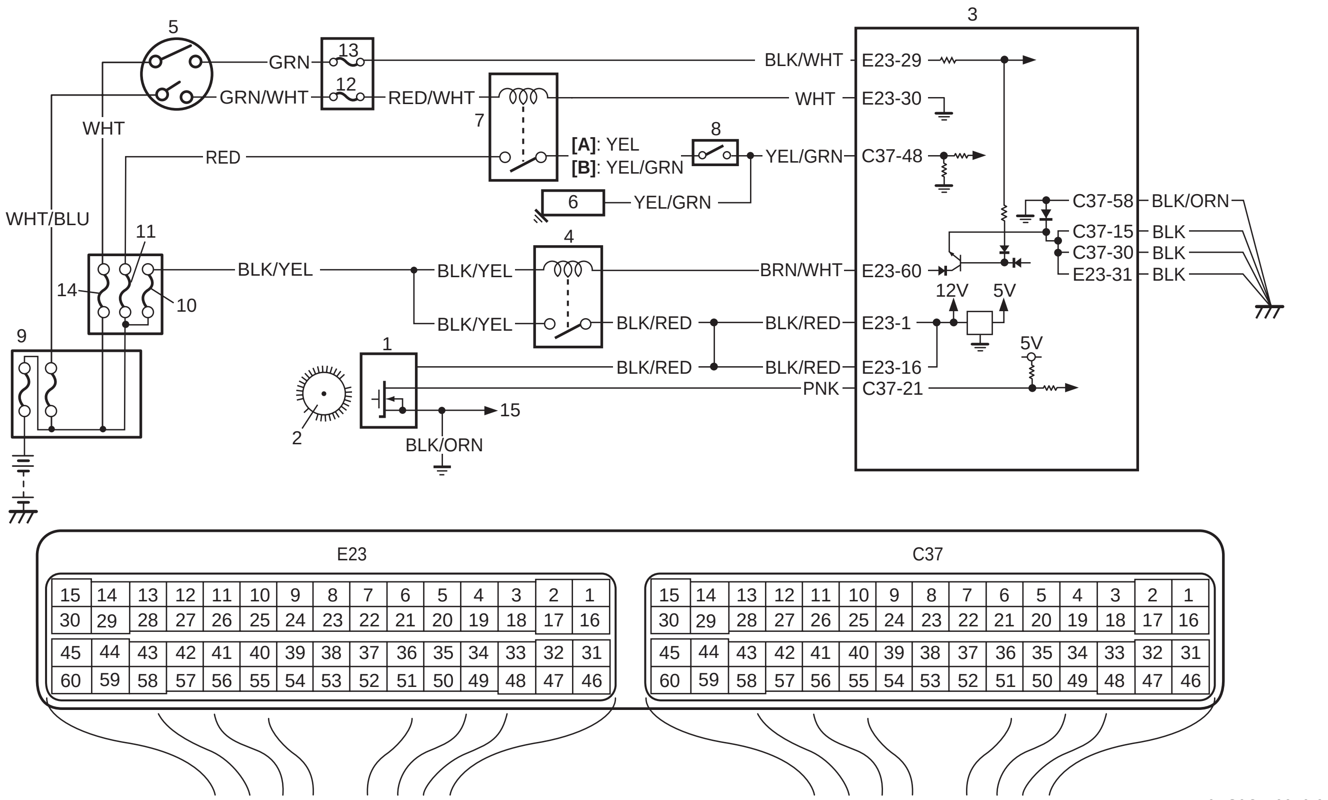
Step	Action	Yes	No
1	*Was “Engine and Emission Control System Check” performed?*	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	**Knock sensor circuit check** 1) Remove ECM from its bracket with ECM connectors connected. 2) Measure voltage between “C37-56” terminal of ECM connector and vehicle body ground with engine running. *Is voltage within 1.23 – 3.91 V?*	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”. If OK, substitute a known-good ECM and recheck.	Go to Step 3.
3	**Knock sensor circuit for open check** 1) Disconnect connector from knock sensor with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between “RED” wire of knock sensor connector and engine ground.  I2RH01110089-01 *Is voltage 4 – 6 V?*	Go to Step 6.	Go to Step 4.
4	**Knock sensor circuit for open check** 1) Turn ON ignition switch, measure voltage between “C37-56” terminal of ECM connector and engine ground *Is voltage 4 – 6 V?*	“RED” wire is open circuit.	Go to Step 5.
5	**Knock sensor circuit for short check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “C37-56” terminal of ECM connector and vehicle body ground. *Is resistance infinity?*	Go to Step 6.	“RED” wire is shorted to ground circuit. If wire is OK, substitute a known-good ECM and recheck.
6	**Knock sensor circuit for short check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between “C37-56” terminal of ECM connector and vehicle body ground. *Is voltage 0 V?*	Go to Step 7.	“RED” wire is shorted to other circuit.

Step	Action	Yes	No
7	**Knock sensor circuit for high resistance check** 1) Turn OFF ignition switch, measure resistance between "C37-56" terminal of ECM connector and "RED" wire terminal of knock sensor harness connector. *Is resistance below 5 Ω?*	Faulty knock sensor.	"RED" wire is high resistance circuit.

DTC P0335: Crankshaft Position (CKP) Sensor "A" Circuit

S7RS0B1104041

Wiring Diagram



I6RS0C110016-01

[A]:	For A/T model	5.	Ignition switch	11.	"ST MOT" fuse
[B]:	For M/T model	6.	Starting motor	12.	"ST SIG" fuse
1.	CKP sensor	7.	Starting motor control relay	13.	"IG COIL" fuse
2.	Sensor plate on crankshaft	8.	Transmission range switch (for A/T model)	14.	"IG ACC" fuse
3.	ECM	9.	Main fuse box	15.	To CMP sensor
4.	Main relay	10.	"FI" fuse		

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
No CKP sensor signal for 2 sec. even if starting motor signal is inputted at engine cranking. (1 driving cycle detection logic)	• CKP sensor circuit open or short • Sensor plate teeth damaged • CKP sensor malfunction, foreign material being attached or improper installation • ECM • Engine start signal circuit malfunction

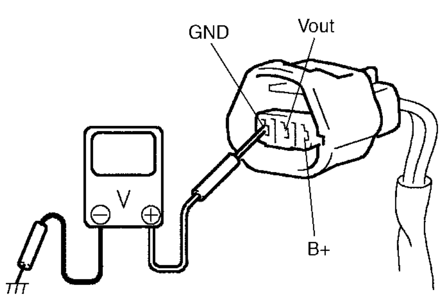
DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Crank engine for 3 – 5 sec.
4) Check DTC.

DTC Troubleshooting

NOTE

- **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.**

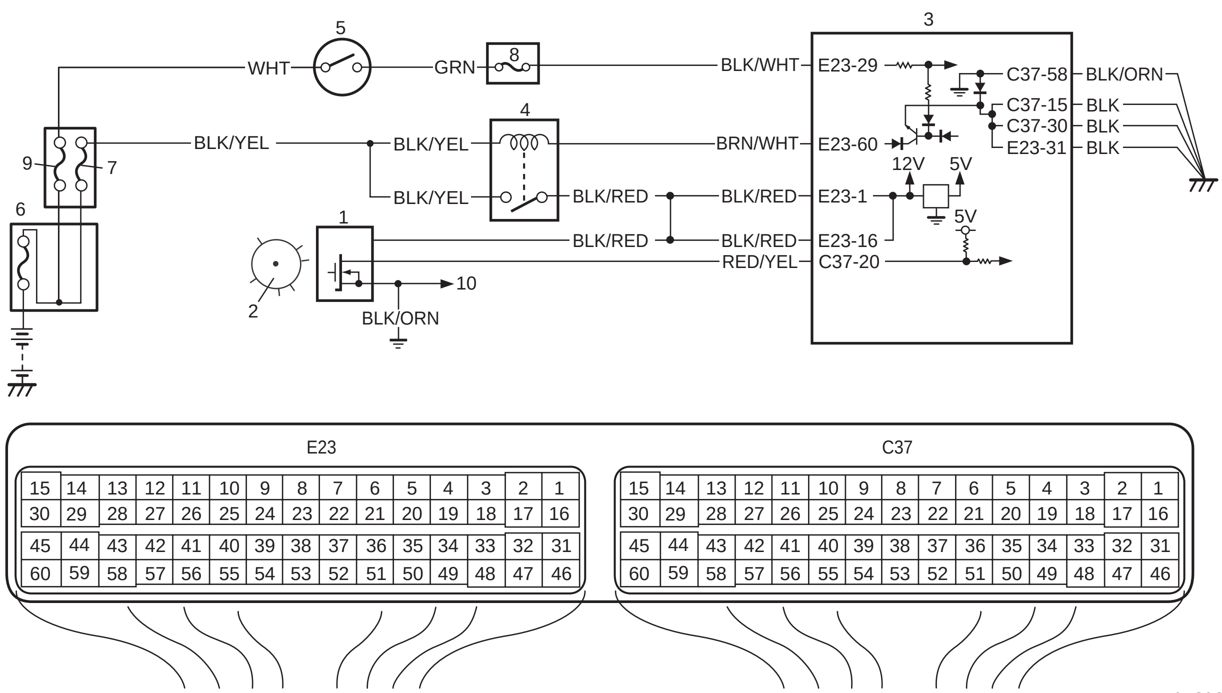
Step	Action	Yes	No
1	*Was “Engine and Emission Control System Check” performed?*	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	**CKP sensor and connector for proper installation check** *Is CKP sensor installed properly and connector connected securely?*	Go to Step 3.	Correct.
3	**Wire harness and connection check** 1) Disconnect connector from CKP sensor with ignition switch turned OFF. 2) Check for proper connection to CKP sensor at “BLK/RED”, “PNK” and “BLK/ORN” wire terminals. 3) If OK, turn ON ignition switch and check voltage at “BLK/RED”, “PNK” and “BLK/ORN” wire terminals of disconnected CKP sensor connector. **<u>CKP sensor voltage</u>** **Terminal “B+”: 10 – 14 V** **Terminal “Vout”: 4 – 5 V** **Terminal “GND”: 0 V**  I2RH0B110048-01 *Is check result satisfactory?*	Go to Step 7.	Go to Step 4.
4	*Was terminal “Vout” voltage in Step 3 within specification?*	Go to Step 5.	“PNK” wire is open or shorted to ground / power supply circuit. If wire and connection are OK, substitute a known-good ECM and recheck.
5	**Ground circuit check** 1) Turn ignition switch to OFF position. 2) Measure resistance between “BLK/ORN” wire terminal of CKP sensor connector and engine ground. *Is measured resistance value less than 3 Ω?*	Go to Step 6.	“BLK/ORN” wire is open or high resistance.

Step	Action	Yes	No
6	*Was terminal "B+" voltage in Step 3 within specification?*	Go to Step 7.	"BLK/RED" wire is open circuit. If wire and connection are OK, substitute a known-good ECM and recheck.
7	**Engine start signal check** 1) Check starting motor circuit for opening and short referring to Step 2 of "DTC P0616: Starter Relay Circuit Low" and Step 3 and 4 of "DTC P0617: Starter Relay Circuit High". *Is check result satisfactory?*	Go to Step 8.	Repair or replace.
8	**CKP sensor check** 1) Check CKP sensor and sensor plate tooth referring to "Camshaft Position (CMP) Sensor Inspection in Section 1C". *Is check result satisfactory?*	Substitute a known-good ECM and recheck.	Replace CKP sensor and/or sensor plate.

DTC P0340: Camshaft Position (CMP) Sensor "A" Circuit

S7RS0B1104042

Wiring Diagram



I6RS0C110017-01

1. CMP sensor	4. Main relay	7. "FI" fuse	10. To CKP sensor
2. Signal rotor	5. Ignition switch	8. "IG COIL" fuse	
3. ECM	6. Main fuse box	9. "IG ACC" fuse	

System Description

The CMP sensor located on the transmission side of cylinder head consists of the signal generator (magnetic sensor) and signal rotor (intake camshaft portion).
The signal generator generates reference signal through slits in the slit plate which turns together with the camshaft.

Reference signal

The CMP sensor generates 6 pulses of signals each of which has a different waveform length while the camshaft makes one full rotation. Refer to “Inspection of ECM and Its Circuits”.
Based on these signals, ECM judges which cylinder piston is in the compression stroke and the engine speed.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
• CMP sensor pulse is less than 20 pulses per crankshaft 8 revolutions • CMP sensor pulse is more than 28 pulses per crankshaft 8 revolutions • CMP sensor pulse is less than 20 pulses between BTDC 155° crank angle and BTDC 5° crank angle with crankshaft 8 revolutions from engine start. (1 driving cycle detection logic)	• CMP sensor circuit open or short • Signal rotor teeth damaged • CMP sensor malfunction, foreign material being attached or improper installation • ECM

DTC Confirmation Procedure

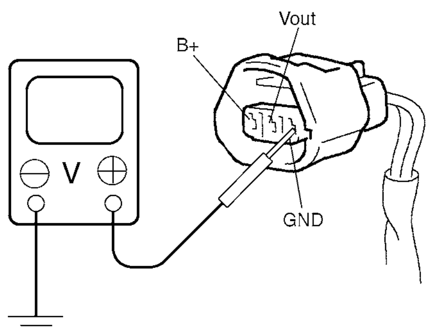
1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Crank engine for 5 sec.
4) Check DTC.

DTC Troubleshooting

NOTE

- **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.**

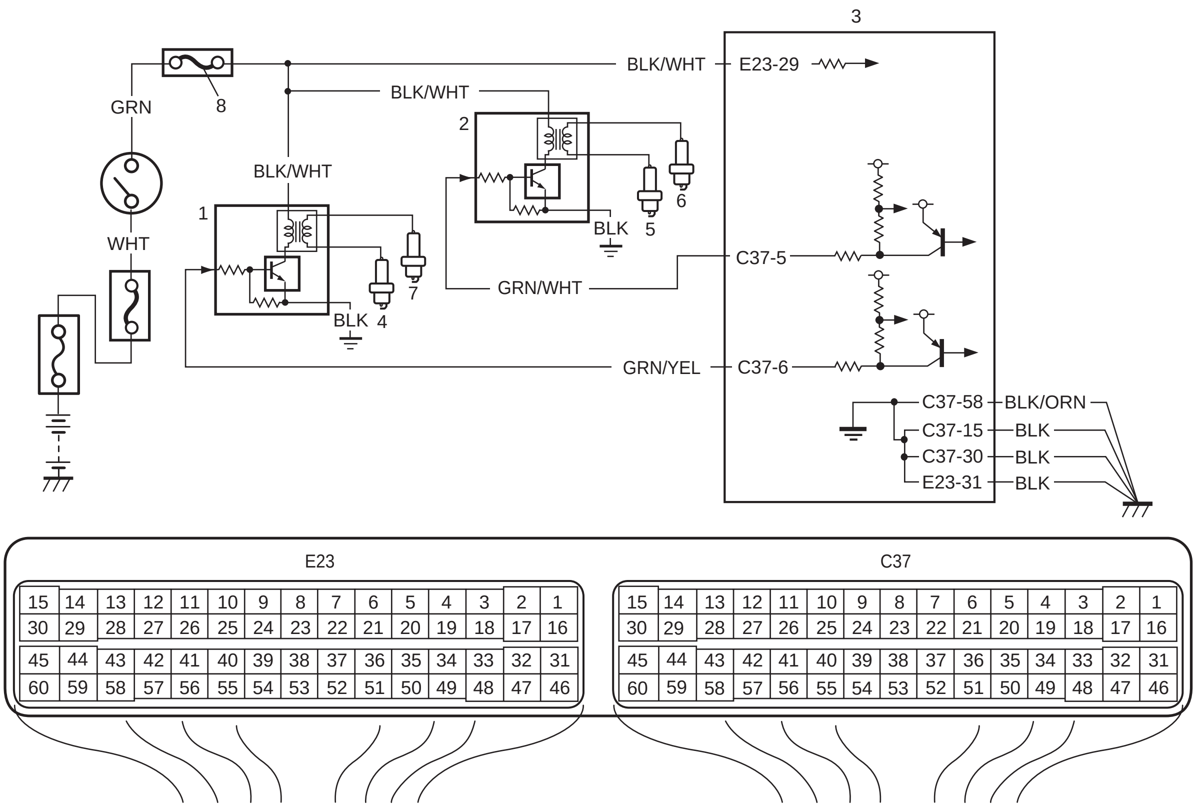
Step	Action	Yes	No
1	*Was “Engine and Emission Control System Check” performed?*	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	**CMP sensor and connector for proper installation check** *Is CMP sensor installed properly and connector connected securely?*	Go to Step 3.	Correct.

Step	Action	Yes	No
3	**Wire harness and connection check** 1) Disconnect connector from CMP sensor. 2) Check for proper connection to CMP sensor at “BLK/ RED”, “RED/YEL” and “BLK/ORN” wire terminals. 3) If OK, turn ON ignition switch and check voltage at “BLK/ RED”, “RED/YEL” and “BLK/ORN” wire terminals of disconnected CMP sensor connector. **CMP sensor voltage** **Terminal “B+”: 10 – 14 V** **Terminal “Vout”: 4 – 5 V** **Terminal “GND”: 0 V**  I4RS0B110094-01 *Is check result satisfactory?*	Go to Step 7.	Go to Step 4.
4	*Was terminal “Vout” voltage in Step 3 within specification?*	Go to Step 5.	“RED/YEL” wire is open or shorted to ground / power supply circuit. If wire and connection are OK, substitute a known-good ECM and recheck.
5	**Ground circuit check** 1) Turn ignition switch to OFF position. 2) Measure resistance between “BLK/ORN” wire terminal of CMP sensor connector and engine ground. *Is measured resistance value less than 3 Ω?*	Go to Step 6.	“BLK/ORN” wire is open or high resistance circuit.
6	*Was terminal “B+” voltage in Step 3 within specification?*	Go to Step 7.	“BLK/RED” wire is open circuit. If wire and connection are OK, substitute a known-good ECM and recheck.
7	**CMP sensor check** 1) Check CMP sensor and signal rotor tooth referring to “Camshaft Position (CMP) Sensor Inspection in Section 1C”. *Is check result satisfactory?*	Substitute a known-good ECM and recheck.	Replace CMP sensor and/or intake camshaft.

DTC P0350: Ignition Coil Primary / Secondary Circuit

S7RS0B1104043

Wiring Diagram



I6RS0C110018-03

1. Ignition coil assembly for No.1 and No.4 spark plugs	4. No.1 spark plug	7. No.4 spark plug
2. Ignition coil assembly for No.2 and No.3 spark plugs	5. No.2 spark plug	8. “IG COIL” fuse
3. ECM	6. No.3 spark plug	

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Ignition signal is not inputted to monitor circuit 5 times or more continuously.	• Ignition coil assembly and/or its circuit • ECM

DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool to DLC.
2) Turn ON ignition switch and clear DTC.
3) Start engine and increase engine speed to 1500 rpm for 5 seconds.
4) Check DTC.

DTC Troubleshooting

NOTE

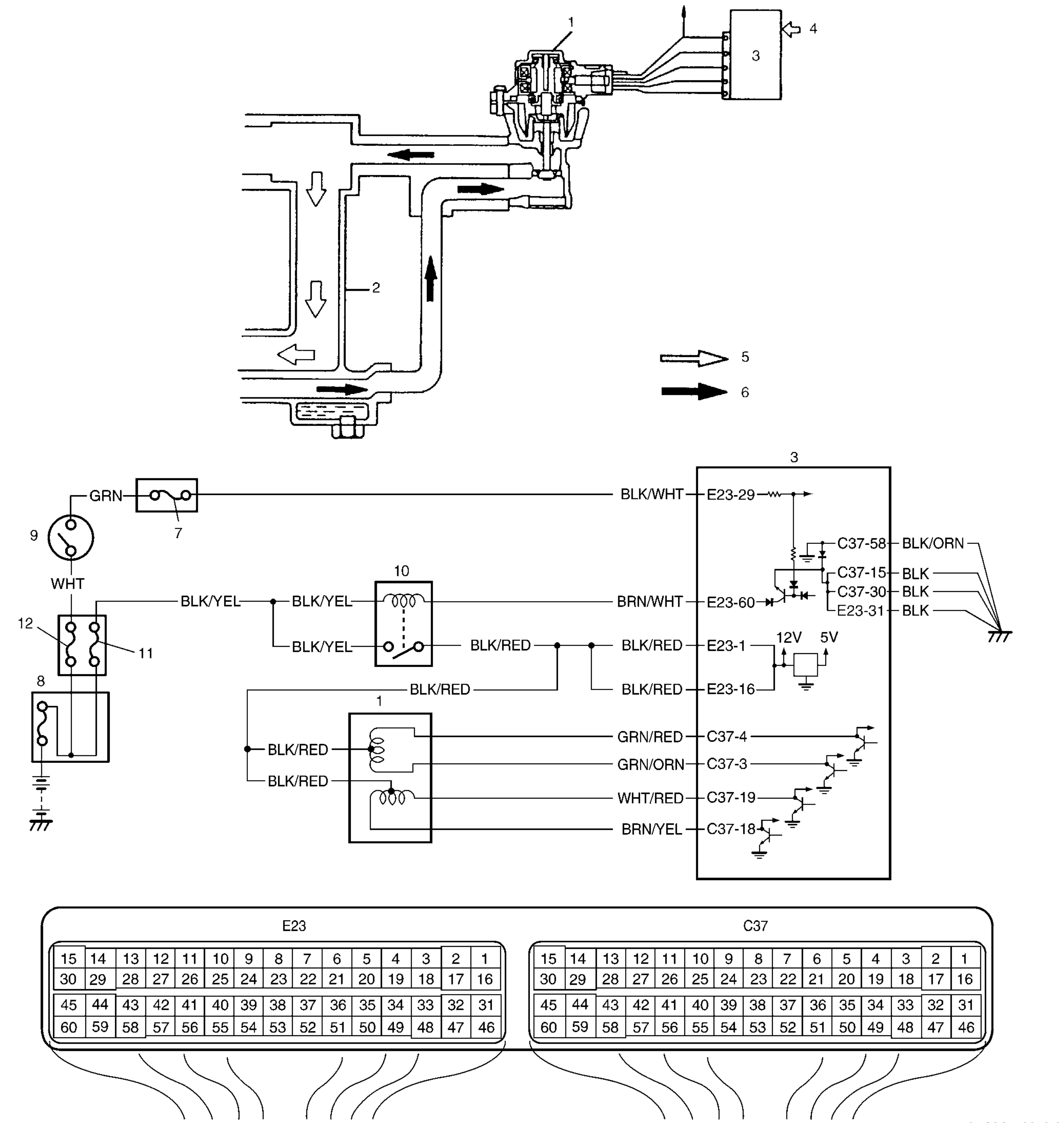
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that 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	**Ignition spark check** 1) Check that each spark plug sparks referring to "Ignition Spark Test in Section 1H". *Is check result satisfactory?*	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection in Section 00".	Go to Step 3.
3	**Ignition coil power, output and ground circuit check** 1) Disconnect ignition coil connector of the cylinder found as faulty in Step 2. 2) Check ignition coil circuit of the cylinder found as faulty in Step 2 for the following. • Voltage between power circuit wire terminal of ignition coil connector and vehicle body ground is 10 – 14 V with ignition switch turned ON. • Voltage between output circuit wire terminal of ignition coil connector and vehicle body ground is 4 – 6 V with ignition switch turned ON. • Resistance between ground circuit wire terminal of ignition coil connector and vehicle body ground is less than 2 Ω. *Are they in good condition?*	Go to Step 4.	Repair or replace defective wire.
4	**Ignition coil check** 1) Replace ignition coil for No.1 and No.4 spark plugs with ignition coil for No.2 and No.3 spark plugs. *Is the cylinder found as faulty in good condition now?*	Faulty ignition coil.	Go to Step 5.
5	**Ignition coil output circuit check** 1) Disconnect connectors from ECM. 2) Check ignition coil circuit of the cylinder found as faulty in Step 2 for the following. • Resistance of output wire circuit between ignition coil connector and ECM connector is less than 2 Ω. • Resistance of output wire circuit between ignition coil connector and vehicle body ground is infinity. *Are they in good condition?*	Substitute a known-good ECM and recheck.	Repair or replace defective wire.

DTC P0401 / P0402: Exhaust Gas Recirculation Flow Insufficient Detected / Excessive Detected

S7RS0B1104044

System and Wiring Diagram



I6RS0C110019-02

1. EGR valve	5. Fresh air	9. Ignition switch
2. Intake manifold	6. Exhaust gas	10. Main relay
3. ECM	7. "IG COIL" fuse	11. "FI" fuse
4. Sensed information	8. Main fuse box	12. "IG ACC" fuse

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
DTC P0401: Difference in intake manifold absolute pressure between opened EGR valve and closed EGR valve is smaller than specified value. (*2 driving cycle detection logic, monitoring once per driving cycle) **DTC P0402:** Difference in intake manifold absolute pressure between opened EGR valve and closed EGR valve is larger than specified value. (*2 driving cycle detection logic, monitoring once per driving cycle)	• EGR valve • EGR passage • MAP sensor • ECM

DTC Confirmation Procedure

⚠ 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.**

NOTE

Check to make sure that following conditions are satisfied when using this “DTC confirmation procedure”.

- **Intake air temperature at engine start: –10 °C (14 °F) to 80 °C (176 °F)**
- **Intake air temperature: –10 °C (14 °F) to 70 °C (158 °F)**
- **Engine coolant temperature: 70 °C (158 °F) to 150 °C (302 °F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (560 mmHg, 75 kPa or more)**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up to normal operating temperature.
4) Run engine at idle for 10 min.
5) Drive vehicle and increase engine speed 3000 rpm in 3rd gear.
6) Release accelerator pedal and with engine brake applied, keep vehicle coasting for 5 sec. or more. (Keep fuel cut condition for 5 sec. or more) If fuel cut condition is not kept for 5 sec. or more, coast down a slope in engine speed 1000 – 3000 rpm for 5 sec. or more.
7) Stop vehicle and run engine at idle.
8) Check DTC and pending DTC by using scan tool.

DTC Troubleshooting

NOTE

- **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	*Do you have SUZUKI scan tool?*	Go to Step 3.	Go to Step 5.

Step	Action	Yes	No
3	**EGR valve operation check** 1) With ignition switch turned OFF, install SUZUKI scan tool to DTC. 2) Check EGR system referring to “EGR System Inspection in Section 1B”. *Is it in good condition?*	Go to Step 4.	Go to Step 5.
4	**MAP sensor check** 1) Check MAP sensor for performance referring to “MAP Sensor Inspection in Section 1C”. *Is check result satisfactory?*	Intermittent trouble or faulty ECM. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”.	Replace MAP sensor.
5	**EGR valve control circuit check** 1) Check that EGR valve control circuits are in good condition referring to Step 2 to 5 of “DTC P0403: Exhaust Gas Recirculation Control Circuit” *Are circuits in good condition?*	Go to Step 6.	Repair or replace EGR valve control circuit(s).
6	**EGR valve check** 1) Check EGR valve referring to “EGR Valve Inspection in Section 1B”. *Is check result satisfactory?*	Go to Step 7.	Faulty EGR valve.
7	**MAP sensor check** 1) Check MAP sensor for performance referring to “MAP Sensor Inspection in Section 1C”. *Is check result satisfactory?*	EGR passage clogged. If OK, substitute a known-good ECM and recheck.	Replace MAP sensor.

DTC P0403: Exhaust Gas Recirculation Control Circuit

S7RS0B1104045

Wiring Diagram

Refer to “DTC P0401 / P0402: Exhaust Gas Recirculation Flow Insufficient Detected / Excessive Detected”.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
EGR valve output voltage is different from output command with more than one pole out of 4 poles. (1 driving cycle detection logic)	• EGR valve circuit open • EGR valve • ECM

DTC Confirmation Procedure

⚠ 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) With ignition switch turned OFF, connect scan tool to DLC.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and run it for 30 seconds.
4) Check DTC.

DTC Troubleshooting

NOTE

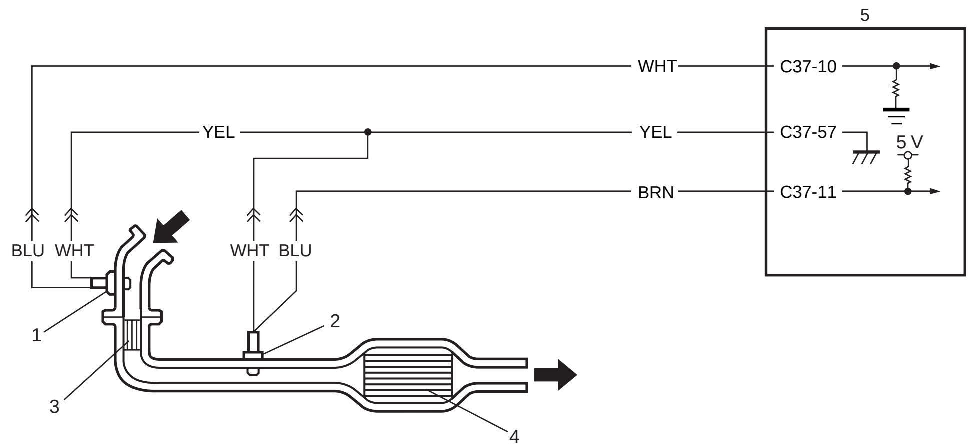
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to “Inspection of ECM and Its Circuits”.**
- **Upon completion of inspection and repair work, perform “DTC Confirmation Procedure” and confirm that 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 Description”.
2	**EGR valve power supply circuit check** 1) Remove air intake pipe. 2) With ignition switch turned OFF, disconnect EGR valve connector. 3) With ignition switch turned ON, measure voltage between “BLK/RED” wire terminal of EGR valve connector and vehicle body ground. *Is check voltage 10 – 14 V?*	Go to Step 3.	“BLK/RED” wire is open circuit.
3	**Wire circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Turn ON ignition switch. 3) Measure voltage between engine ground and each “GRN/RED”, “GRN/ORN”, “WHT/RED”, “BRN/YEL” wire terminals of EGR valve connector. *Is each voltage 0 V?*	Go to Step 4.	Faulty wire(s) are shorted to other circuit. If wires are OK, substitute a known-good ECM and recheck.
4	**Wire circuit check** 1) With ignition switch turned OFF, measure resistance between engine ground and each “GRN/RED”, “GRN/ORN”, “WHT/RED”, “BRN/YEL” wire terminals of EGR valve connector. *Is resistance infinity?*	Go to Step 5.	Faulty wire(s) are shorted to ground circuit. If wires are OK, substitute a known-good ECM and recheck.
5	**Short circuit check for EGR valve control circuit** 1) With ignition turned OFF, measure resistance between each EGR valve control circuit wire (“GRN/RED”, “GRN/ORN”, “WHT/RED” and “BRN/YEL” wire) and each EGR valve control circuit wire. *Is each resistance infinity?*	Go to Step 6.	Faulty wire(s) are short circuit.
6	**EGR valve stepper motor coil circuit check** 1) With ignition switch turned OFF, connect EGR valve connector. 2) Measure resistance between “E23-1/16” and each “C37-4”, “C37-3”, “C37-19”, “C37-18” terminals of ECM connector. *Is each resistance 20 – 31 Ω at 20 °C, 68 °F?*	Faulty ECM. Substitute a known-good ECM and recheck.	Go to Step 7.
7	**EGR valve check** 1) Check EGR valve resistance referring to “EGR Valve Inspection in Section 1B”. *Is resistance within specified value?*	Faulty wire(s) are open or high resistance circuit. If wires are OK, substitute a known-good ECM and recheck.	Faulty EGR valve.

DTC P0420: Catalyst System Efficiency below Threshold

S7RS0B1104046

System and Wiring Diagram



I4RS0A110037-01

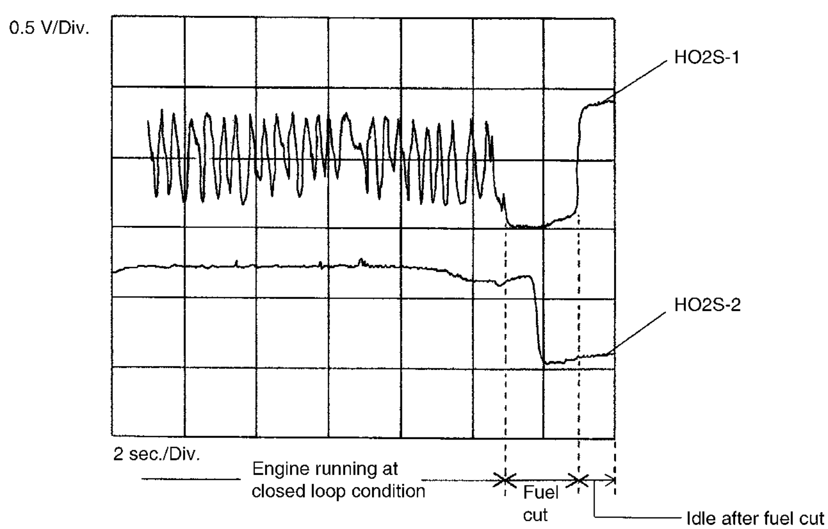
1. HO2S-1	3. Warm up three way catalytic converter	5. ECM
2. HO2S-2	4. Three way catalytic converter	

Circuit Description

ECM monitors oxygen concentration in the exhaust gas which has passed the warm up three way catalytic converter by HO2S-2. When the catalyst is functioning properly, the variation cycle of HO2S-2 output voltage (oxygen concentration) is slower than that of HO2S-1 output voltage because of the amount of oxygen in the exhaust gas which has been stored in warm up three way catalytic converter.

Reference

Oscilloscope waveforms



I2RH01110102-01

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Response delay of HO2S-2 signal (shifting delay from rich to lean and from lean to rich with threshold at 0.45 V) compared to switching cycle (rich-lean) of A/F feed back is less than specified while vehicle is running at constant speed and except with high engine load after warmed up. (*2 driving cycle detection logic, monitoring once per driving cycle)	• Exhaust gas leak • Warm up three way catalytic converter malfunction • HO2S-2 malfunction • HO2S-1 malfunction

DTC Confirmation Procedure

⚠ 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.**

NOTE

Check to make sure that following conditions are satisfied when using this "DTC Confirmation Procedure".

- **Intake air temperature at engine start: –10 °C (14 °F) to 80 °C (176 °F)**
- **Intake air temperature: –10 °C (14 °F) to 70 °C (158 °F)**
- **Engine coolant temp.: 70 °C, 158 °F to 150 °C (302 °F)**
- **Altitude (barometric pressure): 2400 m, 8000 ft or less (500 mmHg, 75 kPa or more)**

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Increase vehicle speed to 37 – 62 mph, 60 – 100 km/h. (engine speed: 2500 – 3000 r/min.)
4) Keep above vehicle speed for 10 min. or more (Throttle valve opening is kept constant in this step).
5) Stop vehicle and check if DTC / pending DTC exists using scan tool. If not, check if catalyst monitoring test has been completed using scan tool. If not in both of above checks (i.e., no DTC / pending DTC and catalyst monitoring test not completed), check vehicle condition (environmental) and repeat Step 3) through 5).

DTC Troubleshooting

NOTE

- **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.**

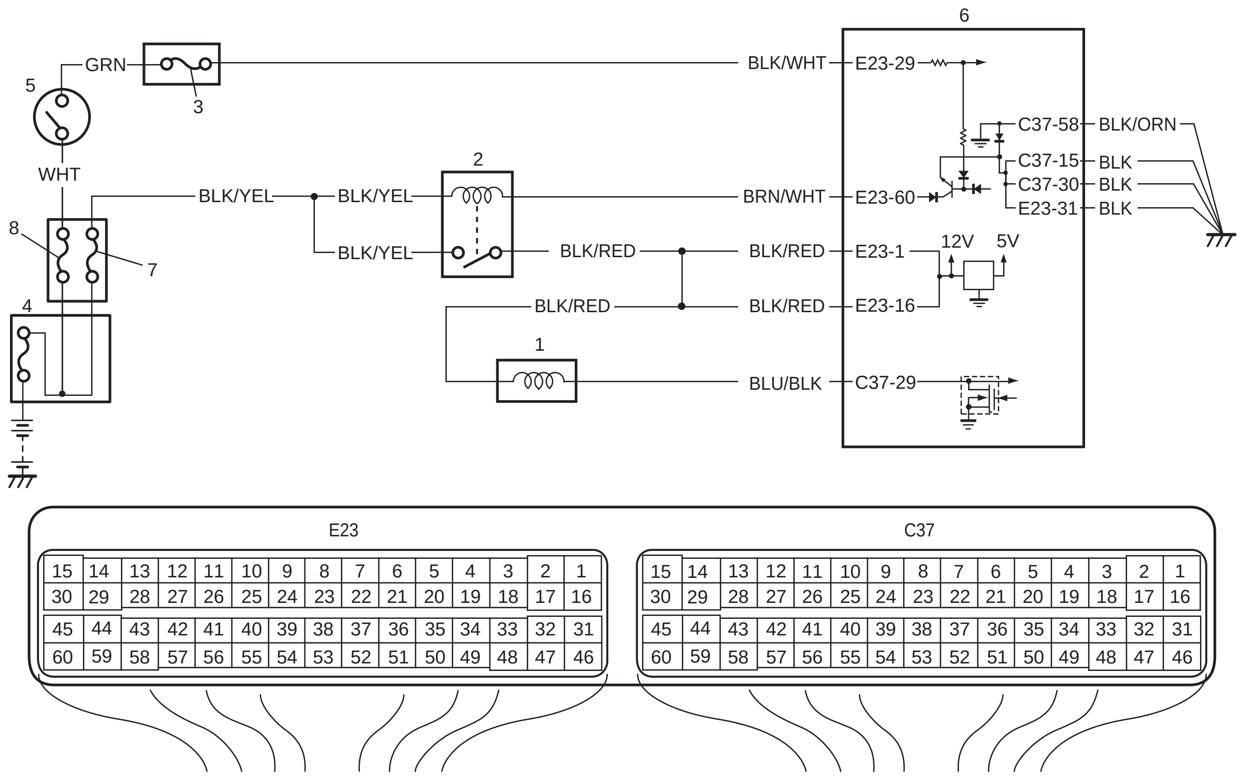
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check".
2	**Exhaust system visual check** 1) Check exhaust system for leaks, damage and loose connection. *Is it in good condition?*	Go to Step 3.	Repair or replace defective part.

Step	Action	Yes	No
3	**HO2S-2 output voltage check** 1) Check output voltage of HO2S-2 referring to "DTC P0137 / P0138: O2 Sensor (HO2S) Circuit Low Voltage / High Voltage (Sensor-2)" and "DTC P0137 / P0138: O2 Sensor (HO2S) Circuit Low Voltage / High Voltage (Sensor-2)". *Is check result satisfactory?*	Replace exhaust manifold (built in warm up three way catalytic converter) and exhaust center pipe (built in three way catalytic converter).	Check "BRN" and / or "YEL" wires for open and short, and connections for poor connection. If wires and connections are OK, replace HO2S-2.

DTC P0443: Evaporative Emission System Purge Control Valve Circuit

S7RS0B1104047

Wiring Diagram



I6RS0C110020-02

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

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Monitor signal of EVAP canister purge valve is different from command signal. (Circuit open or short) (2 driving cycle detection logic)	• EVAP canister purge valve • EVAP canister purge valve circuit • ECM

DTC Confirmation Procedure

⚠ 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) With ignition switch OFF, connect scan tool to DLC.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Start engine and warm up normal operating temperature.
4) Drive vehicle at more than 40 km/h, 25 mph for 5 min. or more.
5) Check DTC and pending DTC.

DTC Troubleshooting

⚠ WARNING

In order to reduce risk of fire and personal injury, this work must be performed in a well ventilated area and away from any open flames such as gas water heater.

NOTE

- **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.**

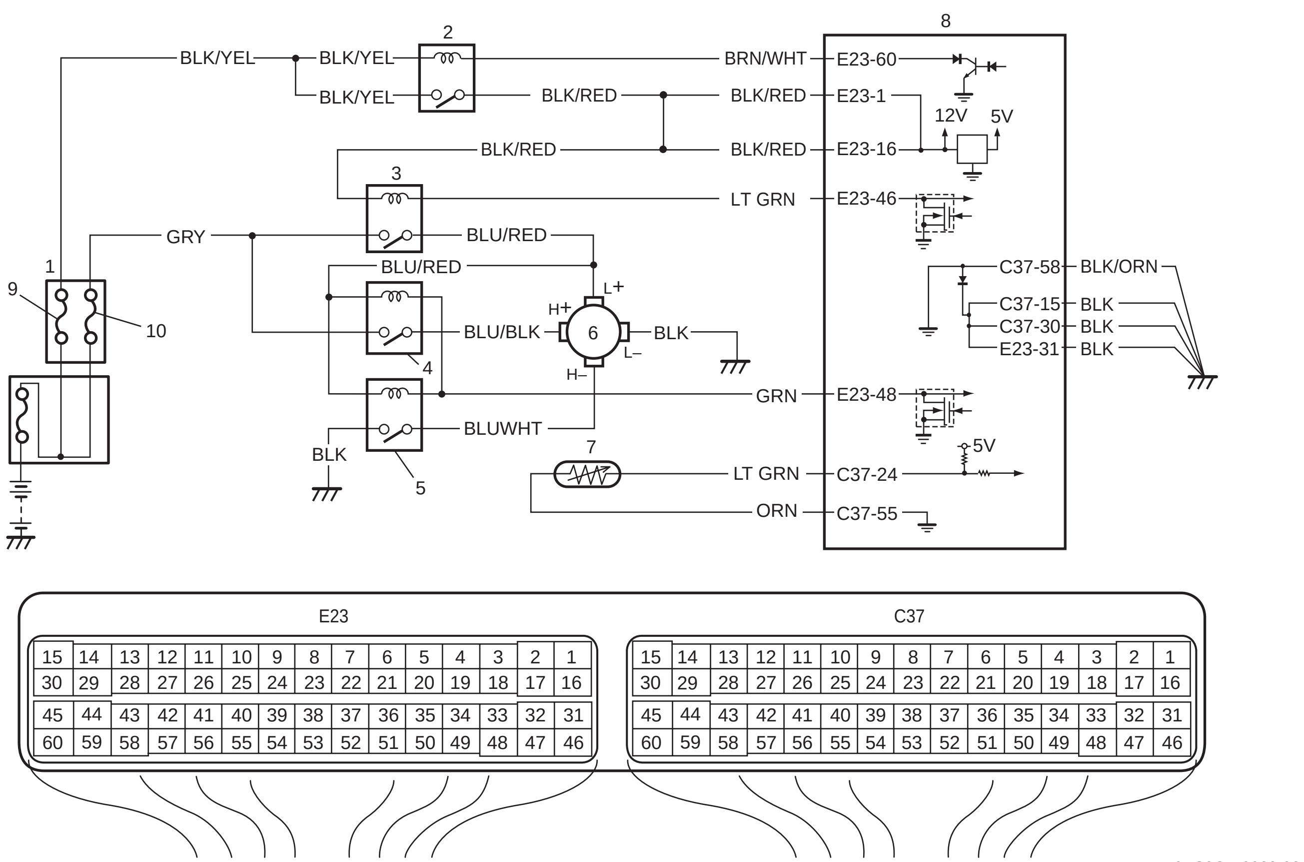
Step	Action	Yes	No
1	*Was “Engine and Emission Control System Check” performed?*	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	**EVAP canister purge power supply circuit check** 1) Turn OFF ignition switch and disconnect connector from EVAP canister purge valve. 2) Measure voltage between engine ground and “BLK/RED” wire terminal of EVAP canister purge valve connector with ignition switch turned ON. *Is it voltage 10 – 14 V?*	Go to Step 3.	“BLK/RED” wire is open circuit.
3	**Wire circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “C37-29” terminal of ECM connector and vehicle body ground. *Is resistance infinity?*	Go to Step 4.	“BLU/BLK” wire is shorted to ground circuit.
4	**Wire circuit check** 1) Measure voltage between “C37-29” terminal of ECM connector and vehicle body ground with ignition switch turned ON. *Is voltage 0 V?*	Go to Step 5.	“BLU/BLK” wire is shorted to other circuit.

Step	Action	Yes	No
5	**Wire circuit check** 1) Connect connector to purge control valve with ignition switch turned OFF. 2) Turn ON ignition switch and measure voltage between “C37-29” terminal of ECM connector and vehicle body ground. *Is it voltage 10 – 14 V?*	Go to Step 6.	“BLU/BLK” wire is open circuit.
6	**EVAP canister purge control valve check** 1) Check EVAP canister purge control valve referring to “EVAP Canister Purge Valve Inspection in Section 1B”. *Is it in good condition?*	Go to Step 7.	Faulty EVAP canister purge control valve.
7	**EVAP canister purge control circuit check** 1) With ignition switch turn OFF, measure resistance between “E23-1/16” terminal and “C37-29” terminal of ECM connector. *Is resistance below 40 Ω at 20 °C, 68 °F?*	Faulty ECM. Substitute a known-good ECM and recheck.	“BLK/RED” and/or “BLU/BLK” wire are high resistance circuit.

DTC P0480: Fan 1 (Radiator Cooling Fan) Control Circuit

S7RS0B1104050

Wiring Diagram



I6RS0C110022-02

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	
4. Radiator cooling fan relay No. 2	8. ECM	

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Monitor signal of radiator cooling fan relay is different from command signal. (1 driving cycle detection logic)	• Radiator cooling fan relay circuit malfunction • Radiator cooling fan relay malfunction • ECM malfunction

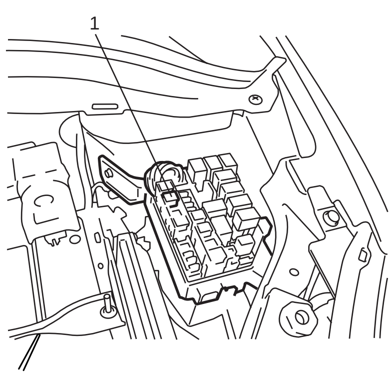
DTC Confirmation Procedure

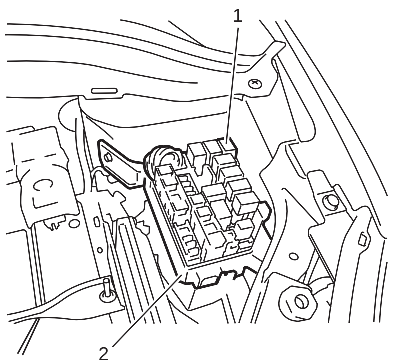
1) Turn OFF ignition switch.
2) Clear DTC with ignition switch turned ON.
3) Run engine at idle speed.
4) Check DTC.

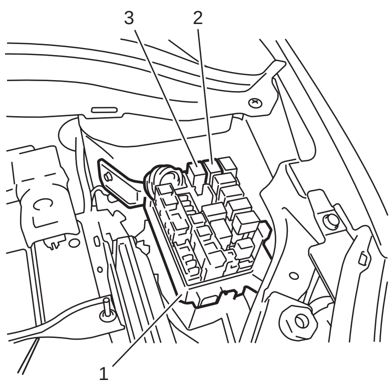
DTC Troubleshooting

NOTE

- **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	**Circuit fuse check** 1) Check “RDTR FAN” fuse (1) in individual circuit fuse box No.1 with ignition switch turned OFF.  I4RS0A110022-01 *Is “RDTR FAN” fuse in good condition?*	Go to Step 3.	Check for short in circuits connected to this fuse.

Step	Action	Yes	No
3	**Wire circuit check** 1) Disconnect radiator cooling fan relay No. 1 (1) from individual circuit fuse box No.1 (2) with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between each engine ground to “BLK/RED” and “GRY” wire terminal.  I7RS0A110010-01 *Is voltage 10 – 14 V?*	Go to Step 4.	Open wire in “BLK/RED” and/or “GRY” wire are open circuit.
4	**Wire circuit check** 1) Connect radiator cooling fan relay No. 1 to individual circuit fuse box No.1 with ignition switch turned OFF. 2) Remove ECM from its bracket with ECM connectors connected. 3) Turn ON ignition switch, make sure that A/C switch is OFF position. 4) Measure voltage between vehicle body ground and “E23-46” terminal of ECM connector when engine coolant temp. is below 95 °C, 203 °F. *Is voltage 10 – 14 V?*	Go to Step 8.	Go to Step 5.
5	**Wire circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Disconnect radiator cooling fan relay No. 1 from individual circuit fuse box No.1. 3) Measure resistance between “E23-46” terminal of ECM connector and vehicle ground. *Is resistance infinity?*	Go to Step 6.	“LT GRN” wire is shorted to ground circuit.
6	**Wire circuit check** 1) Turn ON ignition switch. 2) Measure voltage between “E23-46” terminal of ECM connector and vehicle body ground. *Is voltage 0 V?*	Go to Step 7.	“LT GRN” wire is shorted to other circuit.
7	**Radiator cooling fan relay No. 1 check** 1) Check radiator cooling fan relay No. 1 referring to “Radiator Cooling Fan Relay Inspection in Section 1F”. *Is check result satisfactory?*	“LT GRN” wire is open circuit.	Replace relay.

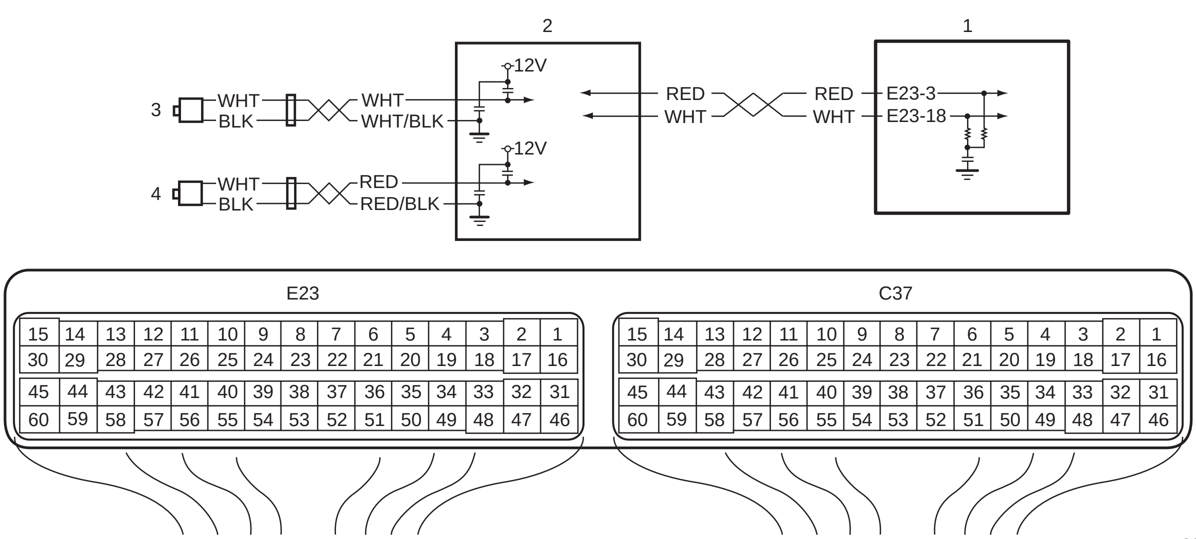
Step	Action	Yes	No
8	**Radiator cooling fan control No. 1 check** 1) Run engine until ECT is over 97.5 °C, 207.5 °F. 2) Measure voltage between vehicle body ground and “E23-46” terminal of ECM connector. *Is voltage lower than 1.5 V?*	Go to Step 9.	Faulty ECM. Substitute a known-good ECM and recheck.
9	**Radiator cooling fan control check** 1) Disconnect radiator cooling fan relay No. 2 (2) and No. 3 (3) from individual circuit fuse box No.1 (1) with ignition switch turned OFF. 2) Run engine until ECT is over 97.5 °C, 207.5 °F. 3) Measure voltage between vehicle body ground and each “BLU/RED” wire terminal of radiator cooling fan control relay No. 2 and No. 3 connectors.  I7RS0A110011-01 *Is voltage 10 – 14 V?*	Go to Step 10.	“BLU/RED” wire is open circuit.
10	**Wire circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Connect radiator cooling fan relay No. 2 to individual circuit fuse box No.1. 3) Using service wire, ground “E23-46” and “E23-60” terminals of ECM connector. 4) Turn ON ignition switch, measure voltage between vehicle body ground and “E23-48” terminal of ECM connector. *Is voltage 10 – 14 V?*	Go to Step 11.	Go to Step 12.
11	**Wire circuit check** 1) Disconnect radiator cooling fan relay No. 2 and then connect radiator cooling fan relay No. 3 to individual circuit fuse box No.1 with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between vehicle body ground and “E23-48” terminal of ECM connector. *Is voltage 10 – 14 V?*	Go to Step 15.	Go to Step 12.

Step	Action	Yes	No
12	**Wire circuit check** 1) Disconnect radiator cooling fan control relay No. 2 and No. 3 from individual circuit fuse box No.1 with ignition switch turned OFF. 2) Measure resistance between “E23-48” terminal of ECM connector and vehicle body ground. *Is resistance infinity?*	Go to Step 13.	“GRN” wire is shorted to ground circuit.
13	**Wire circuit check** 1) Turn ON ignition switch. 2) Measure voltage between “E23-48” terminal of ECM connector and vehicle body ground. *Is voltage 0 V?*	Go to Step 14.	“GRN” wire is shorted to power supply circuit.
14	**Radiator cooling fan relay No. 2 and No. 3 check** 1) Check radiator cooling fan relay No. 2 and No. 3 referring to “Radiator Cooling Fan Relay Inspection in Section 1F”. *Are relays in good condition?*	“GRN” wire is open circuit.	Replace relay.
15	**Radiator cooling fan control No. 2 and No. 3 check** 1) Connect connectors to ECM with ignition switch turned OFF. 2) Connect radiator cooling fan relay No. 2 to individual circuit fuse box No.1. 3) Run engine until ECT is over 102.5 °C, 216.5 °F. 4) Measure voltage between vehicle body ground and “E23-48” terminal of ECM connector. *Is voltage lower than 1.5 V?*	Intermittent trouble. Check for intermittent refer to “Intermittent and Poor Connection Inspection in Section 00”. If OK, substitute a known-good ECM and recheck.	Faulty ECM.

DTC P0500: Vehicle Speed Sensor “A” Malfunction

S7RS0B1104051

Wiring Diagram



I7RS0B110017-01

1. ECM	3. Front left side wheel speed sensor
2. ABS/ESP® control module	4. Front right side wheel speed sensor

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
• Vehicle speed signal is not input while fuel is cut at deceleration for 4 seconds continuously at 3600 rpm or less. • Vehicle speed signal is not input even if engine is running with more than 3000 rpm at D-Range for 4 sec. (A/T model). (2 driving cycle detection logic)	• Wheel speed sensor and/or its circuit • ABS/ESP® control module • ECM

DTC Confirmation Procedure

⚠ 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.**

1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Warm up engine to normal operating temperature.
4) M/T model
   a) Drive vehicle at 4000 rpm (engine speed) with 3rd gear.
   b) Release accelerator pedal and with engine brake applied, keep vehicle coasting for 6 sec. or more (fuel cut condition for 5 sec. or more) and stop vehicle.

   A/T model
   a) Drive vehicle at more than 3000 rpm for 10 sec.
5) Check pending DTC and DTC.

DTC Troubleshooting

NOTE

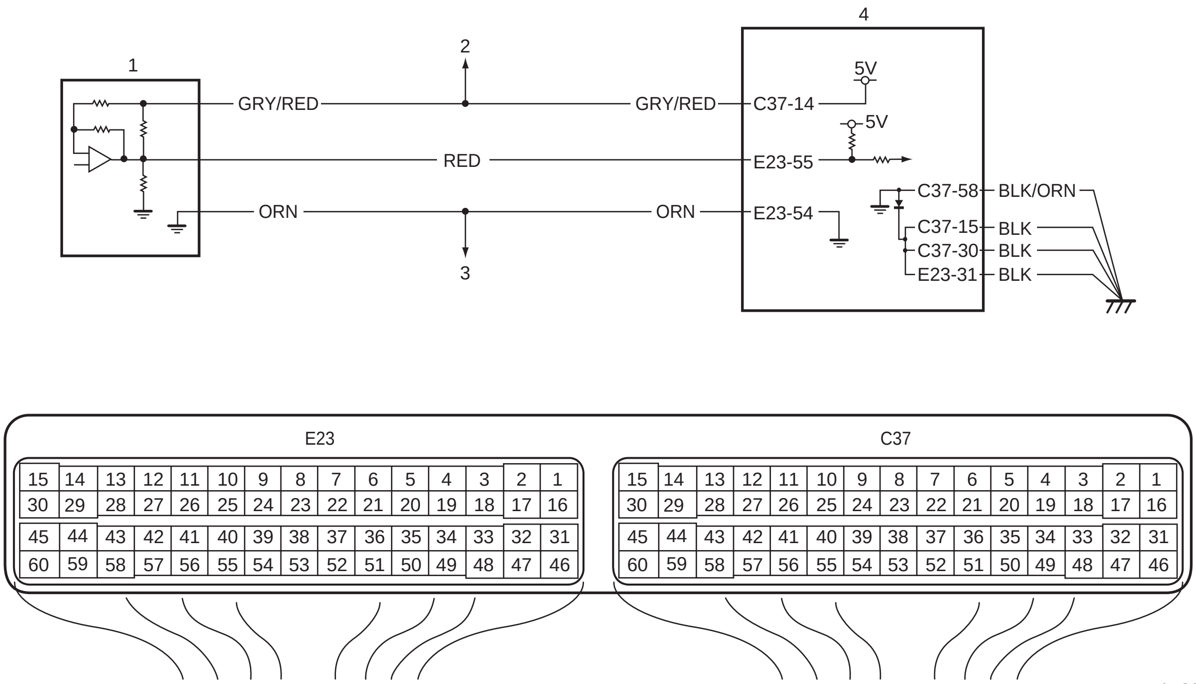
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to “Inspection of ECM and Its Circuits”.**
- **Upon completion of inspection and repair work, perform “DTC Confirmation Procedure” and confirm that 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	**Vehicle speed signal check** *Is vehicle speed displayed on scan tool in Step 4) and 5) of “DTC Confirmation Procedure”?*	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”.	Go to Step 3.
3	**DTC check in ABS/ESP® control module** 1) Check ABS/ESP® control module for DTC. *Is there any DTC of wheel speed sensor or CAN communication system?*	Go to applicable DTC diag. flow.	Substitute a know-good ECM and recheck.

DTC P0532: A/C Refrigerant Pressure Sensor “A” Circuit Low

S7RS0B1104052

Wiring Diagram



I6RS0C110024-03

1. A/C refrigerant pressure sensor	3. To other sensors
2. To MAP sensor	4. ECM

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
A/C refrigerant pressure sensor signal voltage is less than 0.15 V for 0.5 sec. continuously. (1 driving detection logic but MIL does not light up)	• A/C refrigerant pressure sensor circuit • A/C refrigerant pressure sensor • MAP sensor • ECM

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Check DTC.

DTC Troubleshooting

NOTE

- **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	**A/C refrigerant pressure sensor power supply circuit check** 1) Disconnect connector from A/C refrigerant pressure sensor with ignition switch turned OFF. 2) Check for proper connection of A/C refrigerant pressure sensor at "GRY/RED", "RED" and "ORN" wire terminals. 3) Turn ON ignition switch, measure voltage between engine ground and "GRY/RED" wire terminal of A/C refrigerant pressure sensor connector. *Is voltage 4 – 6 V?*	Go to Step 5.	Go to Step 3.
3	**A/C refrigerant pressure sensor power supply circuit check** 1) Disconnect connectors from MAP sensor with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between engine ground and "GRY/RED" wire terminal of A/C refrigerant pressure sensor connector. *Is voltage 4 – 6 V?*	Faulty MAP sensor.	Go to Step 4.
4	**A/C refrigerant pressure sensor power supply circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between engine ground and "C37-14" terminal of ECM connector. *Is resistance infinity?*	Go to Step 6.	"GRY/RED" wire is shorted to ground circuit.
5	**A/C refrigerant pressure sensor signal circuit check** 1) Connect connectors to ECM. 2) Turn ON ignition switch, measure voltage between engine ground and "RED" wire terminal of A/C refrigerant pressure sensor connector. *Is voltage 4 – 6 V?*	Go to Step 7.	Go to Step 6.
6	**A/C refrigerant pressure sensor signal circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between engine ground and "E23-55" terminal of ECM connector. *Is resistance infinity?*	Go to Step 7.	"RED" wire is shorted to ground circuit.

Step	Action	Yes	No
7	**A/C refrigerant pressure sensor check** 1) Check A/C refrigerant pressure sensor referring to “A/C Refrigerant Pressure Sensor and Its Circuit Inspection in Section 7B” or “A/C Refrigerant Pressure Sensor and Its Circuit Inspection in Section 7B”. *Is it in good condition?*	Substitute a known-good ECM and recheck.	Faulty A/C refrigerant pressure sensor.

DTC P0533: A/C Refrigerant Pressure Sensor “A” Circuit High

S7RS0B1104053

Wiring Diagram

Refer to “DTC P0532: A/C Refrigerant Pressure Sensor “A” Circuit Low”.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
A/C refrigerant pressure sensor signal voltage is higher than 4.93 V for 0.5 sec. continuously. (1 driving detection logic but MIL does not light up)	• A/C refrigerant pressure sensor circuit • A/C refrigerant pressure sensor • MAP sensor • ECM

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Check DTC.

DTC Troubleshooting

NOTE

- **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	**A/C refrigerant pressure sensor power supply circuit check** 1) Disconnect connector from A/C refrigerant pressure sensor with ignition switch turned OFF. 2) Check for proper connection of A/C refrigerant pressure sensor at “GRY/RED”, “RED” and “ORN” wire terminals. 3) Turn ON ignition switch, measure voltage between engine ground and “GRY/RED” wire terminal of A/C refrigerant pressure sensor connector. *Is voltage 4 – 6 V?*	Go to Step 4.	Go to Step 3.

Step	Action	Yes	No
3	**A/C refrigerant pressure sensor power supply circuit check** 1) Disconnect connectors from MAP sensor with ignition switch turned OFF. 2) Turn ON ignition switch, measure voltage between engine ground and “GRY/RED” wire terminal of A/C refrigerant pressure sensor connector. *Is voltage 4 – 6 V?*	Faulty MAP sensor.	“GRY/RED” wire is open or shorted to power circuit.
4	**A/C refrigerant pressure sensor signal circuit check** 1) Turn ON ignition switch, measure voltage between engine ground and “RED” wire terminal of A/C refrigerant pressure sensor connector. *Is voltage 4 – 6 V?*	Go to Step 6.	Go to Step 5.
5	**A/C refrigerant pressure sensor signal circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between “RED” wire terminal of A/C refrigerant pressure sensor connector and “E23-55” terminal of ECM connector. *Is resistance below 2 Ω?*	“RED” wire is shorted to power supply circuit.	“RED” wire is open or high resistance circuit.
6	**A/C refrigerant pressure sensor ground circuit check** 1) Turn OFF ignition switch, measure resistance between engine ground and “ORN” wire terminal of A/C refrigerant pressure sensor connector. *Is resistance below 5 Ω?*	Go to Step 8.	Go to Step 7.
7	**ECM ground circuit check** 1) Remove ECM from its bracket with ECM connectors connected. 2) Measure resistance between engine ground and “E23-54” terminal of ECM connector. *Is resistance below 5 Ω?*	“ORN” wire is open or high resistance circuit.	ECM grounds “E23-31”, “C37-58”, “C37-15” and/or “C37-30” is open or high resistance circuit.
8	**A/C refrigerant pressure sensor check** 1) Check A/C refrigerant pressure sensor referring to “A/C Refrigerant Pressure Sensor and Its Circuit Inspection in Section 7B” or “A/C Refrigerant Pressure Sensor and Its Circuit Inspection in Section 7B”. *Is it good condition?*	Substitute a known-good ECM and recheck.	Faulty A/C refrigerant pressure sensor.

DTC P0601 / P0602 / P0607: Internal Control Module Memory Check Sum Error / Control Module Programming Error / Control Module Performance

S7RS0B1104054

System Description

Internal control module is installed in ECM.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
DTC P0601: Data write error or check sum error (1 driving cycle detection logic) **DTC P0602:** Data programming error (1 driving cycle detection logic but MIL does not light up) **DTC P0607:** ECM internal processor error (1 driving cycle detection logic)	• ECM power supply circuit and/or ground circuit • ECM

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch and clear DTC by using scan tool.
3) Start engine and run it at idle if possible.
4) Check DTC.

DTC Troubleshooting

NOTE

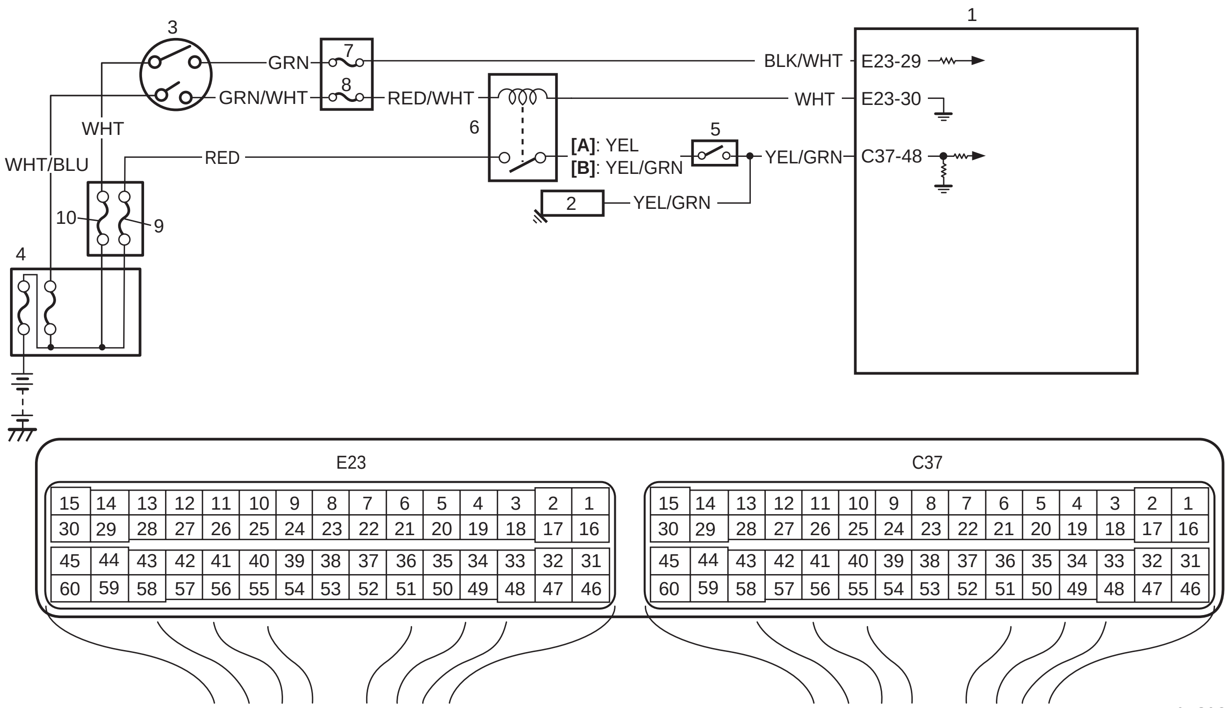
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to “Inspection of ECM and Its Circuits”.**
- **Upon completion of inspection and repair work, perform “DTC Confirmation Procedure” and confirm that the trouble has been corrected.**

Step	Action	Yes	No
1	**DTC recheck** 1) Clear DTC referring to “DTC Clearance”. 2) Turn OFF ignition switch. 3) Turn ON ignition switch and check DTC. *Is DTC P0601 or P0607 still indicated?*	Go to Step 2.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”.
2	**ECM reprogramming check** *Was reprogramming of ECM executed?*	Execute reprogramming of ECM correctly once again.	Go to step 3.
3	**ECM power and ground circuit check** 1) Check that ECM power supply circuit and ECM ground circuit is in good condition referring to “ECM Power and Ground Circuit Check”. *Are check results OK?*	Substitute a known-good ECM and recheck.	Repair ECM power or ground circuit.

DTC P0616: Starter Relay Circuit Low

S7RS0B1104055

Wiring Diagram



I6RS0C110025-01

[A]: For A/T model	2. Starter motor	5. Transmission range switch (for A/T model)	8. “ST SIG” fuse
[B]: For M/T model	3. Ignition switch	6. Starting motor control relay	9. “ST MOT” fuse
1. ECM	4. Main fuse box	7. “IG COIL” fuse	10. “IG ACC” fuse

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Engine starts even though vehicle is at stop and engine starter signal is low voltage. (2 driving cycle detection logic)	• Engine starter signal circuit • 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) Start engine.
4) Check DTC.

DTC Troubleshooting

NOTE

- **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”.

Step	Action	Yes	No
2	**Signal circuit check** 1) Turn OFF ignition switch. 2) Remove ECM from its bracket with ECM connectors connected. 3) Measure voltage at terminal “C37-48” of ECM connector, under following condition. **Voltage at terminal “C37-48” of ECM connector** **While engine cranking: 6 – 14 V** **After starting engine: 0 – 1 V** *Is each voltage within specified range?*	Poor “C37-48” connection or intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”. If wire and connections are OK, substitute a known-good ECM and recheck.	“YEL/GRN” wire is open or high resistance circuit.

DTC P0617: Starter Relay Circuit High

S7RS0B1104056

Wiring Diagram

Refer to “DTC P0616: Starter Relay Circuit Low”.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Engine starter signal is high voltage for 180 seconds continuously while engine is running. (2 driving cycle detection logic)	• Engine starter signal circuit • 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) Start engine and run it at idle for 3 min. or more.
4) Check DTC.

DTC Troubleshooting

NOTE

- **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.**

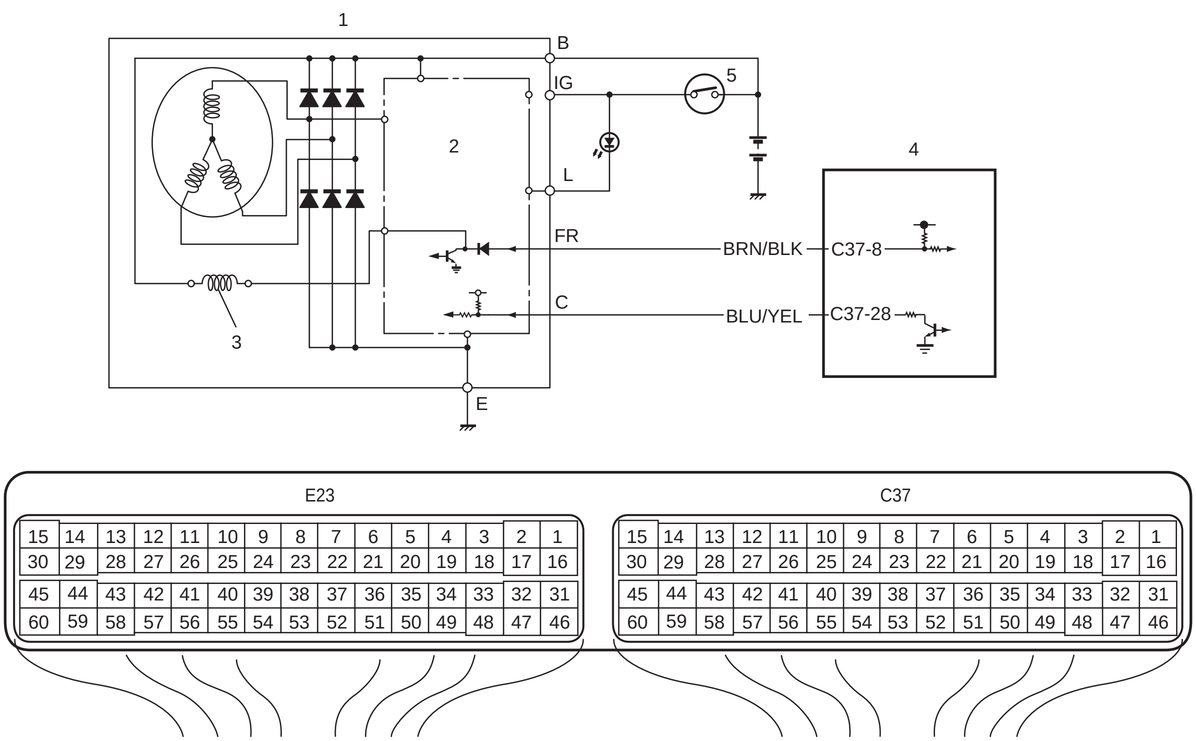
Step	Action	Yes	No
1	*Was “Engine and Emission Control System Check” performed?*	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	**Starter signal check** 1) Turn OFF ignition switch. 2) Remove ECM from its bracket with ECM connectors connected. 3) Start engine, measure voltage between “C37-48” terminal of ECM connector and vehicle body ground. *Is voltage 0 – 1 V?*	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”. If OK, substitute a known-good ECM and recheck.	Go to Step 3.

Step	Action	Yes	No
3	**Wire circuit check** 1) Disconnect starting motor control relay in individual circuit fuse box No.1 with ignition switch turned OFF. 2) Check for proper connection to starting motor control relay at “RED/WHT”, “RED”, “WHT”, “YEL” (for A/T model) and “YEL/GRN” (for M/T model) wire terminals. 3) Disconnect connector from starting motor. 4) Measure voltage between “C37-48” terminal of ECM connector and vehicle body ground with ignition switch turned ON. *Is voltage 0 – 1 V?*	Go to Step 4.	For A/T model, “YEL” or “YEL/GRN” wire is shorted to power circuit. For M/T model, “YEL/GRN” wire is shorted to power circuit. If wires are OK, substitute a known good ECM and recheck.
4	**Wire circuit check** 1) Measure voltage between “RED/WHT” wire terminal of starting motor control relay connector and vehicle body ground with ignition switch turned ON. *Is voltage 0 – 1 V?*	Check starting motor control relay. If OK, substitute a known-good ECM and recheck.	Faulty ignition switch, check ignition switch referring to “Ignition Switch Inspection in Section 9C”. If ignition switch is OK, check for short circuit between ignition switch and starting motor control relay to power circuit.

DTC P0620: Generator Control Circuit

S7RS0B1104057

System and Wiring Diagram



I5RS0C110013-01

1. Generator	3. Field coil	5. Ignition switch
2. IC regulator	4. ECM	6. Charge lamp

Generator Control System Description

Refer to “Generator Control System Description”.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
• Battery voltage is higher than specification even through generator control is maximum regulation (duty 100%). • Battery voltage is lower than specification even through generator control is minimum regulation (duty 0%) and electric load is less than 15 A. (1 driving cycle detection logic but MIL does not light up)	• Generator and/or its circuit • Electric load current sensor • ECM • Generator drive belt

DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool to DLC
2) Turn ON ignition switch and clear DTC.
3) Make sure that all accessory switches are tuned OFF.
4) Start engine and warm it up to normal operating temperature (ECT approx. 90 – 95 °C, 193 – 203 °F).
5) Turn ON the following accessory switches.
   - Head light switch.
   - Blower motor switch (max position).
   - Rear defogger switch.
6) Increase engine speed to 4000 rpm and keep it for 10 sec or more.
7) Decrease engine speed to idle.
8) Check DTC.

DTC Troubleshooting

NOTE

- **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	**Generator drive belt check** 1) Check generator drive belt tension referring to “Water Pump / Generator Drive Belt Tension Inspection and Adjustment in Section 1J”. *Is check result satisfactory?*	Go to Step 3.	Adjust or replace generator drive belt.

Step	Action	Yes	No
3	**Generator control circuit check** 1) Disconnect connector from generator and ECM with ignition switch turned OFF. 2) Check for proper connection of wire terminal to generator connector and to ECM connector. 3) If connections are OK, check generator control circuit for the following. • Resistance of generator control circuit wire between generator connector and ECM connector is less than 1 Ω (continuity check) • Resistance between generator control circuit wire of generator connector and vehicle body ground is infinity (ground circuit short check) • Voltage between generator control circuit wire of generator connector and vehicle body ground is 0 V with ignition switch tuned ON (power circuit short check) *Are they in good condition?*	Go to Step 3.	Repair or replace defective wire.
4	**Generator check** 1) Check for generator output referring to “Generator Test (Undercharged Battery Check) in Section 1J”. *Is check result satisfactory?*	Go to Step 4.	Repair or replace generator.
5	**Electric load current sensor check** 1) Check for electric load current sensor output referring to “Electric Load Current Sensor On-Vehicle Inspection in Section 1C”. *Is check result satisfactory?*	Substitute a known-good ECM and recheck.	Replace electric load current sensor.

DTC P0625 / P0626: Generator Field Terminal Circuit Low / High

S7RS0B1104058

System and Wiring Diagram
Refer to “DTC P0620: Generator Control Circuit”.

Generator Control System Description
Refer to “Generator Control System Description”.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
P0625: Generator field coil duty is 0% (high voltage) for more than specified time even through generator control is minimum regulation (control duty 0%). (1 driving cycle detection logic but MIL does not light up) **P0626:** Generator field coil duty is 100% (low voltage) for more than specified time even through generator control is maximum regulation (control duty 100%) or Generator field coil duty is 100% (low voltage) when engine is starting. (1 driving cycle detection logic but MIL does not light up)	• Generator and/or its circuit • ECM

DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool to DLC.
2) Turn ON ignition switch and clear DTC.
3) Make sure that all accessory switch is tuned OFF.
4) Start engine and warm it up to normal operating temperature (ECT approx. 90 – 95 °C, 193 – 203 °F).
5) Turn ON following accessory switch.
   - Head lights switch.
   - Blower motor switch (max position).
   - Rear defogger switch.
6) Increase engine speed to 4000 rpm and keep it for 10 sec. or more.
7) Decrease engine speed to idle.
8) Check DTC.

DTC Troubleshooting

NOTE

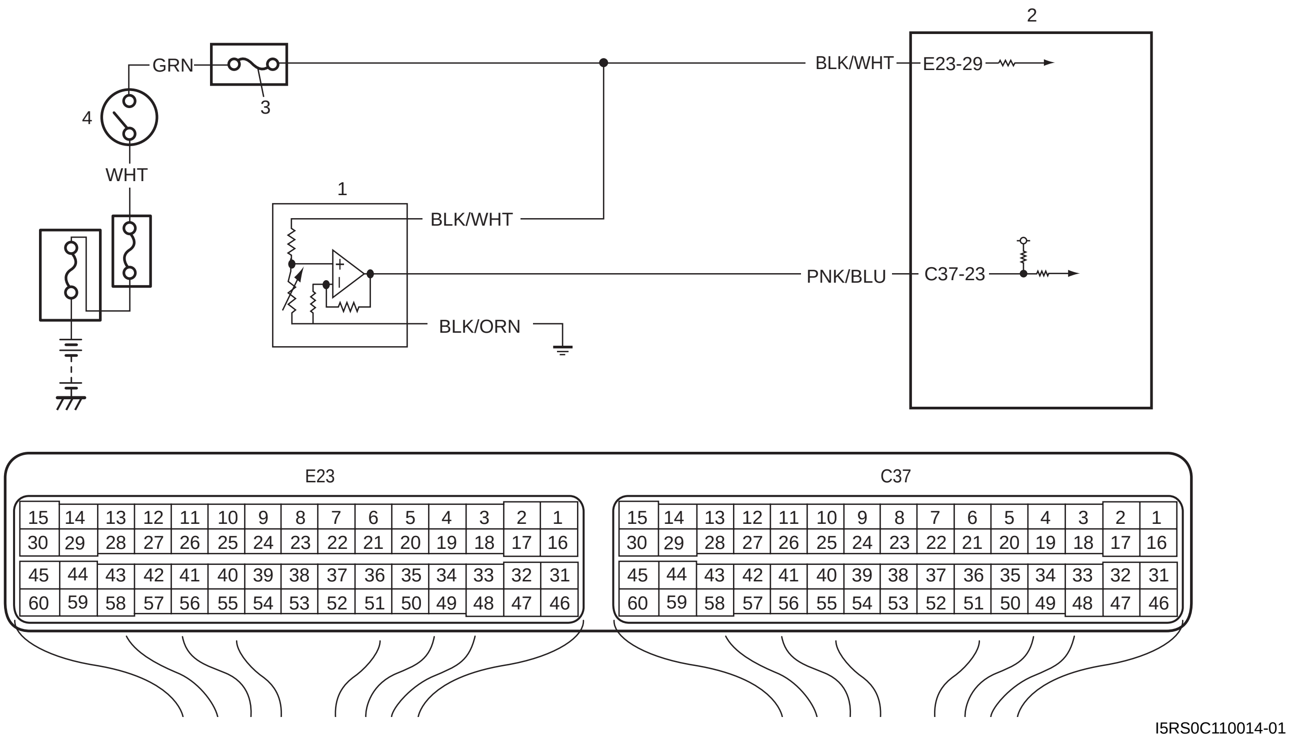
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to “Inspection of ECM and Its Circuits”.**
- **Upon completion of inspection and repair work, perform “DTC Confirmation Procedure” and confirm that 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	**Generator control circuit check** 1) Disconnect connector from generator and ECM with ignition switch turned OFF. 2) Check for proper connection of wire terminal to generator connector and to ECM connector. 3) If connections are OK, check generator control (generator “C” terminal) circuit and field coil monitor (generator “FR” terminal) circuit for the following. • Resistance of each generator control wire and field coil monitor wire between generator connector and ECM connector is less than 1 Ω (continuity check) • Resistance between generator control wire and field coil monitor wire of generator connector is infinity (insulation check) • Resistance between each generator control wire and field coil monitor wire of generator connector and vehicle body ground is infinity (ground circuit short check) • Voltage between each generator control wire and field coil monitor wire of generator connector and vehicle body ground is 0 V with ignition switch tuned ON (power circuit short check) *Are they in good condition?*	Go to Step 3.	Repair or replace defective wire.
3	**Generator check** 1) Check for generator output referring to “Generator Test (Undercharged Battery Check) in Section 1J” and “Generator Inspection in Section 1J”. *Is check result satisfactory?*	Substitute a known good ECM and recheck.	Repair or replace generator.

DTC P1501 / P1502: Electric Load Current Sensor Circuit Low / High

S7RS0B1104059

System and Wiring Diagram



1. Electric load current sensor	3. "IG COIL" fuse
2. ECM	4. Ignition switch

Electric Load Current Sensor Description

Refer to "Generator Control System Description".

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
P1501: Electric load current is lower than specified value (electric load current sensor voltage is higher than specified value). (1 driving cycle detection logic but MIL does not light up) **P1502:** Electric load current is higher than specified value (electric load current sensor voltage is lower than specified value). (1 driving cycle detection logic but MIL does not light up)	• Electric load current sensor and/or its circuit • ECM

DTC Confirmation Procedure

1) With ignition switch turned OFF, connect scan tool to DLC.
2) Turn ON ignition switch and clear DTC.
3) Make sure that all accessory switch is tuned OFF.
4) Start engine and warm it up to normal operating temperature (ECT approx. 90 – 95 °C, 193 – 203 °F).
5) Increase engine speed to 3000 rpm.
6) In this state, Turn ON following accessory switch.
   - Head lights switch.
   - Blower motor switch (max position).
   - Rear defogger switch.
7) Decrease engine speed to idle.
8) Check DTC.

DTC Troubleshooting

NOTE

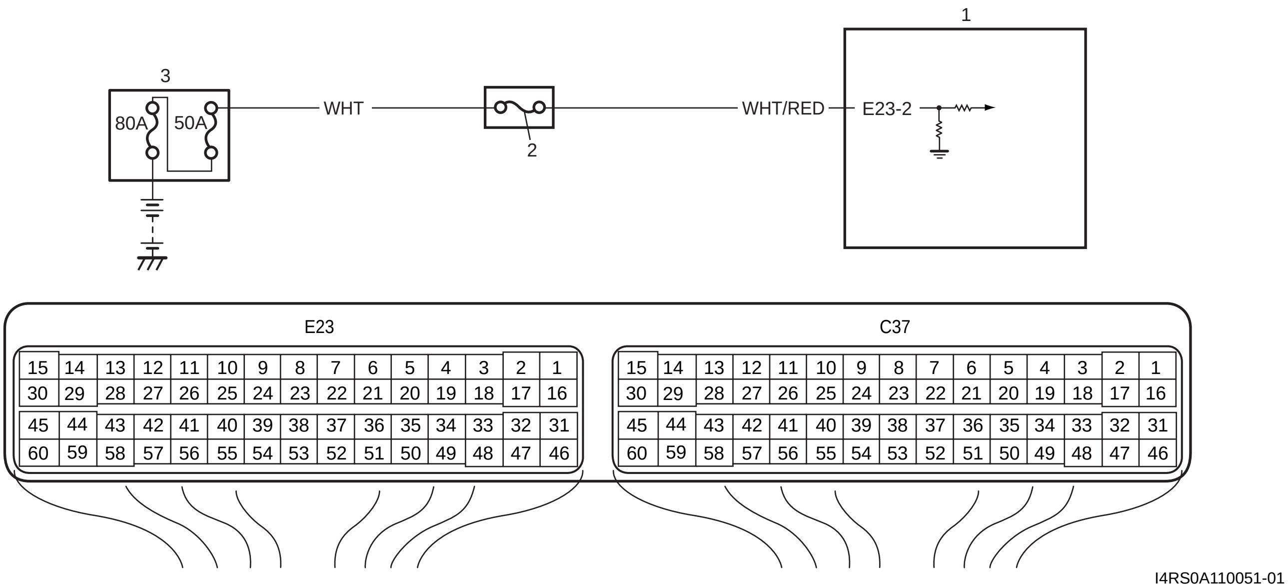
- **When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits".**
- **Upon completion of inspection and repair work, perform "DTC Confirmation Procedure" and confirm that 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	**Electric load current sensor power and ground circuit check** 1) Disconnect connector from electric load current sensor. 2) Check electric load current sensor circuit for the following. • Voltage between "BLK/WHT" wire terminal of electric load current sensor connector and vehicle body ground is 10 – 14 V with ignition switch turned ON • Resistance between "BLK/ORN" wire terminal of electric load current sensor connector and vehicle body ground is less than 2 Ω *Are they in good condition?*	Go to Step 3.	Repair or replace defective wire.
3	**Electric load current sensor output circuit check** 1) Disconnect connectors from ECM. 2) Check electric load current sensor circuit for the following. • Resistance between "PNK/BLU" wire terminal of electric load current sensor connector and "C37-23" terminal of ECM connector is less than 2 Ω • Resistance between "PNK/BLU" wire terminal of electric load current sensor connector and vehicle body ground is infinity • Voltage between "PNK/BLU" wire terminal of electric load current sensor connector and vehicle body ground is 0 V with ignition switch turned ON *Are they in good condition?*	Go to Step 4.	Repair or replace defective wire.
4	**Electric load current sensor check** 1) Check for electric load current sensor output referring to "Electric Load Current Sensor On-Vehicle Inspection in Section 1C". *Is check result satisfactory?*	Substitute a known-good ECM and recheck.	Faulty electric load current sensor.

DTC P1510: ECM Back-Up Power Supply Malfunction

S7RS0B1104060

Wiring Diagram



1. ECM	2. "RADIO" fuse	3. Main fuse box

Circuit Description

Battery voltage is supplied so that DTC memory, values for engine control learned by ECM, etc. are kept in ECM even when the ignition switch is turned OFF.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Back-up power circuit voltage is less than 70% battery voltage for 5 seconds continuously while engine is running. (1 driving cycle detection logic)	Battery voltage supply circuit

DTC Confirmation Procedure

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

DTC Troubleshooting

NOTE

- **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	**Battery voltage supply circuit check** 1) Turn OFF ignition switch. 2) Remove ECM from its bracket with ECM connectors connected. 3) With engine running, measure voltage between “E23-2” terminal of ECM connector and engine ground. *Is voltage 10 – 14 V?*	Poor “E23-2” connection or intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”. If wire and connections are OK, substitute a known-good ECM and recheck.	“RADIO” fuse blown, “WHT” or “WHT/RED” wire is circuit open or short circuit.

DTC P1603: TCM Trouble Code Detected

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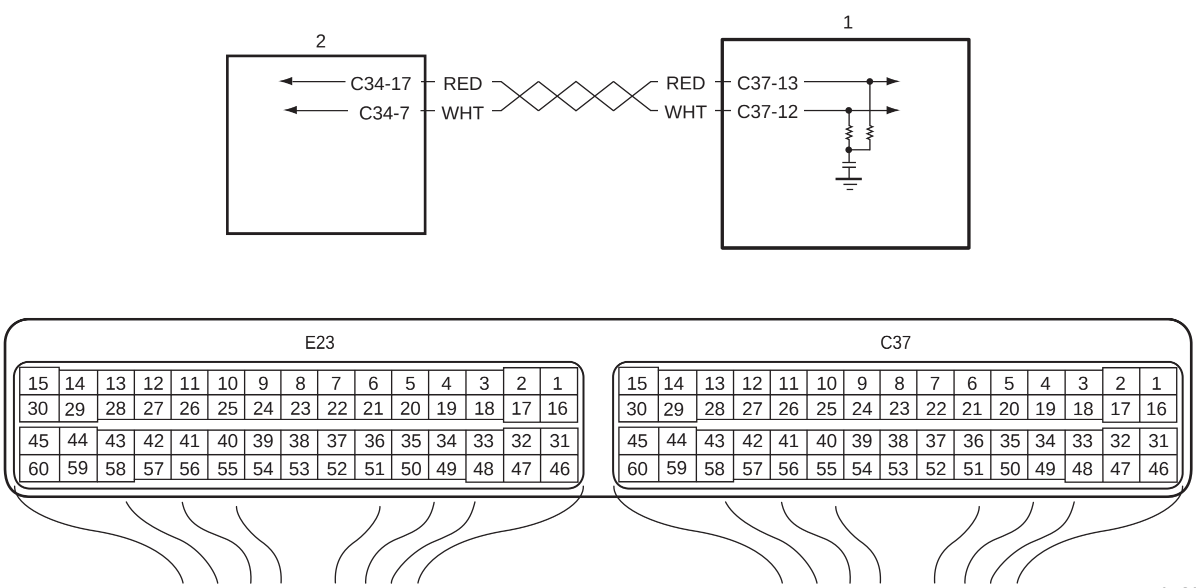
Wiring Diagram



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1. ECM	2. TCM (for A/T model)

DTC Detecting Condition

When ECM receives a trouble code from TCM, which indicates that some problem occurred in sensor circuits and its calculated values used for operations such as idle speed control, engine power control, and so on by TCM, ECM sets DTC P1603. (TCM outputs the trouble code to ECM when TCM can not compute the engine control signal due to malfunctions of sensor circuits used for gear shift control.)

DTC Troubleshooting

NOTE

- **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	**DTC check** 1) Check DTC of TCM referring to “DTC Check in Section 5A”. *Is there any DTC(s)?*	Go to applicable DTC diag. flow.	Substitute a known-good ECM and recheck.

DTC P1674: CAN Communication (Bus Off Error)

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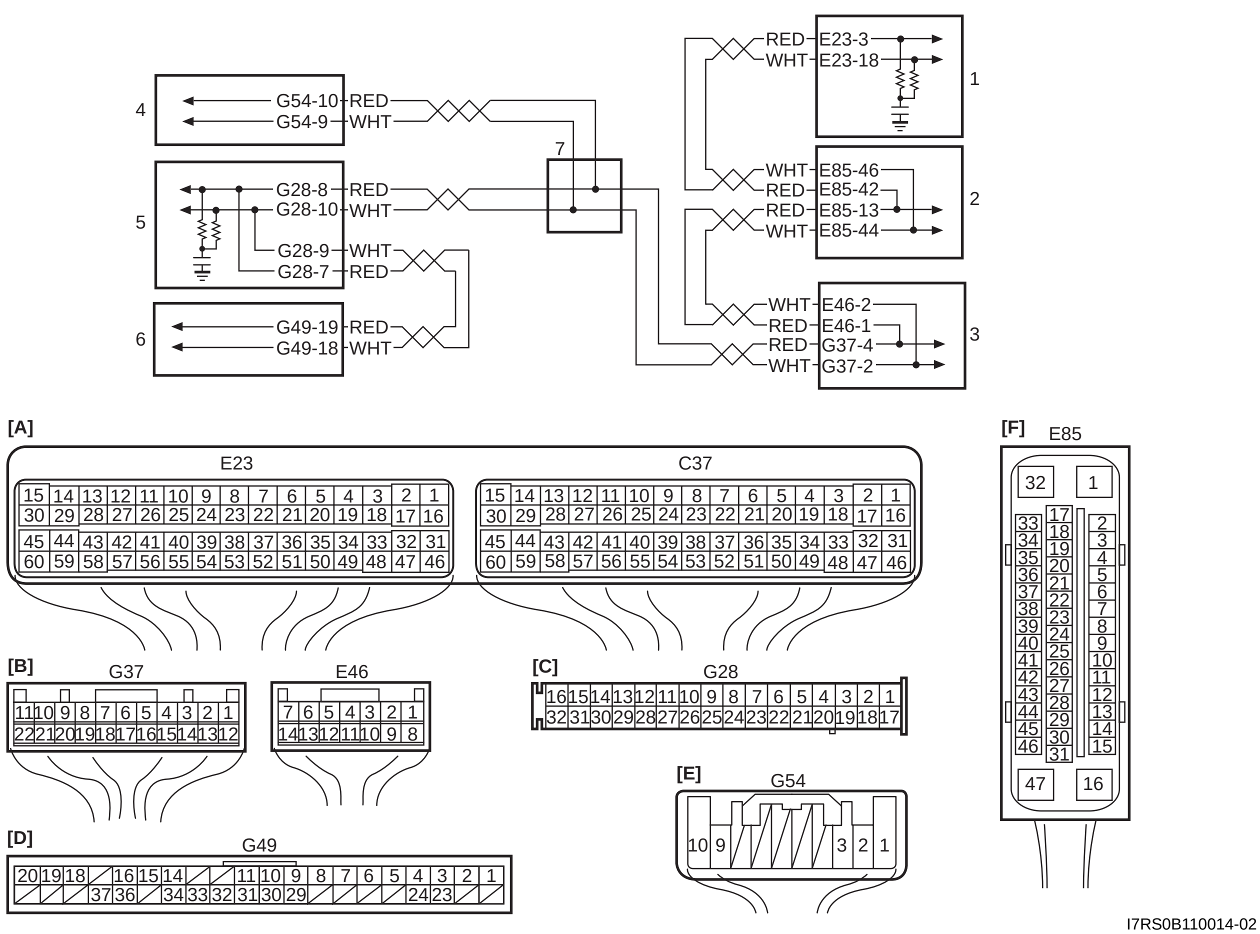
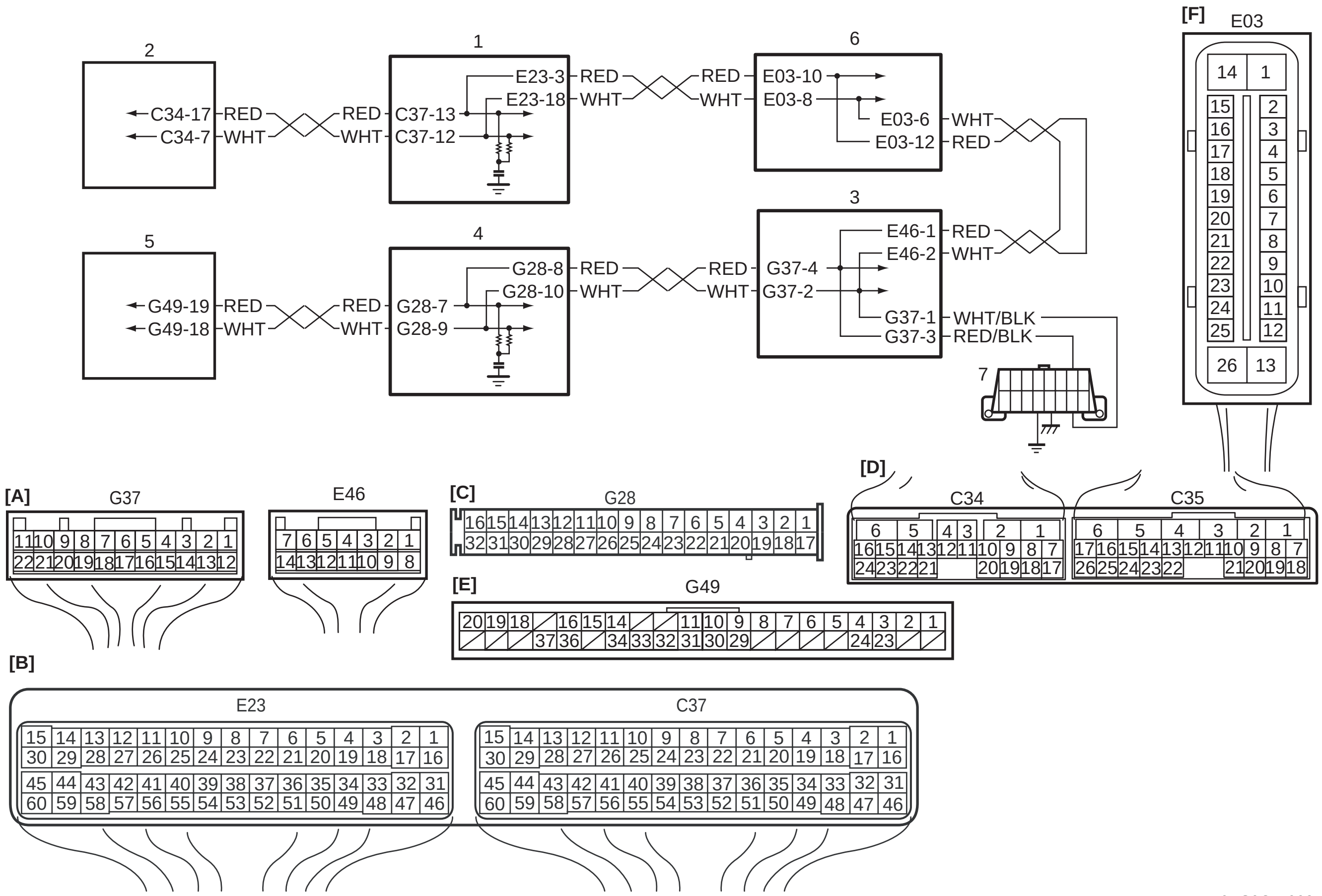
Wiring Diagram

ESP® model



[A]:	ECM connector (viewed from harness side)	1.	ECM
[B]:	BCM connector (viewed from harness side)	2.	ESP® control module
[C]:	Combination meter connector (viewed from harness side)	3.	BCM
[D]:	Keyless start control module connector (viewed from harness side)	4.	Steering angle sensor
[E]:	Steering angle sensor connector (viewed from harness side)	5.	Combination meter
[F]:	ESP® control module connector (viewed from terminal side)	6.	Keyless start control module
		7.	CAN junction connector

Non ESP® model



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[A]: BCM connector (viewed from harness side)	1. ECM
[B]: ECM connector (viewed from harness side)	2. TCM (A/T model)
[C]: Combination meter connector (viewed from harness side)	3. BCM
[D]: TCM connector (viewed from harness side)	4. Combination meter
[E]: Keyless start control module connector (viewed from harness side)	5. Keyless start control module
[F]: ABS control module connector (viewed from harness side)	6. ABS control module

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Transmission error that is inconsistent between transmission data and transmission monitor (CAN bus monitor) data is detected more than 7 times continuously. (1 driving detection logic)	• ECM • BCM • ABS/ESP® control module • TCM (A/T model) • Keyless start control module • Combination meter • Steering angle sensor (ESP® model) • CAN communication circuit

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch and clear DTC by using scan tool.
3) Start engine and run it for 1 min. or more.
4) Check DTC.

DTC Troubleshooting

NOTE

- **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	**Control module connector check** 1) Check connection of connectors of all control module/ sensor communicating by means of CAN. 2) Recheck DTC. *Is DTC P1674 detected?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection in Section 00".
3	**CAN communication circuit check** 1) Turn ignition switch to OFF position. 2) Disconnect connectors of all control module/sensor communicating by means of CAN. 3) Check CAN communication circuit between control module/sensor for open, short and high resistance. *Is each CAN communication circuit in good condition?*	Go to Step 4.	Repair circuit.
4	**DTC check of ECM** 1) Turn ignition switch to OFF position. 2) Connect connectors of disconnected control module/ sensor communicating by means of CAN. 3) Disconnect connector from any one of control module/ sensor other than BCM and ECM. 4) Recheck ECM for DTC. *Is DTC P1674 detected?*	Disconnect connectors of control module/ sensor other than the one whose connector is disconnected in Step 3) one by one and check that DTC P1674 is detected by ECM each time connector is disconnected. When DTC P1674 is not detected by ECM while checking in this way, go to description under "NO" below. If DTC P1674 is detected by ECM, go to Step 5.	Check power and ground circuit of control module disconnect in Step 3). If circuit is OK, substitute a known-good control module disconnected in Step 3) and recheck.
5	**DTC check of ECM** 1) Substitute a known-good BCM and recheck ECM for DTC. *Is DTC P1674 detected?*	Substitute a known-good ECM and recheck.	End.

DTC P1676: CAN Communication (Reception Error for TCM)

S7RS0B1104064

Wiring Diagram

Refer to "DTC P1674: CAN Communication (Bus Off Error)".

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Reception error of communication data for TCM is detected for longer than specified time continuously. (1 driving detection logic)	• ECM • TCM (for A/T model) • CAN communication circuit

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch and clear DTC by using scan tool.
3) Start engine and run it for 1 min. or more.
4) Check DTC.

DTC Troubleshooting

NOTE

- **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	**Check CAN communication error for ECM** 1) Check ECM for DTC. *Is there DTC P1674?*	Go to "DTC P1674: CAN Communication (Bus Off Error)".	Go to Step 3.
3	**ECM and TCM connector check** 1) Check for proper connection at each ECM and TCM connector terminals with ignition switch turned OFF. 2) If connections are OK, recheck ECM for DTC with engine running. *Is there DTC P1676?*	Go to Step 4.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection in Section 00".
4	**DTC check in TCM** 1) Check DTC P1774 in TCM. *Is it indicated?*	Go to "DTC P1774: CAN Communication Bus Off in Section 5A".	Go to Step 5.
5	**CAN communication circuit check** 1) Disconnect connectors of ECM and TCM. 2) Check CAN communication circuit between ECM and TCM connectors for open, short and high resistance. *Is each CAN communication circuit in good condition?*	Go to Step 6.	Repair circuit.
6	**DTC check of ECM** 1) Connect connectors to ECM and TCM with ignition switch turned. 2) Check ECM for DTC. *Does ECM communicate with control module other than TCM (i.e. DTC P1678 and/or P1685 are not detected)?*	Substitute a known-good TCM and recheck.	Substitute a known-good ECM and recheck.

DTC P1678: CAN Communication (Reception Error for BCM)

S7RS0B1104065

Wiring Diagram

Refer to “DTC P1674: CAN Communication (Bus Off Error)”.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Reception error of communication data for BCM is detected for longer than specified time continuously. (1 driving detection logic but MIL does not light up)	• ECM • ABS/ESP® control module • BCM • CAN communication circuit

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch and clear DTC by using scan tool.
3) Start engine and run it for 1 min. or more.
4) Check DTC.

DTC Troubleshooting

NOTE

- **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	**CAN communication error check for ECM** 1) Check ECM for DTC. *Is there DTC P1674?*	Go to “DTC P1674: CAN Communication (Bus Off Error)”.	Go to Step 3.
3	**ECM, ABS control module and BCM connector check** 1) Check for proper connection at each ECM, ABS/ESP® control module and BCM connector terminals with ignition switch turned OFF. 2) If connections are OK, recheck ECM for DTC with engine running. *Is there DTC P1678?*	Go to Step 4.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”.
4	**DTC check in BCM** 1) Check DTC U1073 in BCM. *Is it indicated?*	Go to “DTC U1073 (No. 1073): Control Module Communication Bus Off in Section 10B”.	Go to Step 5.
5	**DTC check of ABS/ESP® control module** 1) Check DTC U1073 in ABS/ESP® control module. *Is it indicated?*	Go to “DTC U1073: Control Module Communication Bus Off in Section 4E”.	Go to Step 6.

Step	Action	Yes	No
6	**CAN communication circuit check** 1) Turn ignition switch to OFF position. 2) Disconnect connectors form ECM, BCM and ABS/ESP® control modules. 3) Check CAN communication circuit for open, short or high resistance. • Between ECM and ABS/ESP® control module • Between ECM and BCM *Is each CAN communication circuit in good condition?*	Go to Step 7.	Repair circuit.
7	**DTC check in ECM** 1) Connect connectors to ECM, BCM and ABS/ESP® control module with ignition switch turned. 2) Check ECM for DTC. *Does ECM communicate with control module other than BCM (i.e. DTC P1676 and/or DTC P1685 are not detected)?*	Substitute a known-good BCM and recheck.	Substitute a known-good ECM and recheck.

DTC P1685: CAN Communication (Reception Error for ABS/ESP® Control Module)

S7RS0B1104066

Wiring Diagram

Refer to "DTC P1674: CAN Communication (Bus Off Error)"

DTC detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Reception error of communication data for ABS/ESP® control module is detected for longer than specified time continuously. (1 driving cycle detection logic)	• ECM • ABS/ESP® control module • CAN communication circuit

DTC confirmation procedure

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Turn ON ignition switch and clear DTC by using scan tool.
3) Start engine and run it for 1 min. or more.
4) Check DTC.

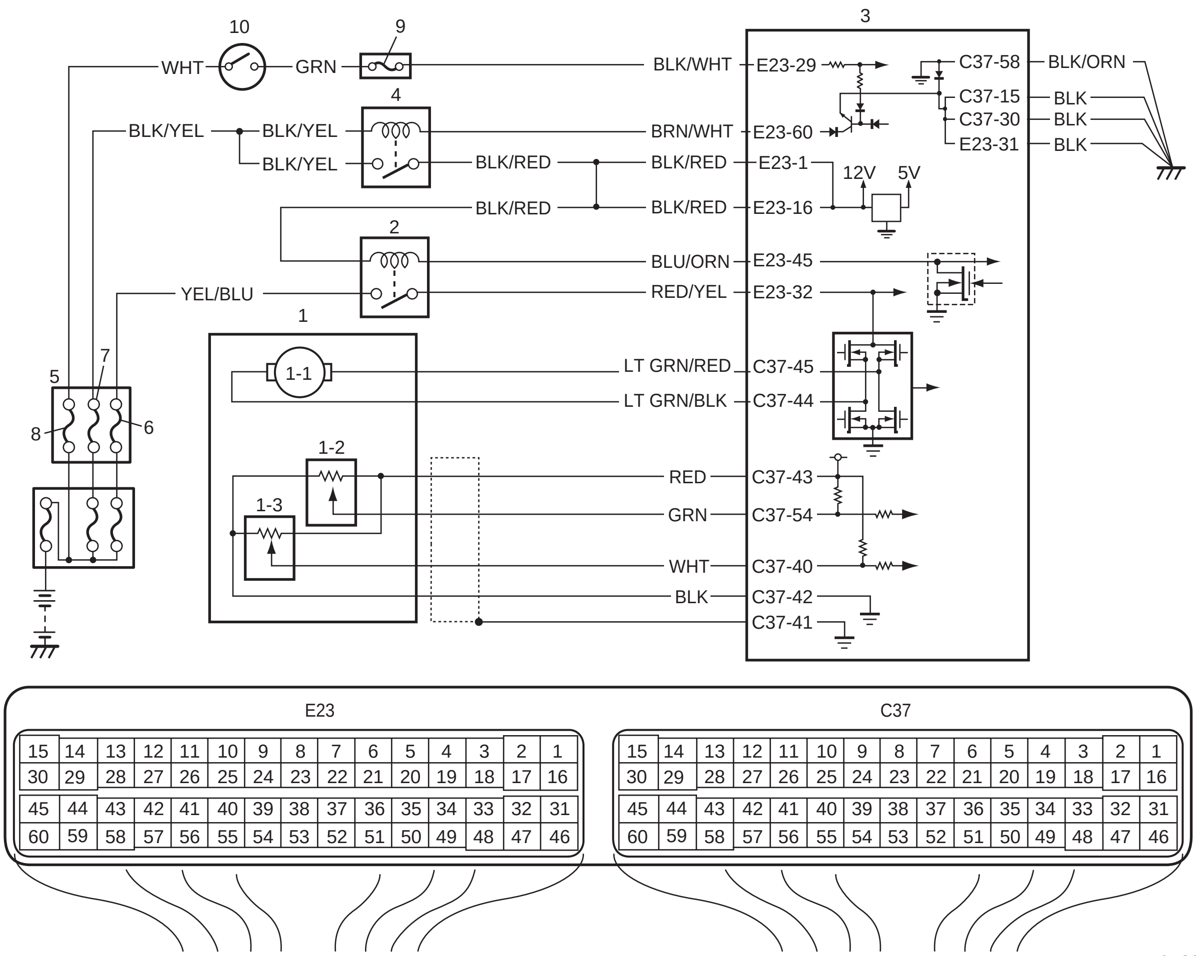
Troubleshooting

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	**DTC check in ECM** 1) Check ECM for DTC. *Is there DTC P1674?*	Go to "DTC P1674: CAN Communication (Bus Off Error)".	Go to Step 3.
3	**ECM and ABS/ESP® control module connector check** 1) Check for proper connection at each ECM and ABS/ESP® control module connector terminals with ignition switch turned OFF. 2) If connections are OK, recheck ECM for DTC with engine running. *Is there DTC P1685?*	Go to Step 4.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection in Section 00".
4	**DTC check of ABS/ESP® control module** 1) Check DTC U1073 in ABS/ESP® control module. *Is it indicated?*	Go to "DTC U1073: Control Module Communication Bus Off in Section 4E" (Non-ESP® model) or "DTC U1073: Control Module Communication Bus Off in Section 4F" (ESP® module).	Go to Step 5.
5	**CAN communication circuit check** 1) Turn ignition switch to OFF position. 2) Disconnect connectors form ECM and ABS/ESP® control module. 3) Check CAN communication circuit between ECM and ABS/ESP® control module for open, short or high resistance. *Is each CAN communication circuit in good condition?*	Go to Step 6.	Repair circuit.
6	**DTC check in ECM** 1) Connect connectors to ECM and ABS/ESP® control module with ignition switch turned. 2) Check ECM for DTC. *Does ECM communicate with control module other than ABS/ESP® control module (i.e. DTC P1676 and/or DTC P1678 are not detected)?*	Substitute a known-good ABS/ESP® control module and recheck.	Substitute a known-good ECM and recheck.

DTC P2101: Throttle Actuator Control Motor Circuit Range / Performance

S7RS0B1104067

Wiring Diagram



I6RS0C110015-01

1. Electric throttle body assembly	3. ECM	8. "IG ACC" fuse
1-1. Throttle actuator	4. Main relay	9. "IG COIL" fuse
1-2. TP sensor (main)	5. Individual circuit fuse box No.1	10. Ignition switch
1-3. TP 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
Monitor signal of throttle actuator output (duty output) is inconsistent with throttle actuator control command. (1 driving detection logic)	• Throttle actuator circuit • Electric throttle body • ECM

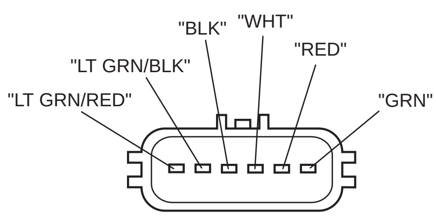
DTC Confirmation Procedure

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

- **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 actuator circuit check** 1) Disconnect connectors from electric throttle body and ECM with ignition switch turned OFF. 2) Check for proper connection of electric throttle body and ECM connectors at “LT GRN/RED” wire, “LT GRN/BLK” wire. “C37-45” and “C37-44” terminals.  I4RS0B110022-02 3) Turn ON ignition switch. 4) Measure voltage between “LT GRN/RED” wire terminal of electric throttle body connector and engine ground, between “LT GRN/BLK” wire terminal of electric throttle body connector and engine ground. *Is voltage 0 V?*	Go to Step 3.	“LT GRN/RED” wire and/or “LT GRN/BLK” wire is shorted to power circuit.
3	**Throttle actuator circuit check** 1) Turn OFF ignition switch. 2) Measure resistance between “LT GRN/RED” wire terminal of electric throttle body connector and engine ground, between “LT GRN/BLK” wire terminal of electric throttle body connector and engine ground. *Is resistance infinity?*	Go to Step 4.	“LT GRN/RED” wire and/or “LT GRN/BLK” wire is shorted to ground circuit.
4	**Throttle actuator circuit check** 1) Check throttle actuator referring to “Throttle Actuator Performance Check” under “Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”. *Is check result satisfactory?*	Substitute a known-good ECM and recheck.	Replace electric throttle body

DTC P2102: Throttle Actuator Control Motor Circuit Low

S7RS0B1104068

Wiring Diagram

Refer to “DTC P2101: Throttle Actuator Control Motor Circuit Range / Performance”.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Power supply voltage of throttle actuator control circuit is less than 5 V for specified time even if throttle actuator control relay is turned on. (1 driving detection logic)	• Throttle actuator control relay circuit • Throttle actuator control relay • 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) Start engine and run it for 1 min. or more.
4) Check DTC.

DTC Troubleshooting

NOTE

- **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 actuator control relay circuit check** 1) Remove ECM from its bracket with ECM connectors connected. 2) Check for proper connection of ECM connector at “E23-45” and “E23-32” terminals. 3) Turn ON ignition switch. 4) Measure voltage between “E23-32” terminal of ECM connector and engine ground. *Is voltage 10 – 14 V?*	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”.	Go to Step 3.
3	*Is “TH MOT” fuse in god condition?*	Go to Step 4	Replace fuse and check for short in circuits connected to this fuse.
4	**Throttle actuator control relay circuit check** 1) Remove throttle actuator control relay from individual circuit fuse box No.1 with ignition switch turned OFF. 2) Check for proper connection to throttle actuator control relay at “BLK/RED”, “YEL/BLU”, “BLU/ORN” and “RED/YEL” wire terminals. 3) Measure voltage between engine ground and each “BLK/RED”, “YEL/BLU” wire terminal with ignition switch turned ON. *Is each voltage 10 – 14 V?*	Go to Step 5.	“BLK/RED” wire and/or “YEL/BLU” wire is open or high resistance.

Step	Action	Yes	No
5	**Throttle actuator control relay circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance at the following connector terminals. • Between “BLU/ORN” wire terminal of throttle actuator control relay connector and “E23-45” terminal of ECM connector • Between “RED/YEL” wire terminal of throttle actuator control relay connector and “E23-32” terminal of ECM connector *Is each resistance below 5 Ω?*	Go to Step 6.	“BLU/ORN” wire and/or “RED/YEL” wire is open or high resistance.
6	**Throttle actuator control relay check** 1) Check throttle actuator control relay referring to “Main Relay, Fuel Pump Relay and Starting Motor Control Relay Inspection in Section 1C”. *Is it in good condition?*	Substitute a known-good ECM and recheck.	Replace throttle actuator control relay.

DTC P2103: Throttle Actuator Control Motor Circuit High

S7RS0B1104069

Wiring Diagram

Refer to “DTC P2101: Throttle Actuator Control Motor Circuit Range / Performance”.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Power supply voltage of throttle actuator control circuit is more than 5 V for specified time even if throttle actuator control relay is turned off. (1 driving detection logic.)	• Throttle actuator control relay circuit • Throttle actuator control relay • 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) Ignition switch turned OFF for 20 sec. or more.
4) Turn ON ignition switch and check DTC.

DTC Troubleshooting

NOTE

- **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 actuator control relay circuit check** 1) Remove throttle actuator control relay from individual circuit fuse box No.1 with ignition switch turned OFF. 2) Check for proper connection to throttle actuator control relay "BLK/RED", "YEL/BLU", "BLU/ORN" and "RED/YEL" wire terminals. 3) Turn ON ignition switch. 4) Measure voltage between engine ground and "E23-32" terminal of ECM connector. *Is voltage 0 V?*	Go to Step 3.	"RED/YEL" wire is shorted to other circuit.
3	**Throttle actuator control relay circuit check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Measure resistance between engine ground and "E23-45" terminal of ECM connector. *Is resistance infinity?*	Go to Step 4.	"BLU/ORN" wire is shorted to ground circuit.
4	**Throttle actuator control relay check** 1) Check throttle actuator control relay referring to "Main Relay, Fuel Pump Relay and Starting Motor Control Relay Inspection in Section 1C". *Is it in good condition?*	Substitute a known-good ECM and recheck.	Replace throttle actuator control relay.

DTC P2111 / P2112: Throttle Actuator Control System - Stuck Open / Closed

S7RS0B1104070

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
P2111: Throttle valve default opening is greater than 6° from complementary closed position when diagnosing throttle valve at ignition switch turned OFF. (1 driving detection logic) **P2112:** Throttle valve default opening is smaller than 6° from complementary closed position when diagnosing throttle valve at ignition switch turned OFF. (1 driving detection logic)	• Electric throttle body • 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) Ignition switch turned OFF for 20 sec. or more.
4) Turn ON ignition switch and check DTC.

DTC Troubleshooting

NOTE

- **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 Step "Engine and Emission Control System Check".
2	**Throttle valve visual check** 1) Check that there isn't any foreign matter caught between throttle valve and throttle body housing referring to "Throttle Valve Visual Check" under "Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C". *Is it in good condition?*	Go to Step 3.	Take it out after removing throttle body and clean inside of throttle body thoroughly.
3	**Throttle valve operation check** 1) Check operation of throttle valve referring to "Throttle Valve Operation Check" under "Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C". *Is check result satisfactory?*	Go to Step 4.	Replace electric throttle body.
4	**Throttle actuator operation check** 1) Check operation of throttle actuator referring to "Throttle Actuator Operation Check" under "Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C". *Is check result satisfactory?*	Go to Step 5.	Replace electric throttle body.
5	**Throttle position sensor performance check** 1) Check performance of throttle position sensor referring to "Throttle Position Sensor Performance Check" under "Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C". *Is check result satisfactory?*	Substitute a known-good ECM and recheck.	Replace electric throttle body.

DTC P2119: Throttle Actuator Control Throttle Body Range / Performance

S7RS0B1104071

Wiring Diagram

Refer to "DTC P2101: Throttle Actuator Control Motor Circuit Range / Performance".

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Difference between the measured (actual) throttle valve opening angle and the target throttle valve opening angle which is calculated based on accelerator pedal opening angle and engine condition is more than specification for specified time continuously. (1 driving detection logic)	• Throttle actuator circuit • Electric throttle body • ECM

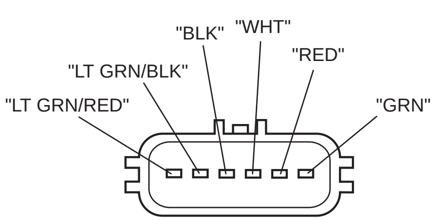
DTC Confirmation Procedure

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

- **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.**

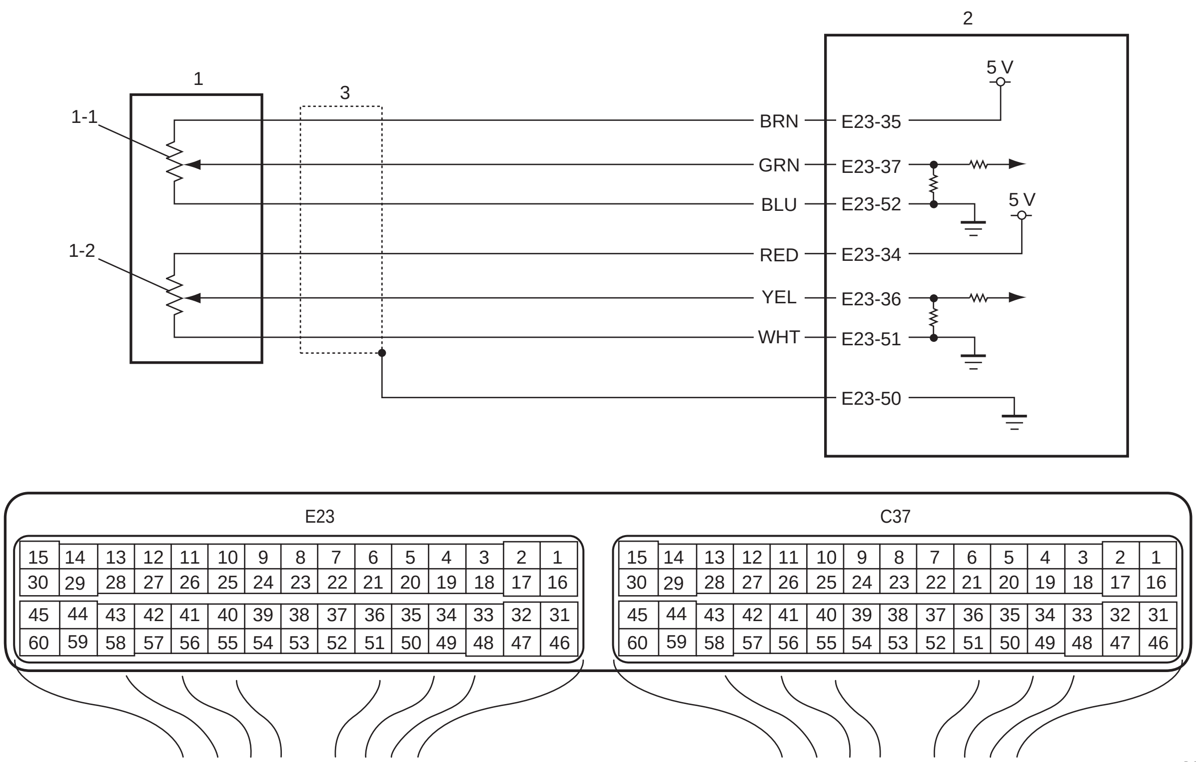
Step	Action	Yes	No
1	*Was “Engine and Emission Control System Check” performed?*	Go to Step 2.	Go to “Engine and Emission Control System Check”.
2	**Electric throttle body assembly system check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch, check each voltage 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	**Throttle actuator circuit check** 1) Disconnect connector from electric throttle body with ignition switch turned OFF. 2) Check for proper connection to electric throttle body at “LT GRN/RED” and “LT GRN/BLK” wire terminals.  I4RS0B110022-02 3) Disconnect connectors from ECM. 4) Check for proper connection to ECM at “C37-45” and “C37-44” terminals. 5) Measure resistance at the following connector terminals. • Between “LT GRN/RED” wire terminal of electric throttle body connector and “C37-45” terminal of ECM connector • Between “LT GRN/BLK” wire terminal of electric throttle body connector and “C37-44” terminal of ECM connector *Is each resistance below 5 Ω?*	Go to Step 4.	“LT GRN/RED” wire and/or “LT GRN/BLK” wire is open or high resistance.

Step	Action	Yes	No
4	**Electric throttle body check** 1) Check electric throttle body referring to" Electric Throttle Body Assembly and Its Circuit Check" under "Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C". *Is check result satisfactory?*	Substitute a known-good ECM and recheck.	Replace electric throttle body.

DTC P2122: Throttle / Pedal Position Sensor / Switch "D" (Main) Circuit Low Input

S7RS0B1104072

Wiring Diagram



I4RS0B110047-01

1. APP sensor	1-2. APP sensor (sub)	3. Ground of APP sensor for shield wire
1-1. APP sensor (main)	2. ECM	

DTC Detecting Condition and Trouble Area

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

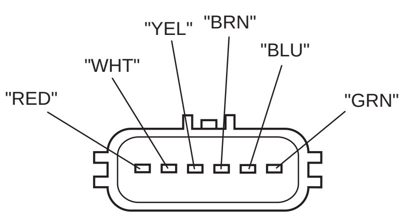
DTC Confirmation Procedure

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

- **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	**APP sensor mounting check** 1) Check that APP sensor has been mounted to vehicle body properly (no pinched floor carpet, etc.). *It is OK?*	Go to Step 3.	Reinstall APP sensor properly referring to "APP Sensor Assembly Removal and Installation in Section 1C".
3	**APP 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 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 APP sensor with ignition switch turned OFF. 2) Check for proper connection to APP sensor at "BRN", "GRN" and "BLU" wire terminals.  I4RS0B110048-01 3) If OK, measure voltage between "BRN" wire terminal of APP sensor connector and vehicle body ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	Go to Step 7.	Go to Step 5.
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.

Step	Action	Yes	No
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 APP sensor 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 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 APP sensor 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	**APP sensor check** 1) Check APP sensor (main) referring to "APP Sensor Assembly Removal and Installation in Section 1C". *Is output voltage within specified value?*	Substitute a known-good ECM and recheck.	Replace APP sensor.

DTC P2123: Throttle / Pedal Position Sensor / Switch "D" (Main) Circuit High Input

S7RS0B1104073

Wiring Diagram

Refer to "DTC P2122: Throttle / Pedal Position Sensor / Switch "D" (Main) Circuit Low Input".

DTC Detecting Condition and Trouble Area

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

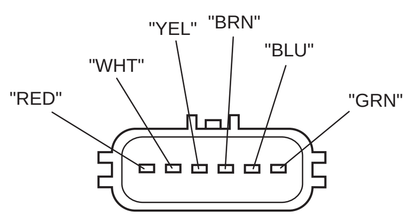
DTC Confirmation Procedure

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

- **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	**APP sensor mounting check** 1) Check that APP sensor has been mounted to vehicle body properly (no pinched floor carpet, etc.). *Is it OK?*	Go to Step 3.	Reinstall APP sensor properly referring to “APP Sensor Assembly Removal and Installation in Section 1C”.
3	**APP 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 APP sensor with ignition switch turned OFF. 2) Check for proper connection to APP sensor at “BRN”, “GRN” and “BLU” wire terminals.  I4RS0B110048-01 3) If OK, measure voltage between “BRN” wire terminal of 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.
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.

Step	Action	Yes	No
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 APP sensor 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 APP sensor 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	**APP sensor check** 1) Check APP sensor (main) referring to “APP Sensor Assembly Removal and Installation in Section 1C”. *Is output voltage within specified value?*	Substitute a known-good ECM and recheck.	Replace APP sensor.

DTC P2127: Throttle Pedal Position Sensor / Switch “E” (Sub) Circuit Low Input

S7RS0B1104074

Wiring Diagram

Refer to “DTC P2122: Throttle / Pedal Position Sensor / Switch “D” (Main) Circuit Low Input”.

DTC Detecting Condition and Trouble Area

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

DTC Confirmation Procedure

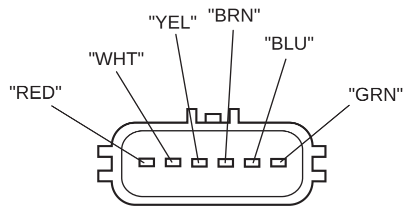
1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Keep the accelerator pedal at idle position for 2 seconds.
4) Keep the accelerator pedal at fully depressed position for 2 seconds.
5) Repeat Step 3) and 4) for 3 times.
6) Check DTC.

DTC Troubleshooting

NOTE

- **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	**APP sensor mounting check** 1) Check that APP sensor has been mounted to vehicle body properly (no pinched floor carpet, etc.). *Is it OK?*	Go to Step 3.	Reinstall APP sensor properly referring to “APP Sensor Assembly Removal and Installation in Section 1C”.
3	**APP 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”.

Step	Action	Yes	No
4	**ECM voltage check** 1) Disconnect connector from APP sensor with ignition switch turned OFF. 2) Check for proper connection to APP sensor at “RED”, “YEL” and “WHT” wire terminals.  I4RS0B110048-01 3) If OK, measure voltage between “RED” wire terminal of APP sensor connector and vehicle body ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	Go to Step 7.	Go to Step 5.
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 APP sensor 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 APP sensor 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.

Step	Action	Yes	No
10	**APP sensor check** 1) Check APP sensor (sub) referring to “APP Sensor Assembly Inspection in Section 1C”. *Is output voltage within specified value?*	Substitute a known-good ECM and recheck.	Replace APP sensor.

DTC P2128: Throttle / Pedal Position Sensor / Switch “E” (Sub) Circuit High Input

S7RS0B1104075

Wiring Diagram

Refer to “DTC P2122: Throttle / Pedal Position Sensor / Switch “D” (Main) Circuit Low Input”.

DTC Detecting Condition and Trouble Area

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

DTC Confirmation Procedure

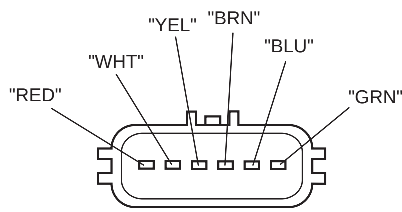
1) With ignition switch turned OFF, connect scan tool.
2) Turn ON ignition switch and clear DTC using scan tool.
3) Keep the accelerator pedal at idle position for 2 seconds.
4) Keep the accelerator pedal at fully depressed position for 2 seconds.
5) Repeat Step 3) and 4) for 3 times.
6) Check DTC.

DTC Troubleshooting

NOTE

- **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	**APP sensor mounting check** 1) Check that APP sensor has been mounted to vehicle body properly (no pinched floor carpet, etc.). *Is it OK?*	Go to Step 3.	Reinstall APP sensor properly referring to “APP Sensor Assembly Removal and Installation in Section 1C”.
3	**APP 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”.

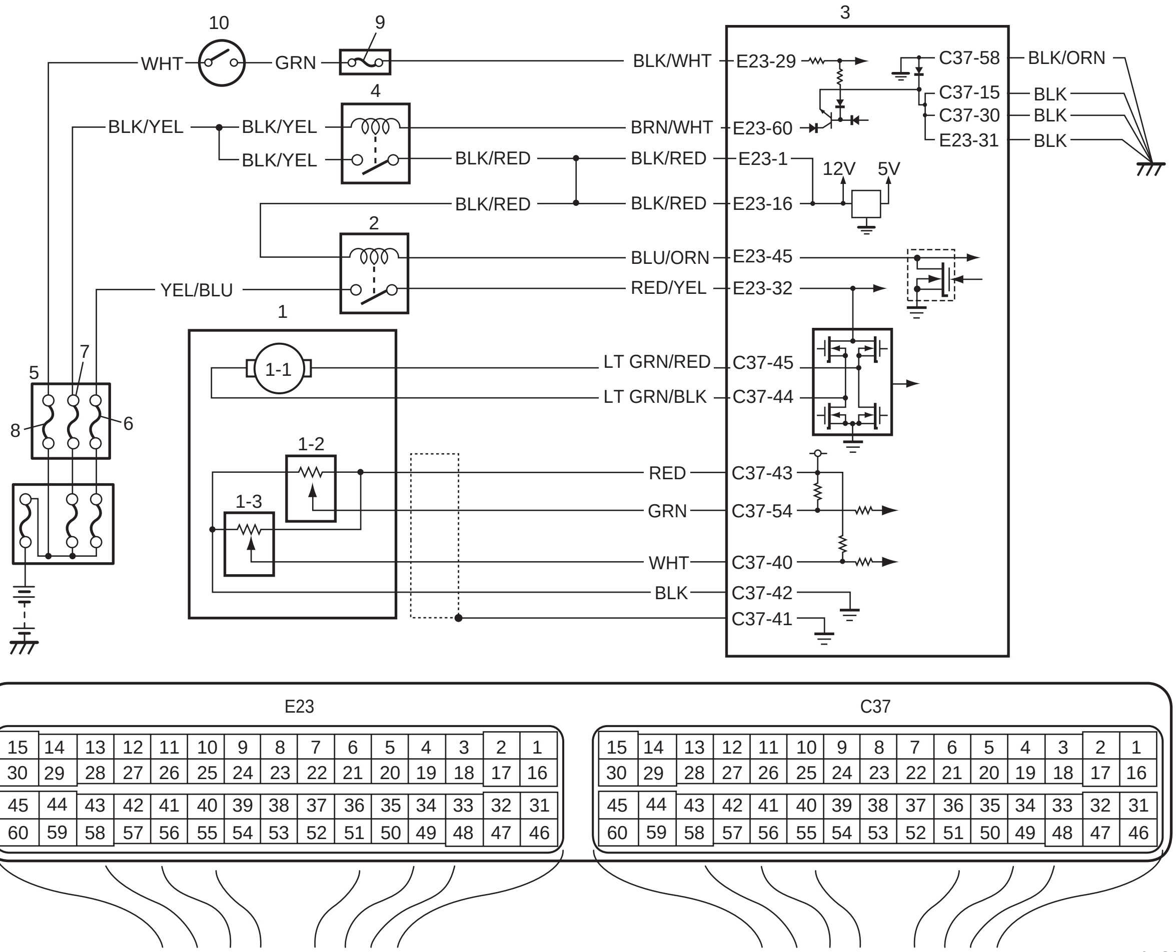
Step	Action	Yes	No
4	**ECM voltage check** 1) Disconnect connector from APP sensor with ignition switch turned OFF. 2) Check for proper connection to APP sensor at “RED”, “YEL” and “WHT” wire terminals.  I4RS0B110048-01 3) If OK, measure voltage between “RED” wire terminal of APP sensor connector and vehicle body ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	Go to Step 6.	Go to Step 5.
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 APP sensor 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 APP sensor connector and vehicle body ground. *Is resistance below 5 Ω?*	Go to Step 10.	Go to Step 9.

Step	Action	Yes	No
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	**APP sensor check** 1) Check APP sensor (sub) referring to “APP Sensor Assembly Inspection in Section 1C”. *Is output voltage within specified value?*	Substitute a known-good ECM and recheck.	Replace APP sensor.

DTC P2135: Throttle / Pedal Position Sensor / Switch “A”/“B” (Main / Sub) Voltage Correlation

S7RS0B1104076

Wiring Diagram



1. Electric throttle body assembly	3. ECM	8. “IG ACC” fuse
1-1. Throttle actuator	4. Main relay	9. “IG COIL” fuse
1-2. TP sensor (main)	5. Individual circuit fuse box No.1	10. Ignition switch
1-3. TP 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 TP sensor (main) and the opening angle based on TP sensor (sub) is more than specification for specified time continuously. (1 driving detection logic)	• Throttle position sensor (main) and (sub) circuit • Electric throttle body • ECM

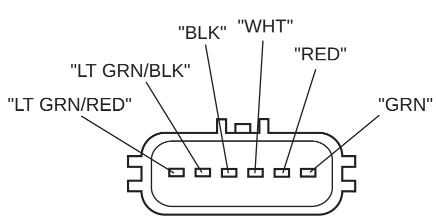
DTC Confirmation Procedure

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

- **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.**

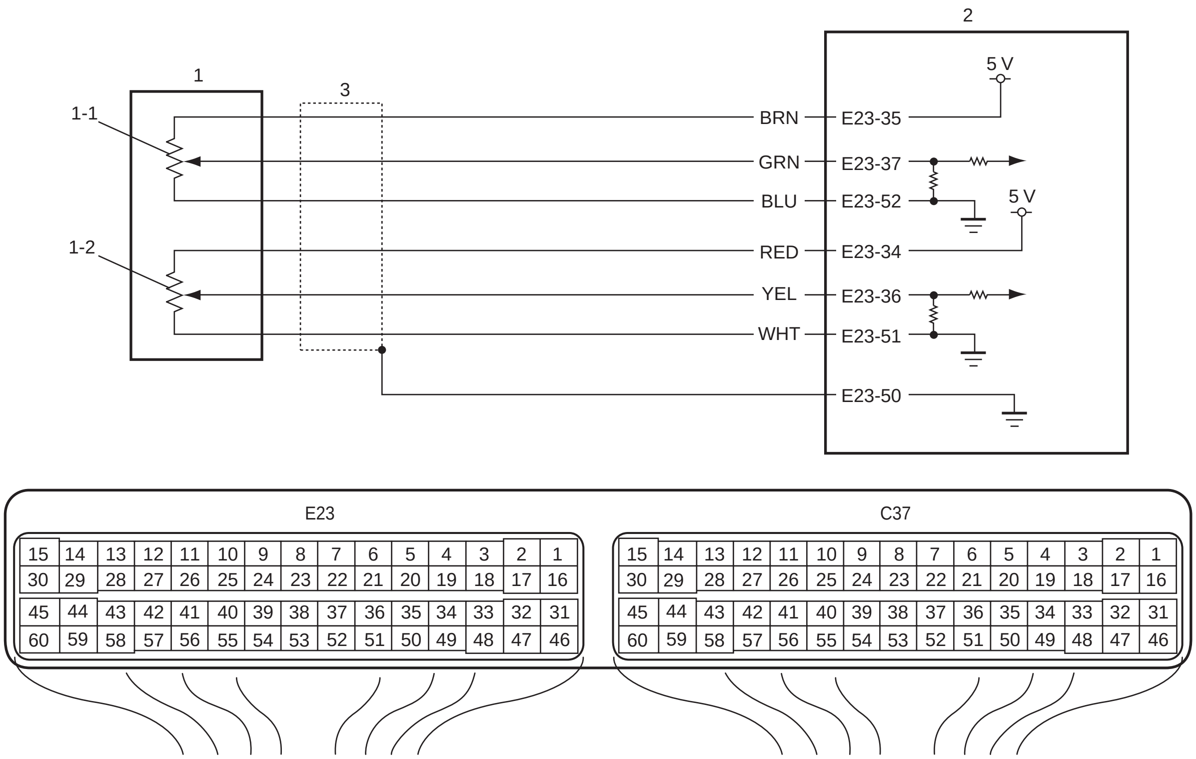
Step	Action	Yes	No
1	*Was "Engine and Emission Control System Check" performed?*	Go to Step 2.	Go to "Engine and Emission Control System Check".
2	**Throttle position sensor and its circuit check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch, check each voltage 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 with ignition switch turned OFF. 2) Check for proper connection to electric throttle body at "RED", "GRN", "WHT" and "BLK" wire terminals.  I4RS0B110022-02 3) If OK, measure voltage between "RED" wire terminal of electric throttle body connector and engine ground with ignition switch turned ON. *Is voltage 4 – 6 V?*	Go to Step 6.	Go to Step 4.

Step	Action	Yes	No
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.
6	**Wire harness check** 1) Measure voltage between “GRN” wire terminal of electric throttle body connector and engine ground, between “WHT” wire terminal of electric throttle body 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 connector and engine ground, between “WHT” wire terminal of electric throttle body 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 check** 1) Check TP sensor referring to “Throttle Position Sensor Performance Check” under “Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”. *Is each output voltage within specified value?*	Substitute a known-good ECM and recheck.	Replace electric throttle body.

DTC P2138: Throttle / Pedal Position Sensor / Switch “D”/“E” (Main / Sub) Voltage Correlation

S7RS0B1104077

Wiring Diagram



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1. APP sensor	1-2. APP sensor (sub)	3. Ground of APP sensor for shield wire
1-1. APP sensor (main)	2. ECM	

DTC Detecting Condition and Trouble Area

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

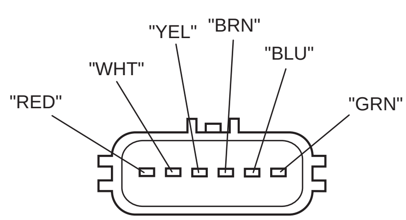
DTC Confirmation Procedure

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

- **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	**APP 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 APP sensor with ignition switch turned OFF. 2) Check for proper connection to APP sensor at “BRN”, “GRN”, “BLU”, “RED”, “YEL” and “WHT” wire terminals.  I4RS0B110048-01 3) If OK, measure voltage between “BRN” wire terminal of APP sensor connector and vehicle body ground, between “RED” wire terminal of APP sensor 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.
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.

Step	Action	Yes	No
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 APP sensor connector and vehicle body ground, between “YEL” wire terminal of APP sensor 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	**APP sensor check** 1) Check APP sensor referring to “APP Sensor Assembly Inspection in Section 1C”. *Is output voltage within specified value?*	Substitute a known-good ECM and recheck.	Replace APP sensor assembly.

DTC P2227 / P2228 / P2229: Barometric Pressure Circuit Malfunction

S7RS0B1104078

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, monitoring once par driving cycle)	• 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.

DTC Troubleshooting

NOTE

- **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 / Barometric Pressure Circuit Low Input" and/or "DTC P0108: Manifold Absolute Pressure / Barometric 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

S7RS0B1104079

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

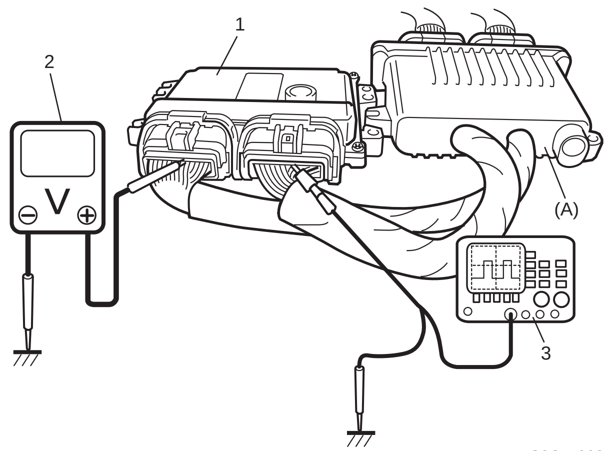
1) Remove ECM (1) from its bracket referring to “ECM Removal and Installation in Section 1C”.
2) Connect special tool between ECM and ECM connectors securely.

Special tool
(A): 09933–06320

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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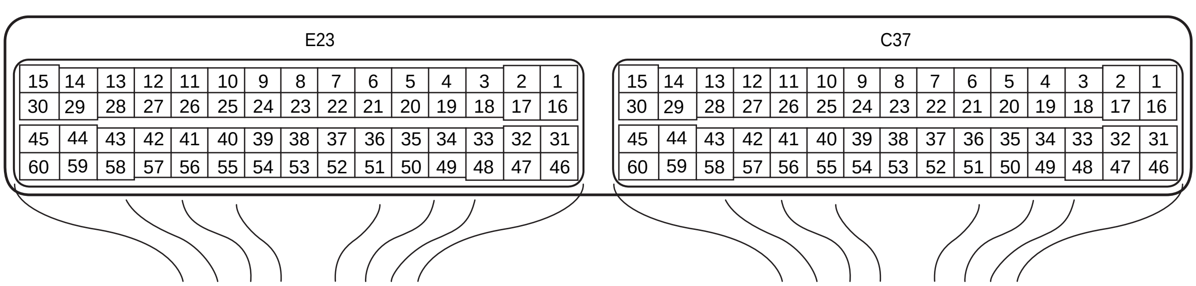
- **Before this inspection, be sure to read the “Precautions of ECM Circuit Inspection”.**

Viewed from harness side



I4RS0A110055-01

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.22: ”)	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.
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.22: ”)	Engine running at idle after warmed up engine.	Output signal is active high pulse. Pulse frequency varies depending on engine speed.
C37-7	—	—	—	—	—
C37-8	BRN/WHT	Generator field coil monitor signal	10 – 14 V	Ignition switch turned ON.	Signal is duty pulse. Duty ratio varies depending on vehicle condition.
			*0 – 1 V ↑↓ 10 – 14 V (“Reference waveform No.8: ”)	Engine running at idle after warmed up engine.	
C37-9	—	—	—	—	—

Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
C37-10	WHT	Oxygen signal of HO2S-1	0 – 1 V	Ignition switch turned ON.	—
			*Deflects between over 0.5 V and under 0.45 V (“Reference waveform No.10: ” and “Reference waveform No.11: ”)	While engine running at 2,000 r/min. for 1 min. or longer after warmed up.	
C37-11	BRN	Oxygen signal of HO2S-2	4 – 5 V	Ignition switch turned ON.	—
			*Deflects between over 0.5 V and under 0.45 V (“Reference waveform No.12: ”)	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 (A/T model)	*0.5 – 2.5 V (“Reference waveform No.13: ”)	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 (A/T model)	*2.5 – 4.5 V (“Reference waveform No.13: ”)		
C37-14	GRY/RED	Output of 5 V power source for MAP sensor, A/C refrigerant pressure sensor	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.14: ”)	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.15: ”)	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.
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.

Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
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.16: ” and “Reference waveform No.17: ”)	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.16: ” and “Reference waveform No.17: ”)	Engine running at idle after warmed 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	—	—	—	—	—
C37-23	PNK/ BLU	Electric load current sensor signal	3.8 – 4.2 V	Ignition switch turned ON.	—
			3.0 – 3.4 V	Ignition switch turned ON and headlight switch turned ON (HI beam).	
			2.3 – 2.7 V	Ignition switch turned ON, headlight switch turned ON (HI beam) and blower selector at HI position.	
C37-24	LT GRN	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	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	MAF sensor signal	0.5 – 1.5 V	Ignition switch turned ON with engine at stop.	—
			1.5 – 2.0 V (“Reference waveform No.18: ”)	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	BLU/ YEL	Generator control signal output	*0 – 0.6 V ↑↓ 5 – 8 V (“Reference waveform No.19: ”)	Engine running at idle speed, headlight switch turned ON.	Output signal is active low duty pulse. Duty ratio varies depending on vehicle condition.
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.20: ”)	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.
C37-30	BLK	Ground for ECM	Below 0.3 V	Ignition switch turned ON.	—
C37-31	—	—	—	—	—

Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
C37-32	—	—	—	—	—
C37-33	—	—	—	—	—
C37-34	—	—	—	—	—
C37-35	—	—	—	—	—
C37-36	—	—	—	—	—
C37-37	—	—	—	—	—
C37-38	—	—	—	—	—
C37-39	—	—	—	—	—
C37-40	WHT	TP sensor (sub) signal	1.57 – 1.09 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	Below 0.3 V	Ignition switch turned ON.	—
C37-42	BLK	Ground for TP sensor	Below 0.3 V	Ignition switch turned ON.	—
C37-43	RED	Output for 5 V power source of TP sensor	4.5 – 5.5 V	Ignition switch turned ON.	—
C37-44	LT GRN/ BLK	Output of throttle actuator	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.21: ”)	Ignition switch turned ON and accelerator pedal at full depressed position after warmed up engine.	
C37-45	LT GRN/ RED	Output of throttle actuator	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.21: ”)	Ignition switch turned ON and accelerator pedal at idle position after warmed up engine.	
C37-46	BLK/ RED	Heater output of HO2S-1	10 – 14 V	Ignition switch turned ON.	—
			*0 – 2 V ↑↓ 10 – 14 V (“Reference waveform No.10: ” and “Reference waveform No.11: ”)	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 HO2S-2	10 – 14 V	Ignition switch turned ON.	—
			0 – 1 V (“Reference waveform No.12: ”)	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	—	—	—	—	—

Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
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	MAP sensor signal	Approx. 4 V (“Reference waveform No.23: ”)	Ignition switch turned ON with barometric pressure at 100 kPa, 760 mmHg.	—
			0.4 – 2.0 V (“Reference waveform No.24: ”)	While engine running at specified idle speed after warmed up with barometric pressure at 100 kPa, 760 mmHg.	
C37-54	GRN	TP sensor (main) signal	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.	—
C37-56	RED	Knock sensor signal	2 – 3 V (“Reference waveform No.25: ” and “Reference waveform No.26: ”)	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/GRN	Oil control valve ground	Below 1.3 V	Ignition switch turned ON.	—
C37-60	YEL/RED	Oil control valve output	*0 – 0.6 V ↑↓ 10 – 14 V (“Reference waveform No.27: ” and “Reference waveform No.28: ”)	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 ABS control module, BCM, combination meter	*2.5 – 4.5 V (“Reference waveform No.29: ”)	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.

Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
E23-4	BRN	Engine revolution signal output for P/S control module	0 – 0.8 V	Ignition switch turned ON with engine at stop.	—
			*0 – 1 V ↑↓ 8 – 14 V (“Reference waveform No.30: ” and “Reference waveform No.31: ”)	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 DLC 12 V	8 – 14 V	Ignition switch turned ON.	—
E23-6	—	—	—	—	—
E23-7	—	—	—	—	—
E23-8	—	—	—	—	—
E23-9	—	—	—	—	—
E23-10	—	—	—	—	—
E23-11	—	—	—	—	—
E23-12	BLU	Diagnosis switch terminal (Hong Kong model)	4 – 5 V	Ignition switch turned ON.	—
E23-13	YEL/RED	Clock signal for immobilizer coil antenna	10 – 14 V	Ignition switch turned ON.	—
E23-14	—	—	—	—	—
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 ABS control module, BCM, combination meter	*0.5 – 2.5 V (“Reference waveform No.29: ”)	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	—	—	—	—	—

Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
E23-25	PPL	Vehicle speed signal output for P/S control module	*0 – 1 V ↑↓ 10 – 14 V (“Reference waveform No.32: ”)	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	Below 0.3 V	Ignition switch turned ON.	—
E23-32	RED/YEL	Power supply of throttle actuator drive circuit	10 – 14 V	Ignition switch turned ON.	—
E23-33	—	—	—	—	—
E23-34	RED	Output for 5 V power source of APP sensor (sub)	4.5 – 5.5 V	Ignition switch turned ON.	—
E23-35	BRN	Output for 5 V power source of APP sensor (main)	4.5 – 5.5 V	Ignition switch turned ON.	—
E23-36	YEL	APP sensor (sub) signal	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	YEL	APP sensor (main) signal	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	—	—	—	—	—

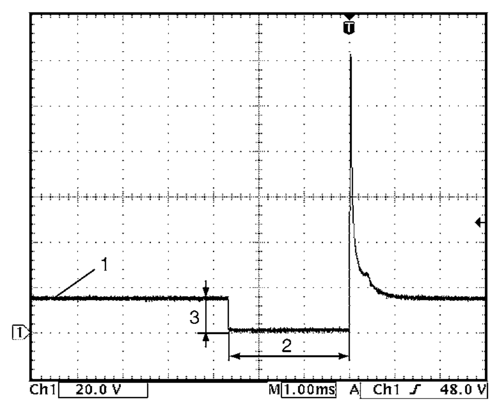
Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
E23-45	BLU/ ORN	Throttle actuator control relay output	0 – 1 V	Ignition switch turned ON.	—
E23-46	LT GRN	Radiator cooling fan relay No.1 output	10 – 14 V	Ignition switch turned ON, engine coolant temp.: below 95 °C (203 °F), or A/C refrigerant 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	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 APP sensor	Below 0.3 V	Ignition switch turned ON.	—
E23-51	WHT	Ground for APP sensor (sub)	Below 0.3 V	Ignition switch turned ON.	—
E23-52	BLU	Ground for APP sensor (main)	Below 0.3 V	Ignition switch turned ON.	—
E23-53	—	—	—	—	—
E23-54	ORN	Ground for sensors	Below 0.3 V	Ignition switch turned ON.	—

Terminal No.	Wire color	Circuit	Normal voltage	Condition	Remarks
E23-55	RED	A/C refrigerant pressure sensor signal	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 (manual A/C model)	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



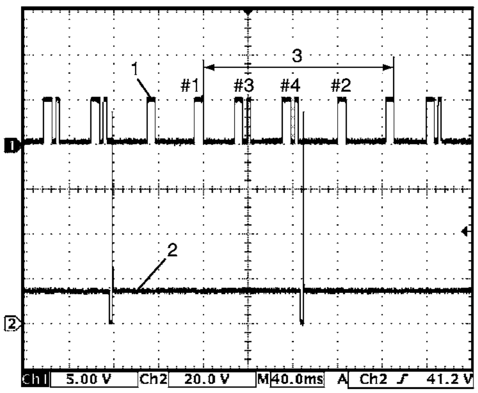
I4RS0B110050-01

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



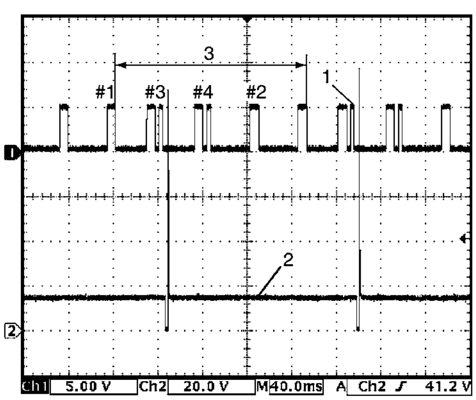
I6RS0C110028-01

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



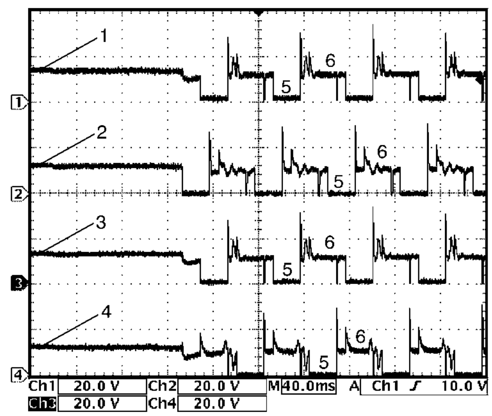
I6RS0C110029-01

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



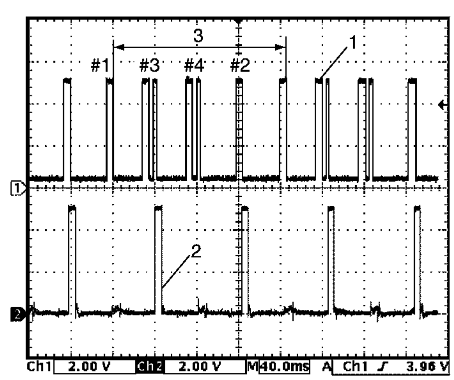
I4RS0B110053-01

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



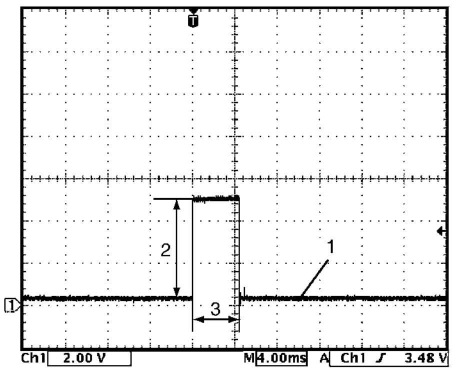
I6RS0C110030-01

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



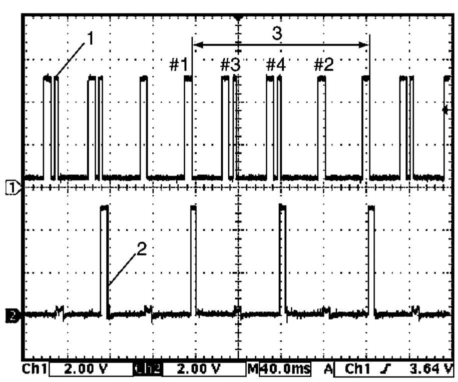
I4RS0B110055-02

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



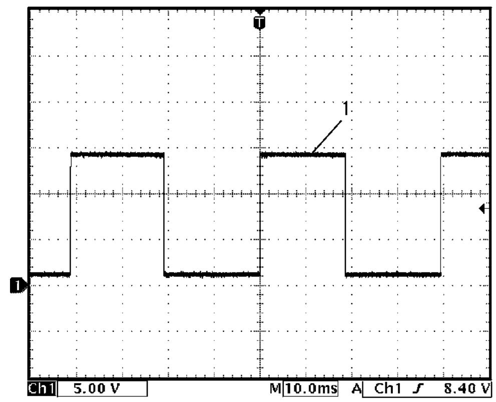
I6RS0C110031-01

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

Reference waveform No.8

Generator field coil monitor signal (1) at engine idling

Measurement terminal	CH1: “C37-8” to “C37-58”
Oscilloscope setting	CH1: 5 V/DIV TIME: 10 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed • Lighting switch at CLEARANCE position

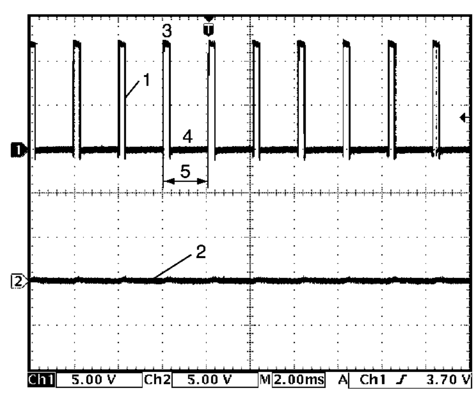


I5RS0C110016-01

Reference waveform No.9

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



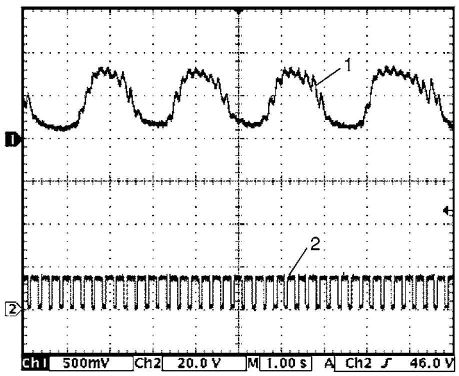
I4RS0B110081-02

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.10

HOS2-1 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



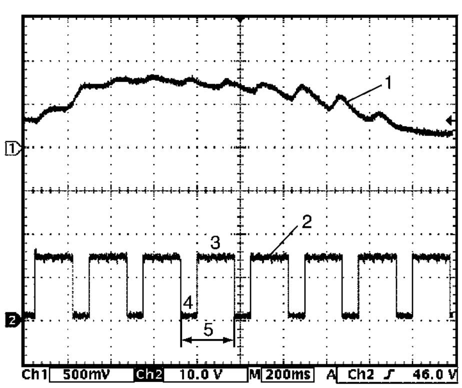
I4RS0B110058-01

2.	HO2S-1 heater signal

Reference waveform No.11

HO2S-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



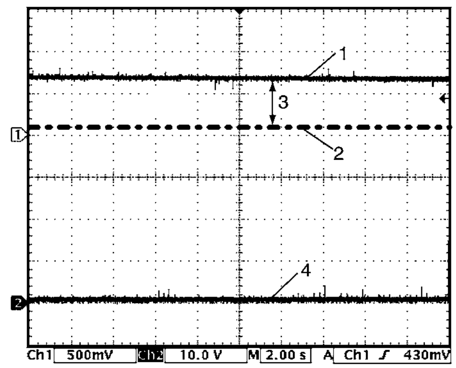
I4RS0B110059-01

1.	HO2S-1 signal
3.	OFF signal
4.	ON signal
5.	One duty cycle

Reference waveform No.12

HO2S-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 • Vehicle driving at 60 km/h (37 mph) for 10 min. • Engine at specified idle speed



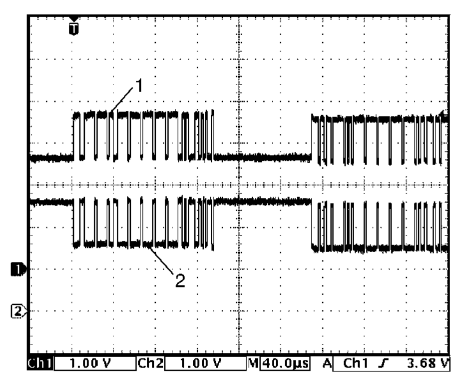
I4RS0B110060-01

1.	HO2S-2 signal upper limit
2.	HO2S-2 signal lower limit
3.	Normal waveform range

Reference waveform No.13

CAN communication line signal from TCM 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)



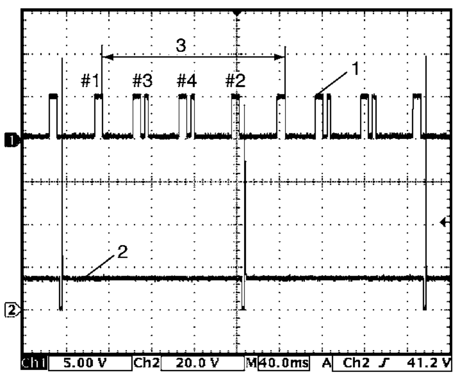
I4RS0B110061-01

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

Reference waveform No.14

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



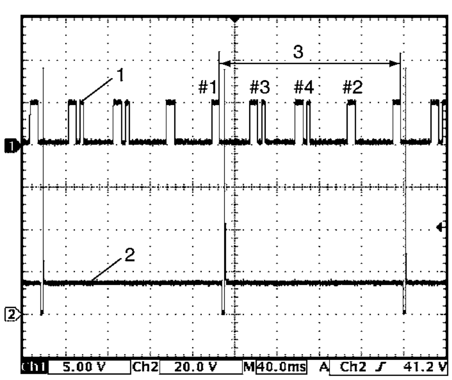
I6RS0C110032-01

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

Reference waveform No.15

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



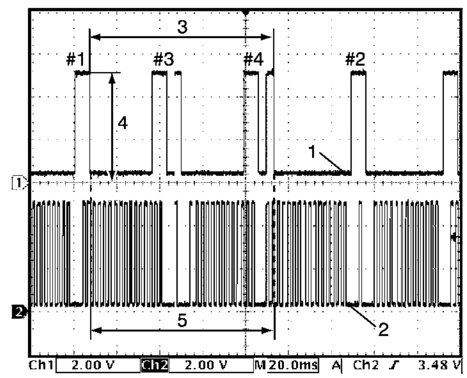
I6RS0C110033-01

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

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: 20 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed



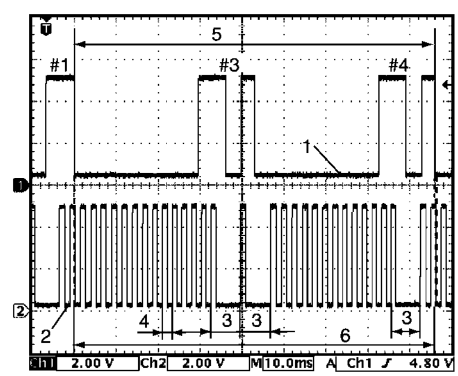
I6RS0C110034-01

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.17

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



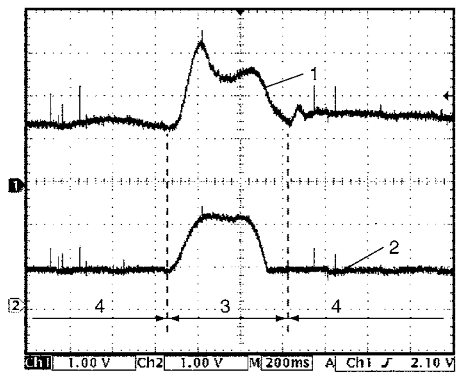
I6RS0C110035-01

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.18

MAF 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



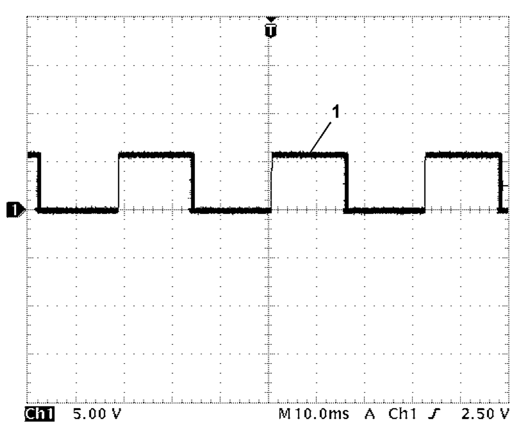
I4RS0B110066-01

2.	TP sensor signal
3.	Racing
4.	Idle

Reference waveform No.19

Generator control signal (1) at engine idling

Measurement terminal	CH1: "C37-28" to "C37-58"
Oscilloscope setting	CH1: 5 V/DIV TIME: 10 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed • For a few sec. from headlight switch turned ON

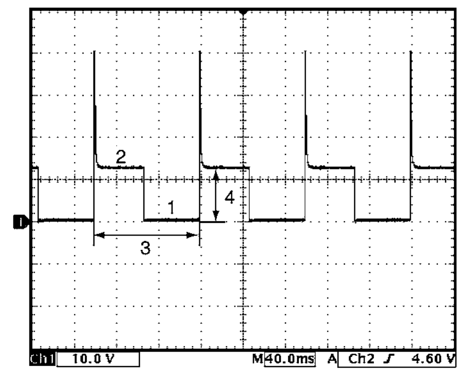


I7RS0B110015-01

Reference waveform No.20

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 • EVAP canister purge valve setting at 52% by using "Misc Test" of scan tool



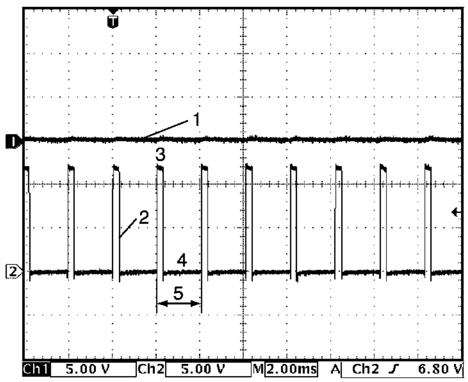
I4RS0B110067-01

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

Reference waveform No.21

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



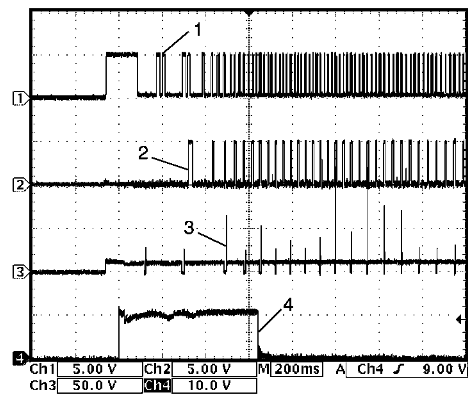
I4RS0B110082-02

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.22

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



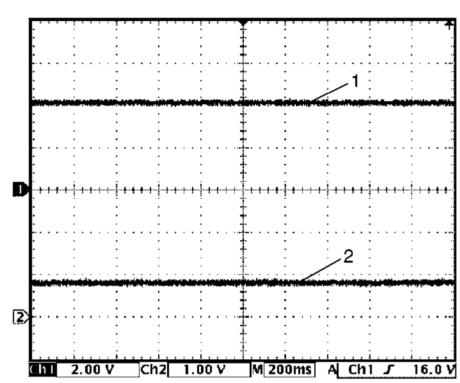
I6RS0C110038-01

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

Reference waveform No.23

MAP 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



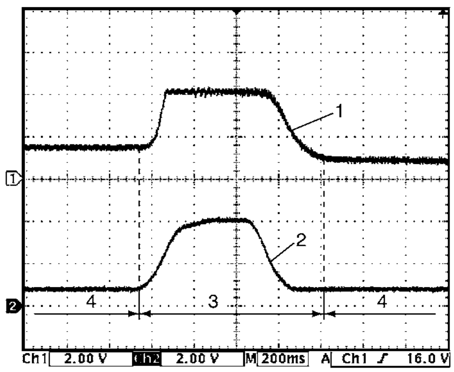
I4RS0B110070-01

2.	TP sensor signal

Reference waveform No.24

MAP 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



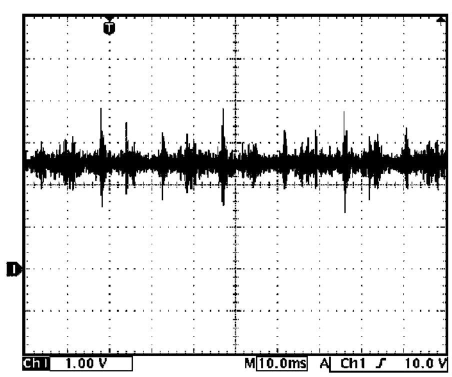
I4RS0B110071-01

2.	TP sensor signal
3.	Racing
4.	Idle

Reference waveform No.25

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 • Engine running at 4000 r/min.

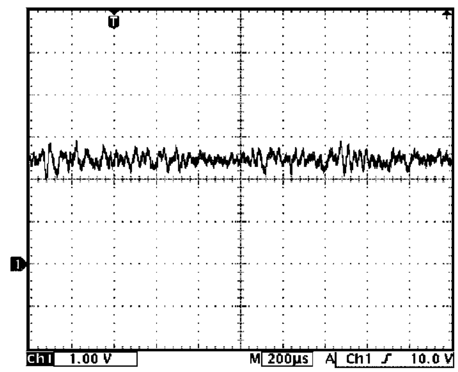


I4RS0B110072-01

Reference waveform No.26

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 • Engine running at 4000 r/min.

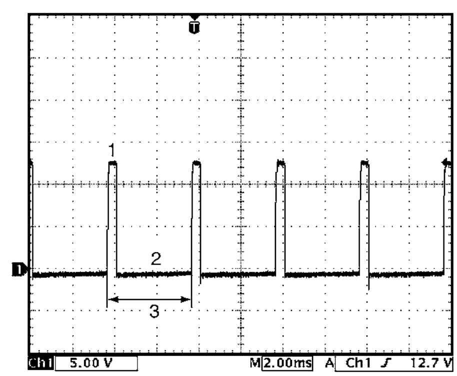


I4RS0B110073-01

Reference waveform No.27

Oil control valve signal with engine idling

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



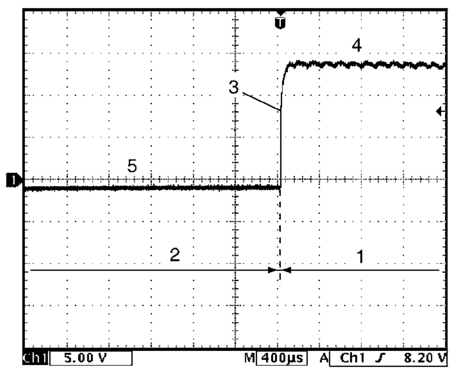
I4RS0B110074-01

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

Reference waveform No.28

Oil control valve signal with engine racing

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 • Vehicle driving at 20 km/h (12 mph) and depress accelerator pedal fully



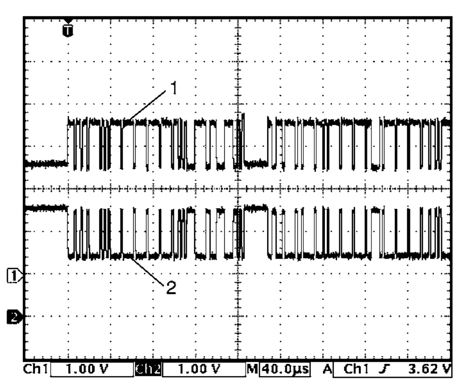
I4RS0B110075-01

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

Reference waveform No.29

CAN communication line signal from each control module 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)



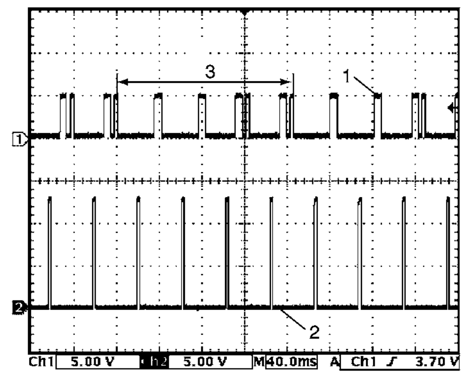
I4RS0B110076-01

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

Reference waveform No.30

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



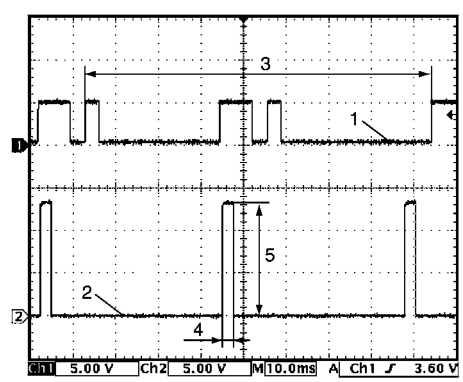
I6RS0C110036-01

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

Reference waveform No.31

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



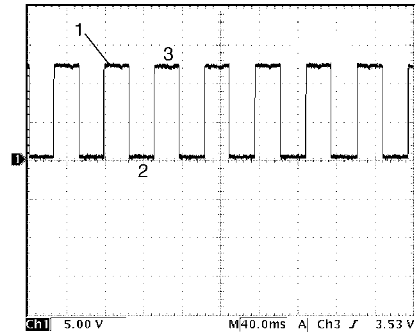
I6RS0C110037-01

1.	Cylinder reference signal (CMP reference signal)
3.	360° crank angle
4.	2 to 4 msec.
5.	10 – 14 V

Reference waveform No.32

VSS signal at 30 km/h (19 mph)

Measurement terminal	CH1: "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 • Vehicle driving at 30 km/h (19 mph)



I6RS0C110047-01

1.	VSS signal for EPS control module
2.	ON
3.	OFF

Resistance Check

1) Remove ECM from its bracket referring to "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.

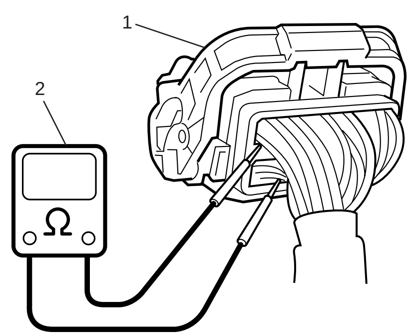
NOTE

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

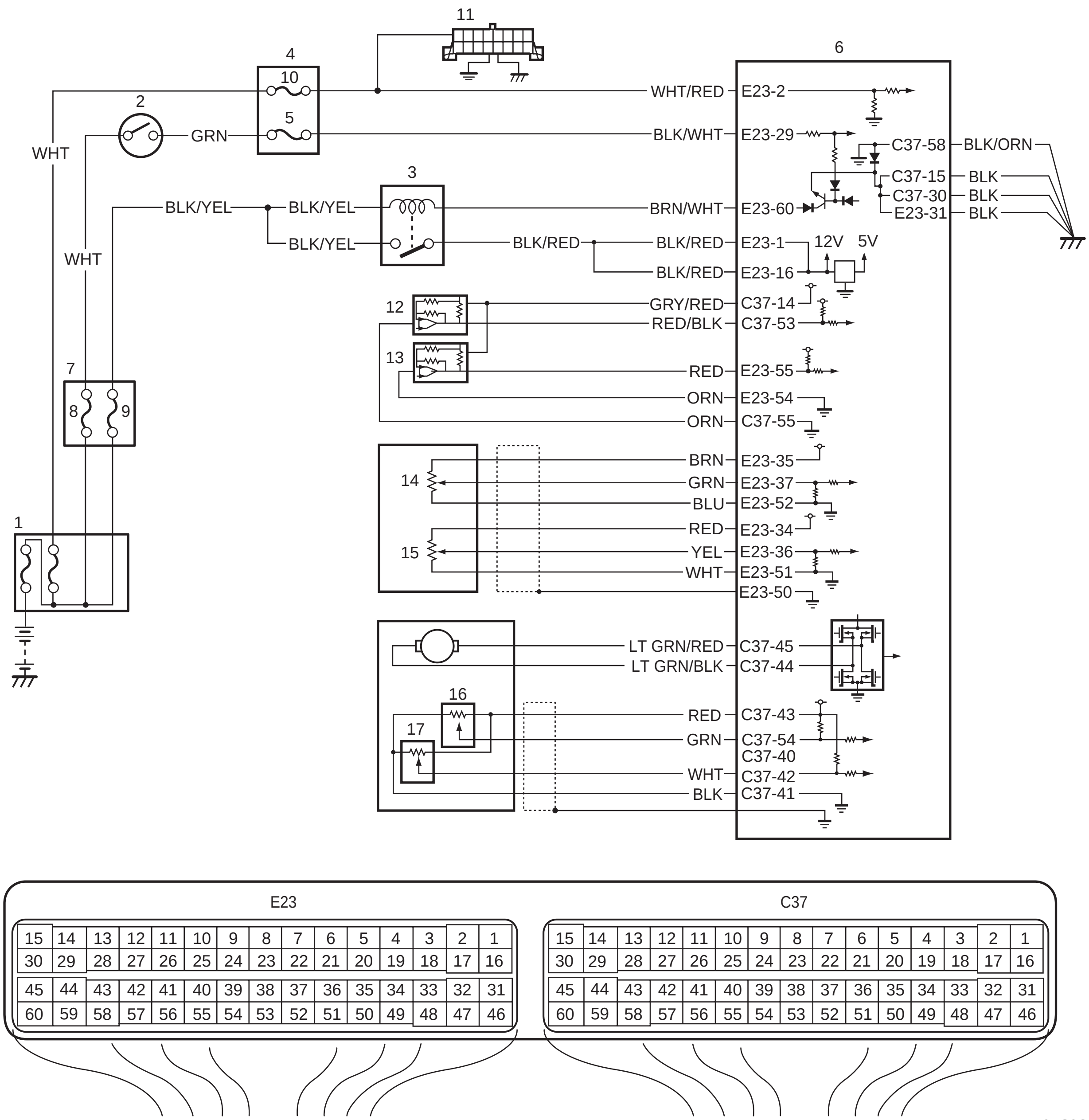
Terminals	Circuit	Standard resistance	Condition
C37-47 to E23-29	Heater of HO2S-2	4 – 15 Ω	—
E23-46 to E23-1/16	Radiator cooling fan relay No.1	160 – 240 Ω	—
E23-60 to E23-29	Main relay	160 – 240 Ω	Battery disconnected and ignition switch turned ON
E23-15 to E23-29	Fuel pump relay	160 – 240 Ω	—
C37-16 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	—

Terminals	Circuit	Standard resistance	Condition
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	160 – 240 Ω	—
C37-60 to C37-59	Oil control valve	6 – 15 Ω	—
E23-45 to E23-1/16	Throttle actuator control relay	160 – 240 Ω	—

ECM Power and Ground Circuit Check

S7RS0B1104080

Wiring Diagram



I6RS0C110039-01

1. Main fuse box	7. Individual circuit fuse box No.1	13. A/C refrigerant pressure sensor (if equipped with A/C)
2. Ignition switch	8. “IG ACC” fuse	14. APP sensor (main)
3. Main relay	9. “FI” fuse	15. APP sensor (sub)
4. BCM (included in junction block assembly)	10. “RADIO” fuse	16. TP sensor (main)
5. “IG COIL” fuse	11. DLC	17. TP sensor (sub)
6. ECM	12. MAP sensor	

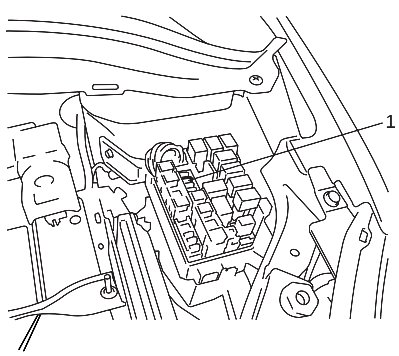
Circuit Description

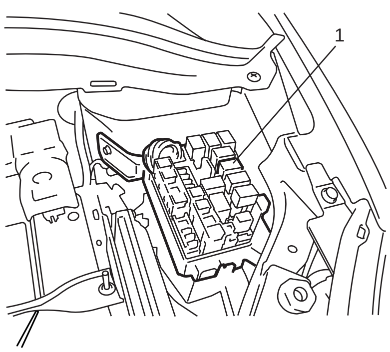
When the ignition switch is turned ON, the main relay turns ON (the contact point closes) and the main power is supplied to ECM.

Troubleshooting

NOTE

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) in individual circuit fuse box No.1 for blowing.  I4RS0A110016-01 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.

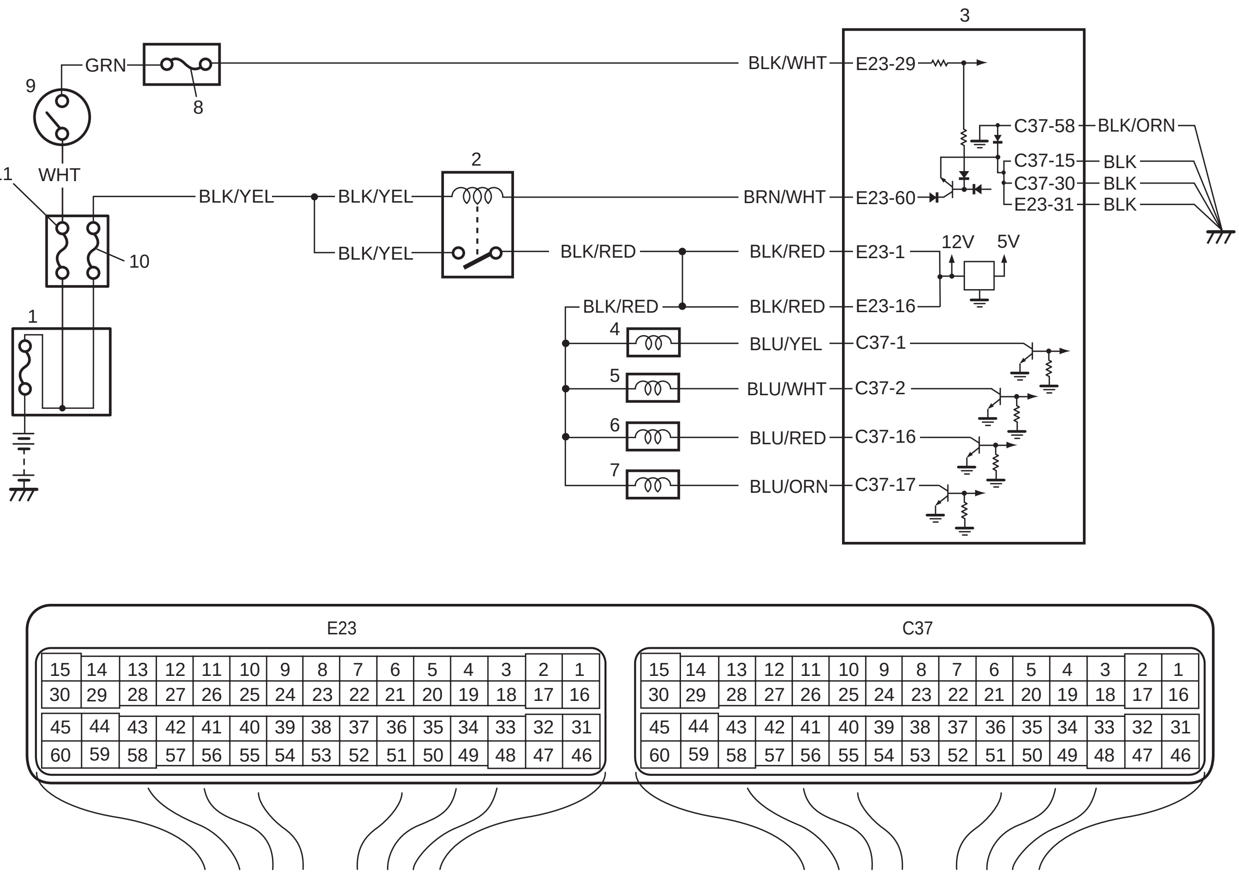
Step	Action	Yes	No
5	**Main relay circuit check** 1) Connect connectors to ECM with ignition switch turned OFF. 2) Turn ignition switch to ON position. 3) Measure voltage between “E23-60” terminal of ECM connector and body ground. *Is voltage 0 – 1 V?*	Go to Step 7.	Go to Step 6.
6	**ECM ground circuit 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.  I4RS0A110017-01 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.

Step	Action	Yes	No
10	**Main relay check** 1) Check main relay referring to “Main Relay, Fuel Pump Relay and Starting Motor Control Relay Inspection in Section 1C”. *Is main relay in good condition?*	“BRN/WHT” wire is open or high resistance circuit.	Replace main relay.
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” terminals 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, APP sensor, MAP sensor and A/C refrigerant pressure sensor (if equipped with A/C) with ignition switch turned OFF. 2) Measure each resistance between “C37-14”, “E23-35”, “E23-34” and “C37-43” terminals of ECM connector and vehicle body ground. *Is each resistance infinity?*	Check internal short circuit of TP sensor, APP sensor, MAP sensor and/or A/C refrigerant pressure sensor (if equipped with A/C).	“GRY/RED” wire is shorted to ground circuit.

Fuel Injector Circuit Check

S7RS0B1104081

Wiring Diagram



I6RS0C110040-01

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	

Troubleshooting

NOTE

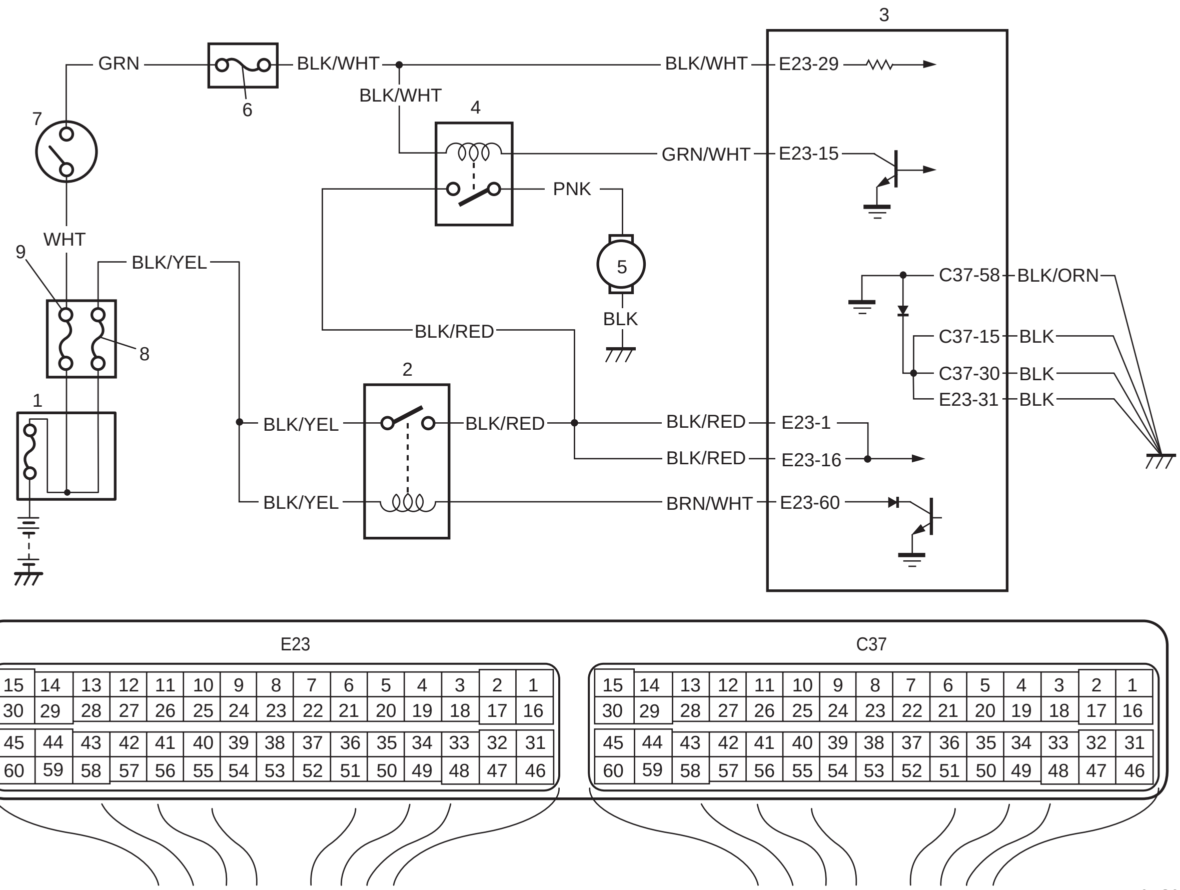
When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to “Inspection of ECM and Its Circuits”.

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

S7RS0B1104082

Wiring Diagram



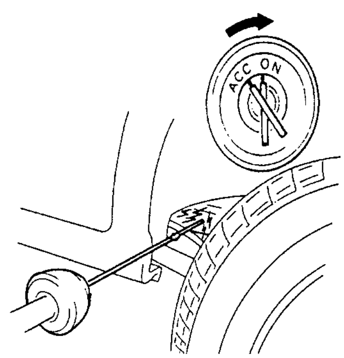
I6RS0C110041-01

1. Main fuse box	4. Fuel pump relay	7. Ignition switch
2. Main relay	5. Fuel pump	8. “FI” fuse
3. ECM	6. “IG COIL” fuse	9. “IG ACC” fuse

Troubleshooting

NOTE

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 and Starting Motor 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.

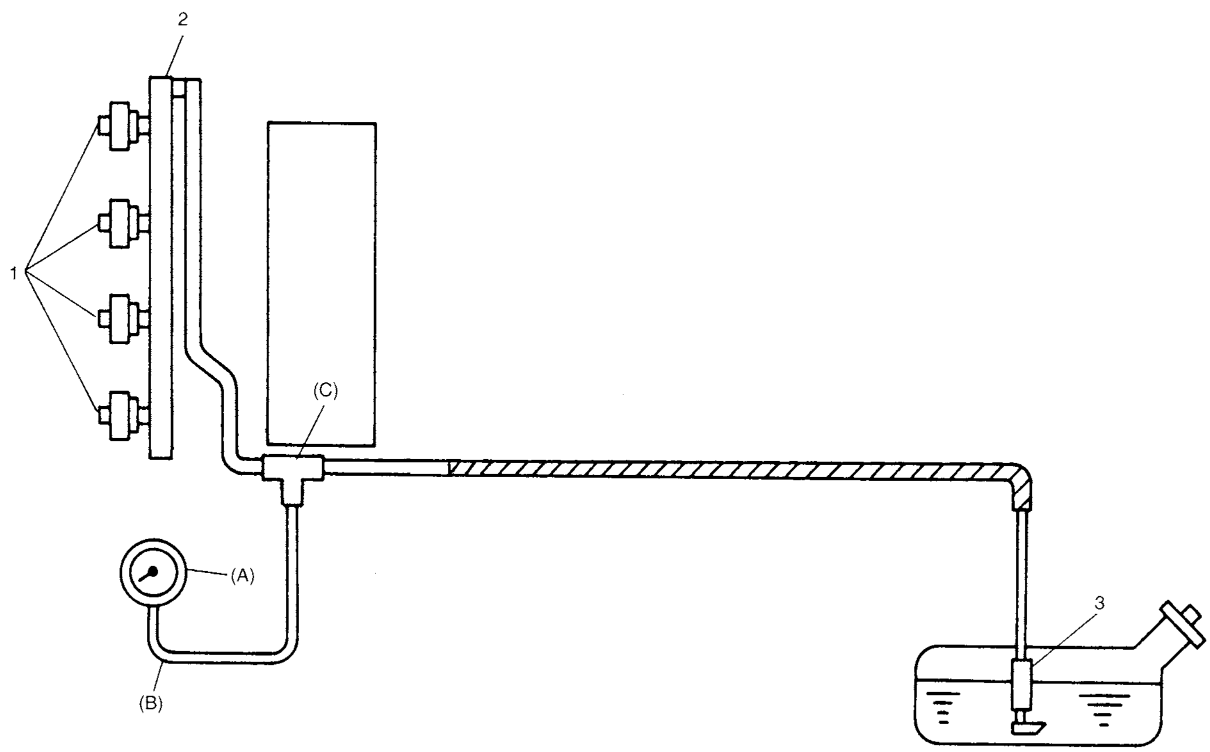
Step	Action	Yes	No
6	**Fuel pump relay drive signal check** 1) Measure voltage within 2 second after ignition switch is turned ON. *Is voltage 0 – 1 V?*	Go to Step 7.	Substitute a known-good ECM and recheck.
7	**Wire circuit check** 1) Turn OFF ignition switch. 2) Detach fuel tank referring to “Fuel 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

S7RS0B1104083

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

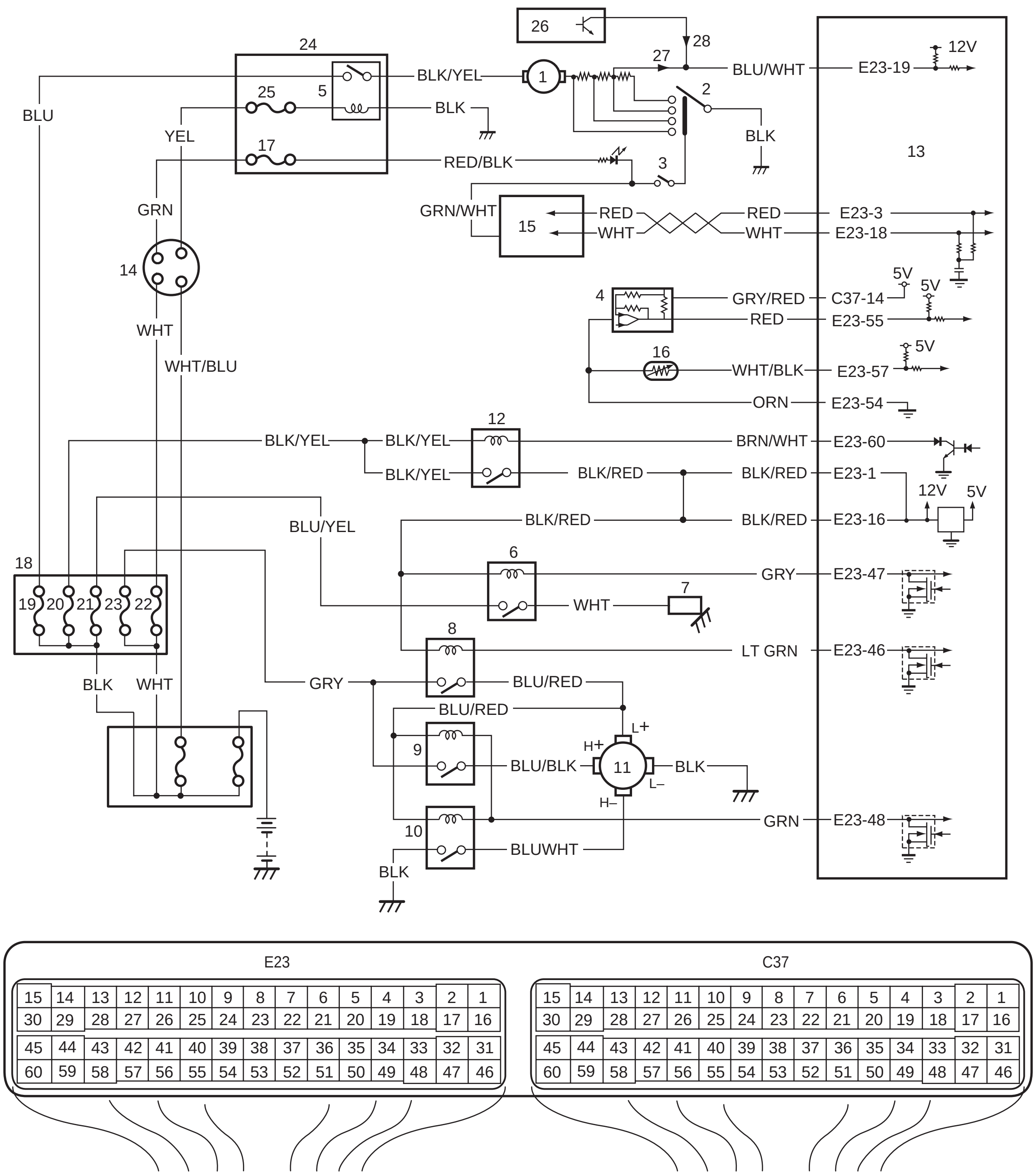
Before using following flow, check to make sure that battery voltage is higher than 11 V. If battery voltage is low, pressure becomes lower than specification even if fuel pump and line are in good condition.

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.
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.

A/C System Circuits Check

S7RS0B1104084

Wiring Diagram



I6RS0C110042-01

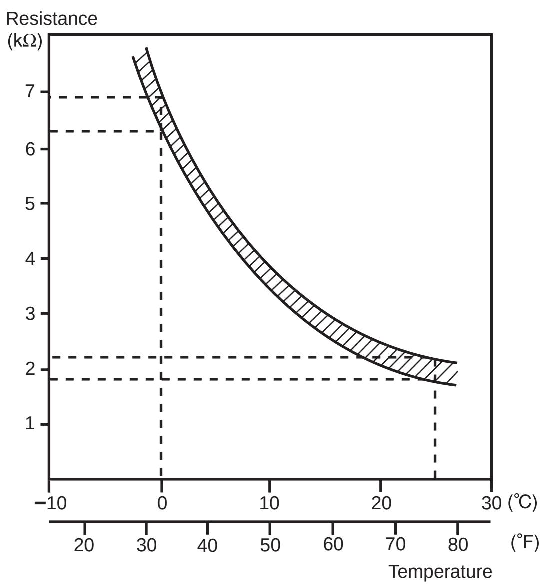
1. Blower fan motor	11. Radiator cooling fan motor	21. “A/C COMP” fuse
2. Blower fan switch	12. Main relay	22. “IG ACC” fuse
3. A/C switch	13. ECM	23. “RDTR FAN” fuse
4. A/C refrigerant pressure sensor	14. Ignition switch	24. Junction block assembly
5. Blower motor relay	15. BCM	25. “IG2 SIG” fuse
6. Compressor relay	16. Evaporator outlet air temp. sensor	26. HVAC control module
7. A/C compressor	17. “BACK” fuse	27. For manual A/C
8. Radiator cooling fan relay No.1	18. Individual circuit fuse box No.1	28. For automatic A/C
9. Radiator cooling fan relay No.2	19. “HTR FAN” fuse	
10. Radiator cooling fan relay No.3	20. “FI” fuse	

Troubleshooting

NOTE

- **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.

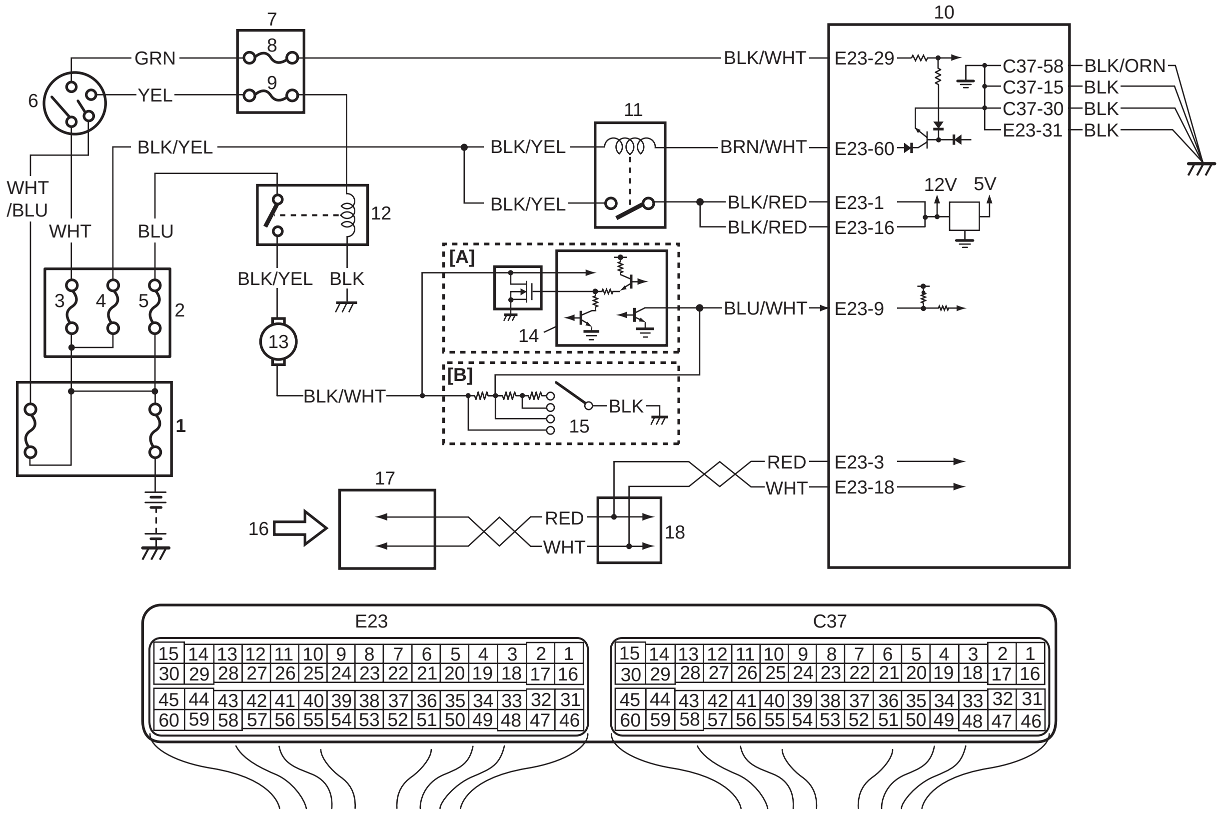
Step	Action	Yes	No
6	**A/C evaporator outlet air temp. sensor check** 1) Disconnect connectors from ECM with ignition switch turned OFF. 2) Check for proper connection to “E23-57” and “E23-54” wire terminals of ECM connector. 3) If OK, measure resistance between “E23-57” and “E23-54” wire terminals of ECM connector. **Evaporator temp. sensor resistance** **At 0 °C: 6.3 – 6.9 kΩ** **At 25 °C: 1.8 – 2.2 kΩ**  I3RB0A110053-01 *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. **<u>Voltage between “E23-47” terminal of ECM connector and ground</u>** **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” or “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” or “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

S7RS0B1104085

Wiring Diagram



I7RS0B110016-01

[A]:	Manual A/C model	6.	Ignition switch	13.	Blower motor
[B]:	Auto A/C model	7.	Junction block assembly	14.	HVAC control module
1.	Main fuse	8.	"IG COIL" fuse	15.	Blower speed selector
2.	Individual circuit fuse box No.1	9.	"IG2 SIG" fuse	16.	Electric load (rear defogger signal and headlight signal), etc.
3.	"IG ACC" fuse	10.	ECM	17.	BCM
4.	"FI" fuse	11.	Main relay	18.	ABS/ESP® control module
5.	"HTR FAN" fuse	12.	Blower motor relay		

Troubleshooting

NOTE

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".

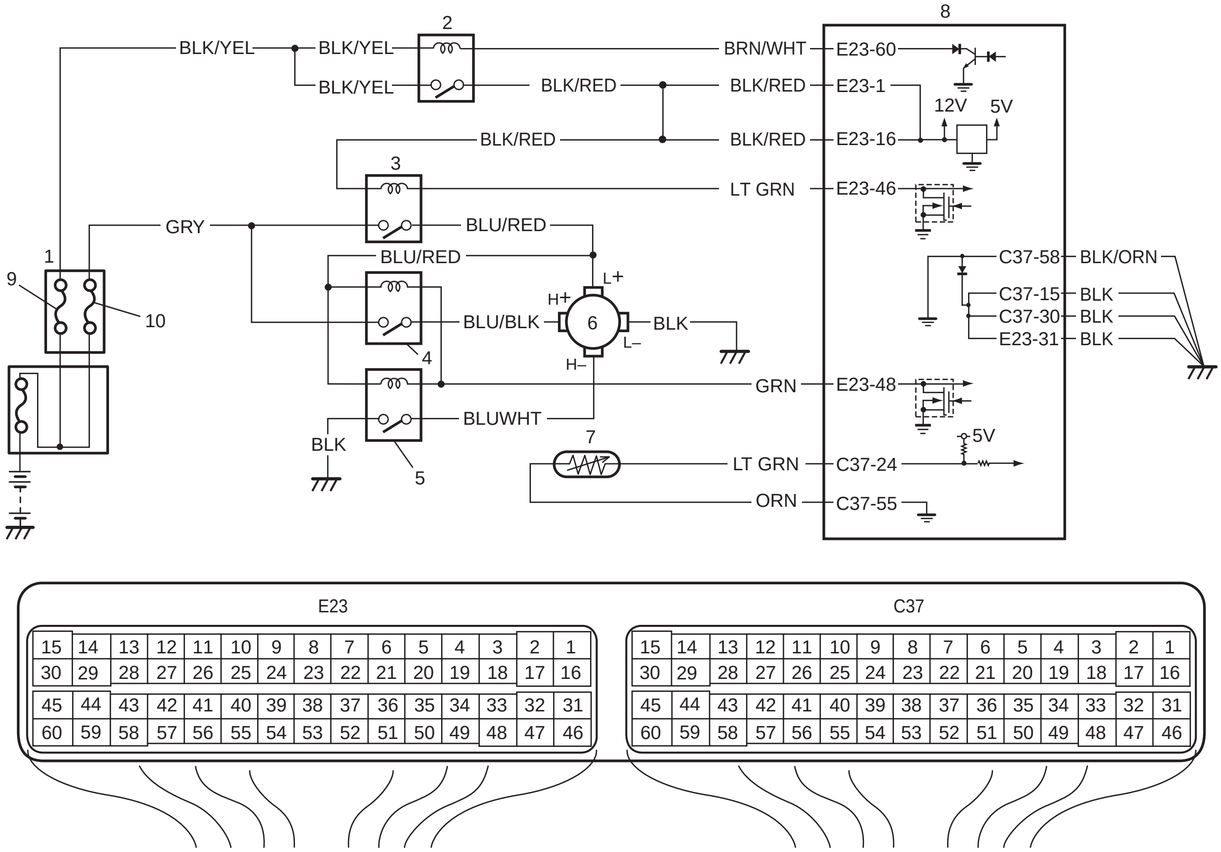
Step	Action	Yes	No
1	**DTC check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ON ignition switch and check DTC. *Is there any DTS(s) related to CAN?*	Go to applicable DTC diag. flow.	Go to Step 2.

Step	Action	Yes	No
2	**Electric load signal circuit check** 1) Start engine and select “Data List” mode on scan tool. 2) Check electric load signal under following conditions respectively. **<u>Blower fan signal (Manual A/C model)</u>** **Blower speed selector turned OFF or 1st position: OFF** **Blower speed selector turned to 2nd position or more: ON** **<u>Blower fan signal (Auto A/C model)</u>** **Blower speed selector OFF or 4th position or less: OFF** **Blower speed selector turned to 6th position or more: ON** **<u>Radiator fan signal</u>** **Engine coolant temperature is lower than 95 °C (103 °F): OFF** **Engine coolant temperature is higher than 97.5 °C (207.5 °F): ON** **<u>Electric load signal</u>** **Engine running, rear defogger switch, small light or headlight switch OFF: OFF** **Engine running, rear defogger switch, small light or headlight switch ON: ON** *Is check result satisfactory?*	Electric load signal circuit is in good condition.	Check defective signal circuit.

Radiator Cooling Fan Low Speed Control System Check

S7RS0B1104086

Wiring Diagram



I6RS0C110043-01

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	
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

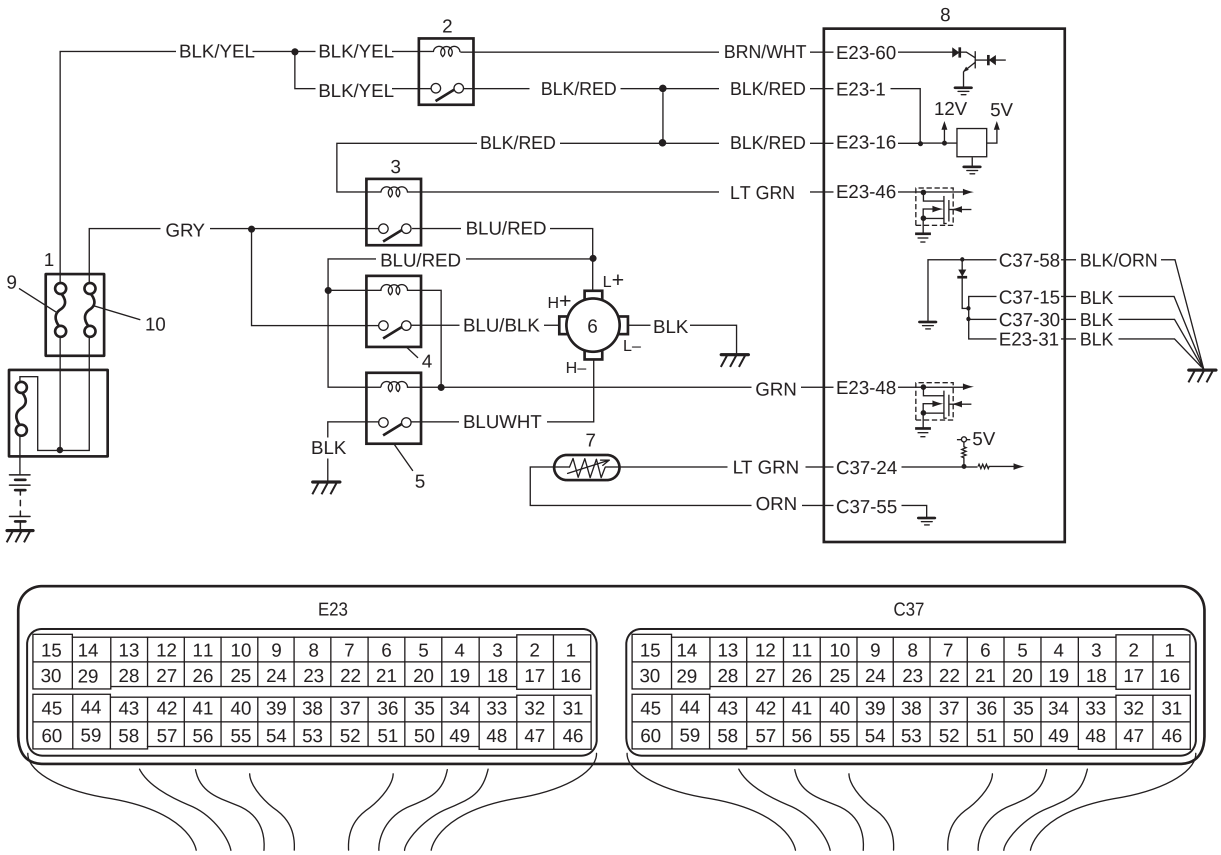
When measuring circuit voltage, resistance and/or pulse signal at ECM connector, connect the special tool to ECM and/or the ECM connectors referring to "Inspection of ECM and Its Circuits".

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

S7RS0B1104087

Wiring Diagram



I6RS0C110044-01

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	
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

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.

Step	Action	Yes	No
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.
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 and IAC Throttle Valve Opening Inspection

S7RS0B1106001

Before idle speed check, make sure of the following.

- Lead wires and hoses of electronic fuel injection and engine and emission control systems are connected securely.
- 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.

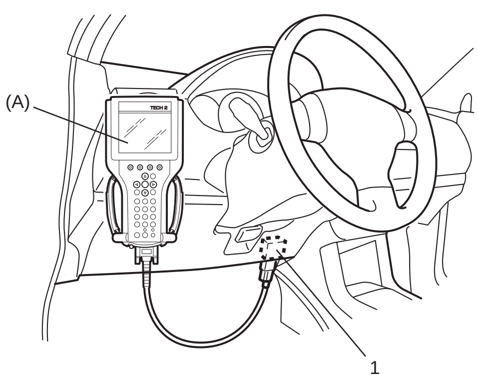
After all items are confirmed, check idle speed and IAC duty as follows.

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 throttle opening" by using "Data List" mode on scan tool to check "IAC throttle opening".
4) If check result is out of specification, inspect electric throttle body assembly referring to "Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C".

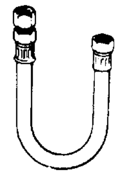
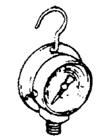
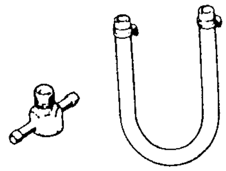
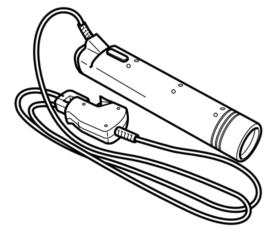
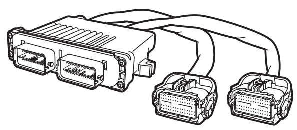
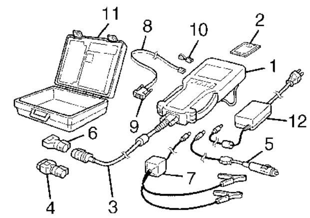
Engine idle speed
A/C OFF: 700 ± 50 rpm (IAC duty: 5 – 55%)
A/C ON: 850 ± 50 rpm

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.

Special Tools and Equipment

Special Tool

S7RS0B1108001

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) ☞ 
09933–06320 ECM check harness (120P) ☞ 	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 loop back adapter, 7. Battery power cable, 8. RS232 cable, 9. RS232 adapter, 10. RS232 loop back connector, 11. Storage case, 12.☞ / ☞ 

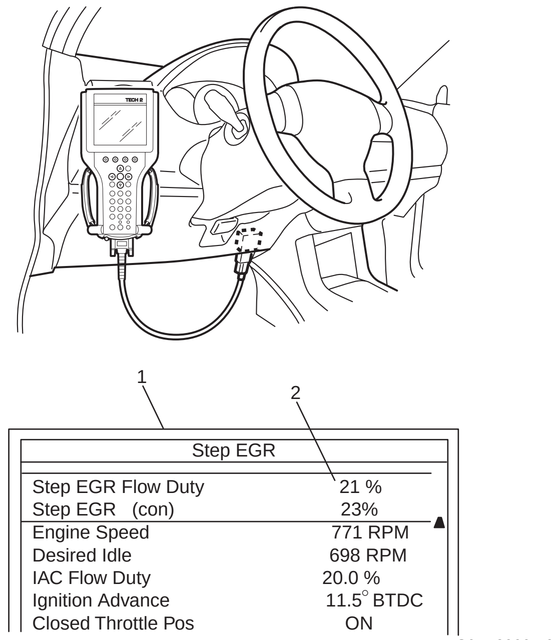
Aux. Emission Control Devices

Diagnostic Information and Procedures

EGR System Inspection

S7RS0B1204001

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

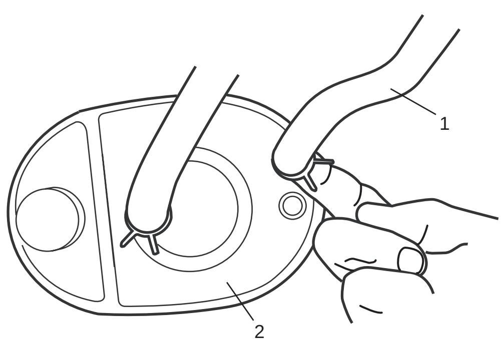
EVAP Canister Purge Inspection

S7RS0B1206001

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.



I6RS0C120001-01

EVAP Canister Purge Valve and Its Circuit Inspection

S7RS0B1206002

⚠ WARNING

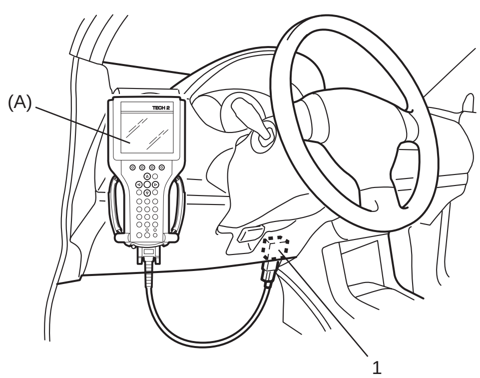
Do not apply vacuum by mouth; otherwise harmful fuel vapor can be breathed in.

⚠ 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



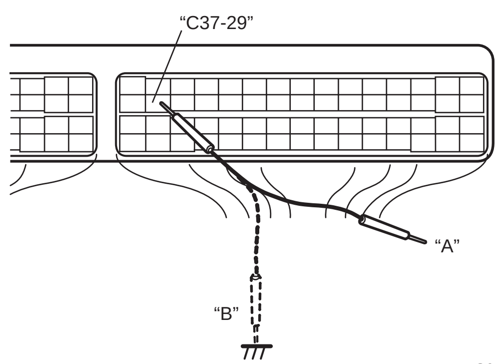
I4RS0B120003-03

   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 “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”).

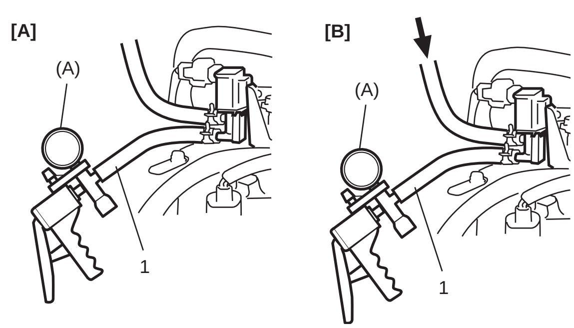


I4RS0B120006-02

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.

<u>**EVAP canister purge valve specification**</u>
[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

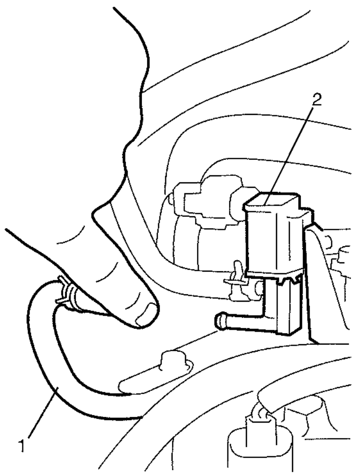


I3RB0A120005-02

Vacuum Passage Inspection

S7RS0B1206003

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

S7RS0B1206004

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

EVAP Canister Purge Valve Inspection

S7RS0B1206005

⚠ WARNING

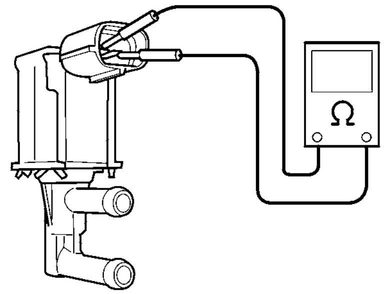
Do not apply vacuum by mouth; otherwise harmful fuel vapor can be breathed in.

⚠ 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 purge valve resistance
   30 – 34 Ω at 20 °C (68 °F)



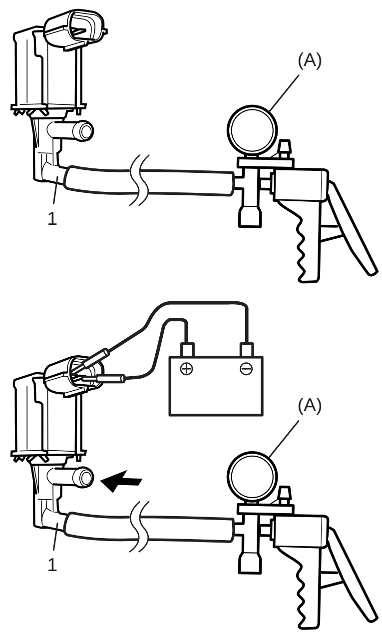
I3RM0A120008-01

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.

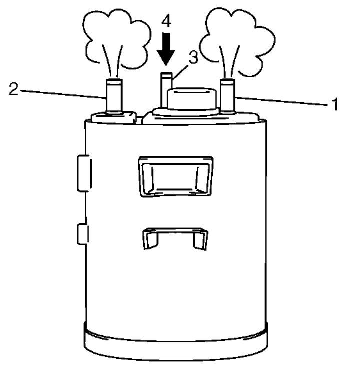
EVAP Canister Inspection

S7RS0B1206006

⚠ 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.



I4RS0A120006-01

EGR Valve Removal and Installation

S7RS0B1206007

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.

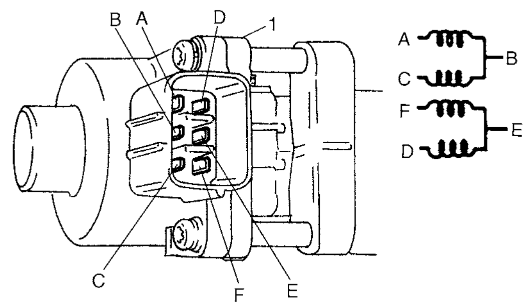
- Clean mating surface of valve and cylinder head.
- Use new gaskets.

EGR Valve Inspection

S7RS0B1206008

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



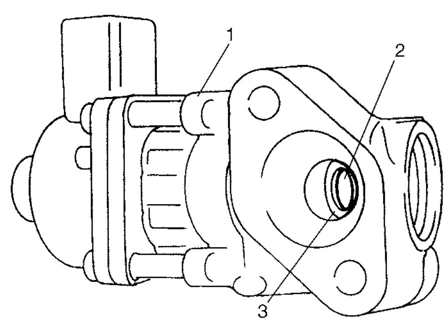
I2RH0B120005-01

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

S7RS0B1206009

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.

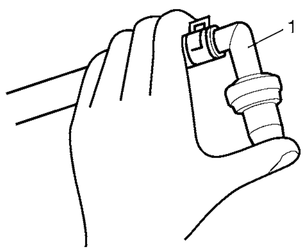
PCV Valve Inspection

S7RS0B1206010

NOTE

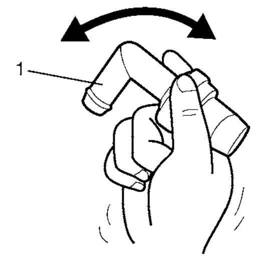
Be sure to check that there is no obstruction in PCV valve or its hoses before checking IAC duty, for obstructed PCV valve or hose hampers its accurate adjustment.

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.



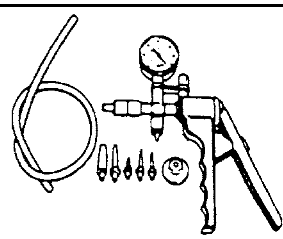
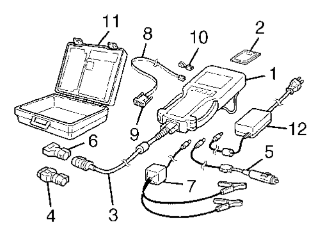
I2RH0B120008-01

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

Special Tools and Equipment

Special Tool

S7RS0B1208001

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 loop back adapter, 7. Battery power cable, 8. RS232 cable, 9. RS232 adapter, 10. RS232 loop back connector, 11. Storage case, 12. ☞	

Engine Electrical Devices

Repair Instructions

ECM Removal and Installation

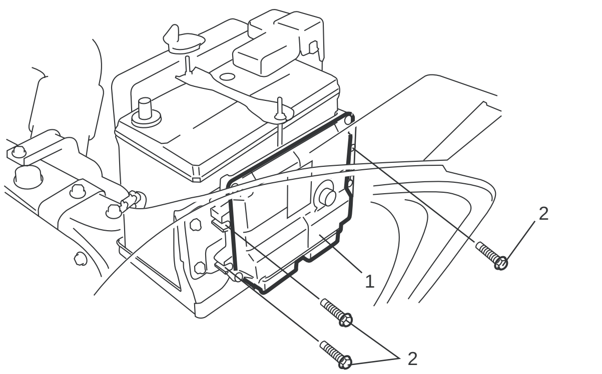
S7RS0B1306001

⚠ **CAUTION**

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

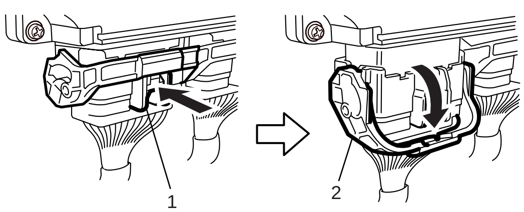
Removal

1) Disconnect negative (–) cable at battery.
2) Remove ECM (1) from its bracket by removing its mounting bolts (2).



I4RS0A130002-01

3) 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.

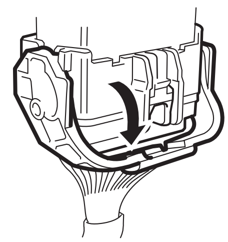


I4RS0A130003-01

Installation

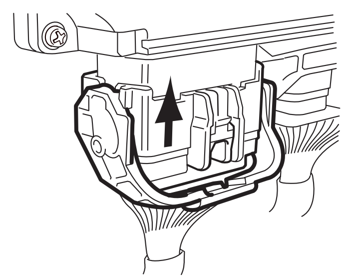
Reverse removal procedure noting the following:

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



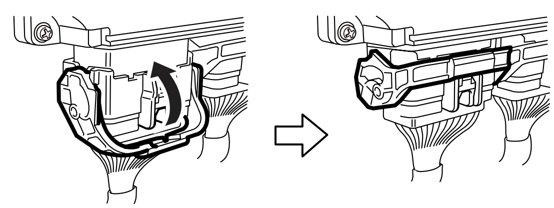
I4RS0B130021-01

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



I4RS0B130022-01

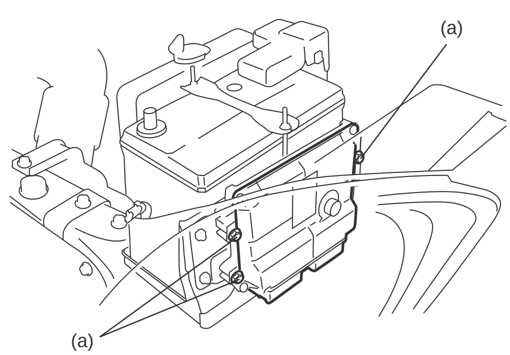
   c. Lock ECM connectors securely by pulling its lock lever up.



I4RS0A130004-01

- Tighten ECM mounting bolts to specified torque.

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



I4RS0A130005-01

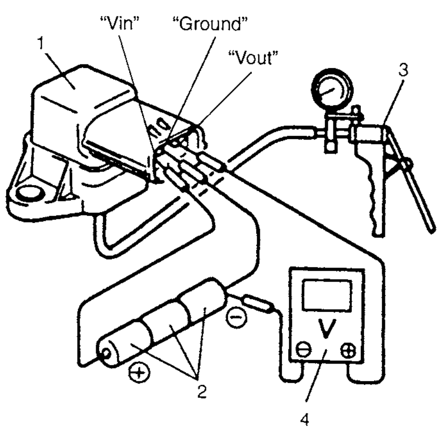
MAP Sensor Inspection

S7RS0B1306002

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.

Electric Throttle Body Assembly On-Vehicle Inspection

S7RS0B1306003

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 accurate 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

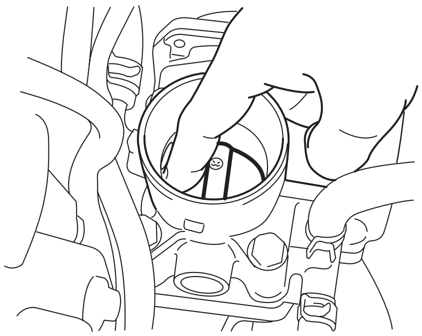
After replacing electric throttle body assembly, perform calibration of electric throttle body assembly referring to “Electric Throttle Body System Calibration”.

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 in Section 1D” and clean inside of throttle body thoroughly.

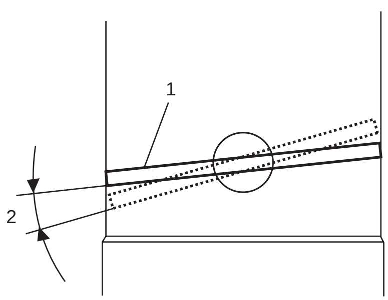
Throttle Valve Operation Check

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

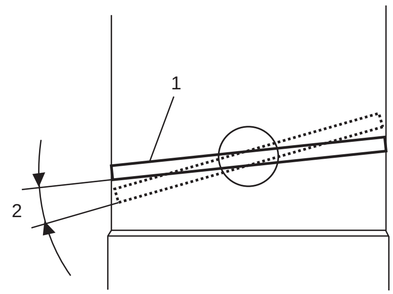
5) Take off finger from throttle valve (1) which is at full open position and check that it moves smoothly by its return spring and open spring force back to default position (2) (position where throttle valve is open by 6° from completely closed position).
6) Take off finger from throttle valve (1) which is at completely closed position and check that it moves smoothly by its return spring and open spring force back to default position.
   If check result is not satisfactory, replace electric throttle body assembly.



I4RS0B130005-01

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 (2) (position where throttle valve is open by 6° from its completely closed position).



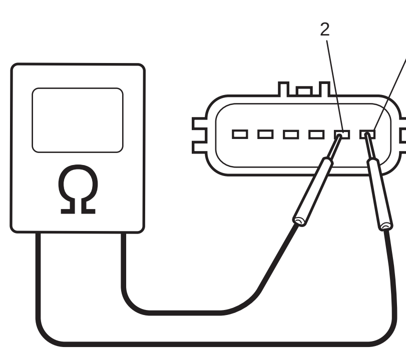
I4RS0B130005-01

   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 (Electric throttle body model)”, “Throttle Actuator (Motor) Check” and 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.

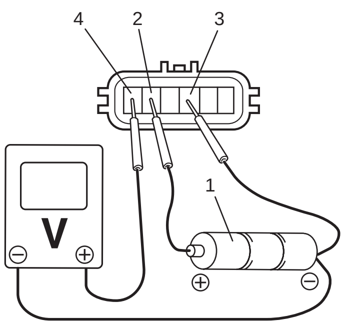
   Throttle actuator (motor) resistance
   0.3 – 100 Ω at 20 °C, 68 °F



I4RS0B130023-01

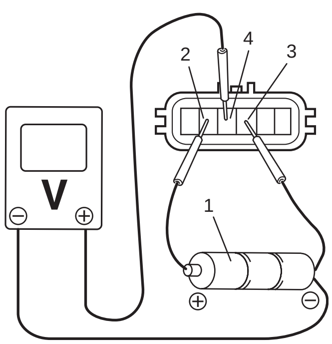
TP Sensor Performance Check

1) Remove air cleaner outlet hose.
2) Turn OFF ignition switch.
3) Disconnect connector from electric throttle body assembly.
4) Check TP sensor (main and sub) output voltage as following steps.
   a) For TP 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 TP 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 “Vout2” terminal (4) of sensor and negative terminal to battery.

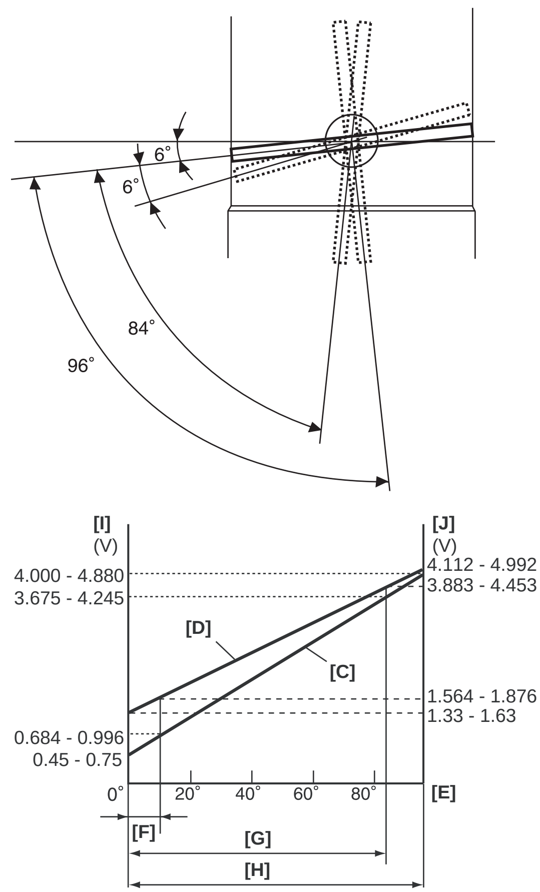


I4RS0B130008-01

   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.

<u>TP sensor output voltage</u>
TP sensor (main) [C]: 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)
TP sensor (sub) [D]: 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)



I6RS0C130002-01

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

Electric Throttle Body System Calibration

S7RS0B1306004

NOTE

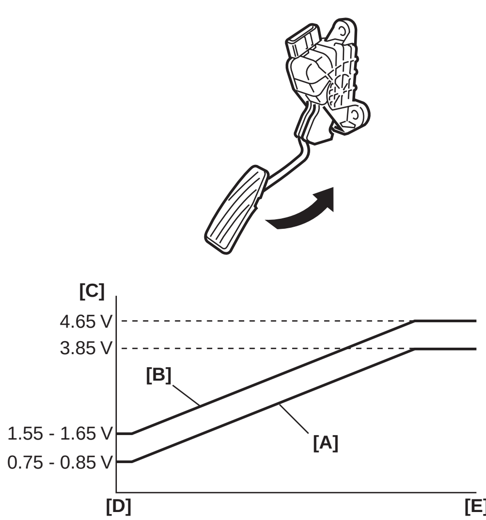
If working the service described under the "Precautions of Electric Throttle Body System Calibration in Section 1A" perform following steps for electric throttle body system calibration.

1) If electric throttle body assembly and/or 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.

APP Sensor Assembly On-Vehicle Inspection

S7RS0B1306005

1) Check that APP sensor assembly has been mounted to vehicle body properly (no pinched floor carpet, etc.).
   If mounting is not properly, reinstall APP sensor assembly properly referring to "APP Sensor Assembly Removal and Installation".
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 APP 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 APP sensor assembly referring to "APP Sensor Assembly Inspection".



I4RS0B130010-02

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

APP Sensor Assembly Removal and Installation

S7RS0B1306006

⚠ **CAUTION**

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

NOTE

After replacing APP sensor assembly, perform calibration of throttle valve referring to "Electric Throttle Body System Calibration".

Removal

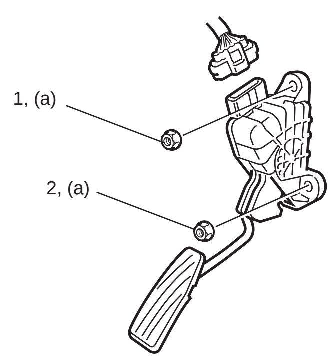
1) Disconnect negative cable at battery.
2) Disconnect connector from APP sensor assembly.
3) Remove APP sensor assembly from its bracket.

Installation

Reverse removal procedure for installation noting the following.

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

Tightening torque
APP sensor assembly nut (a): 5.5 N·m (0.55 kgf-m, 4.0 lb-ft)



I4RS0B130011-01

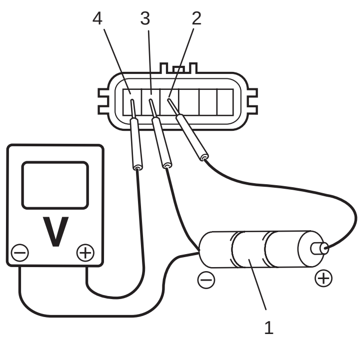
- Connect connector to APP sensor assembly securely.

APP Sensor Assembly Inspection

S7RS0B1306007

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

1) For 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.



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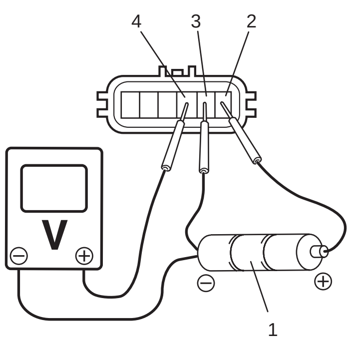
2) For APP sensor (sub), arrange 3 new 1.5 V batteries (1) in series (check that total voltage is 4.5 - 5.0 V) and connect its positive terminal to “Vin 2” terminal (2) and negative terminal to “Ground 2” terminal (3) of sensor. Then using voltmeter, connect positive terminal to “Vout 2” terminal (4)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



I4RS0B130013-01

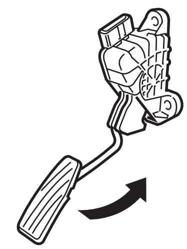
3) Measure output voltage variation while accelerator pedal is no depressed and fully depressed as following specification.

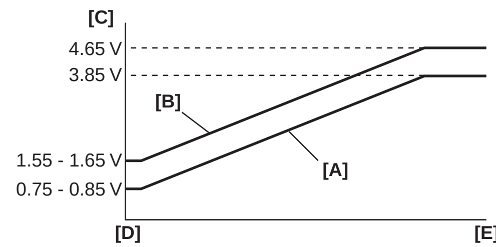
If sensor voltage is out of specified value or does not vary linearly as the following graph, replace APP sensor assembly.

<u>APP sensor output voltage</u>

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

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

ECT Sensor Removal and Installation

S7RS0B1306008

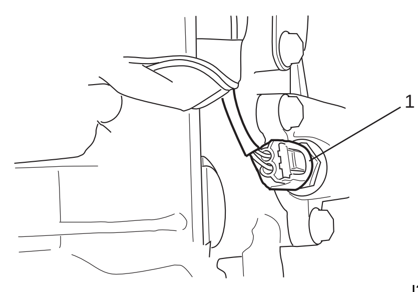
Removal

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

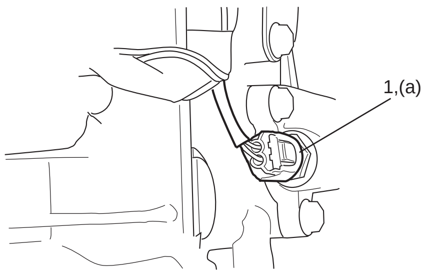
5) Remove ECT sensor from thermostat case.

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)



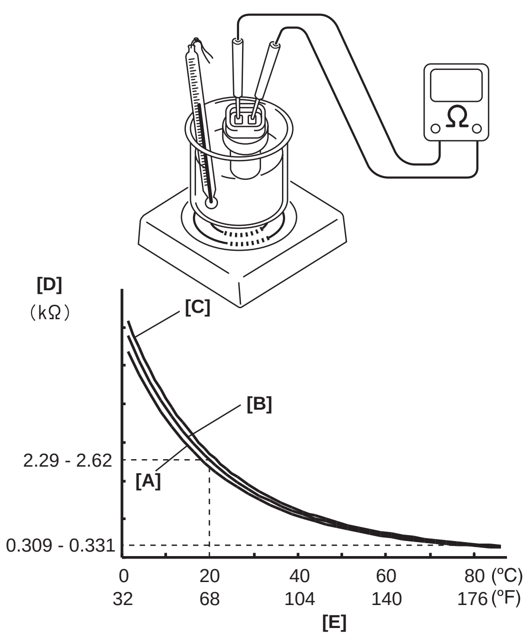
I2RH0B130009-01

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

ECT Sensor Inspection

S7RS0B1306009

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.



I5JB0A130037-01

[A]:	Lower limit	[D]:	Resistance
[B]:	Normal	[E]:	Temperature
[C]:	Upper limit		

HO2S-1 and HO2S-2 Heater On-Vehicle Inspection

S7RS0B1306010

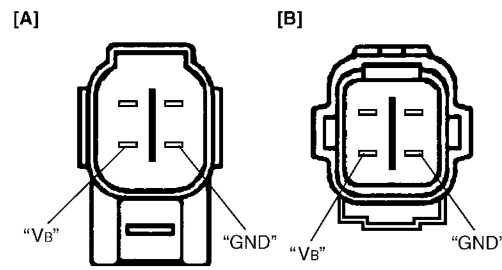
1) Disconnect sensor connector.
2) Using ohmmeter, measure resistance between terminals "V_B" and "GND" of sensor connector.
   If found faulty, replace oxygen sensor.

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.

HO2S-1 and HO2S-2 Removal and Installation

S7RS0B1306011

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 from exhaust pipe or exhaust manifold.

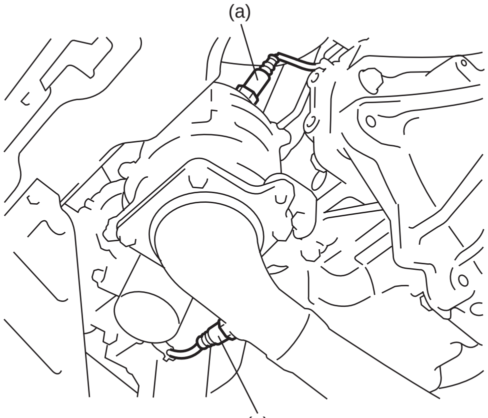
Installation

Reverse removal procedure noting the following.

- Tighten heated oxygen sensor 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 and clamp wire harness securely.
- After installing heated oxygen sensor, start engine and check that no exhaust gas leakage exists.



I6RS0C130003-02

CMP Sensor Removal and Installation

S7RS0B1306012

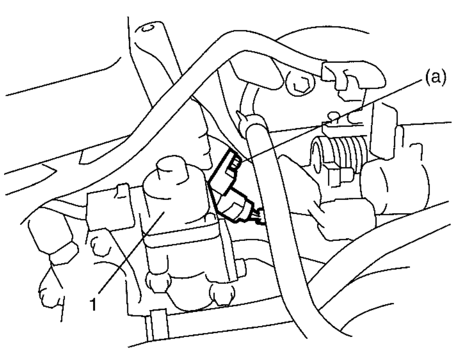
Removal

1) Disconnect negative (–) cable at battery.
2) Disconnect connector from CMP sensor.
3) Remove CMP sensor from cylinder head.

Installation

1) Install CMP sensor to cylinder head.

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



I6RS0C130004-01

1.	EGR valve

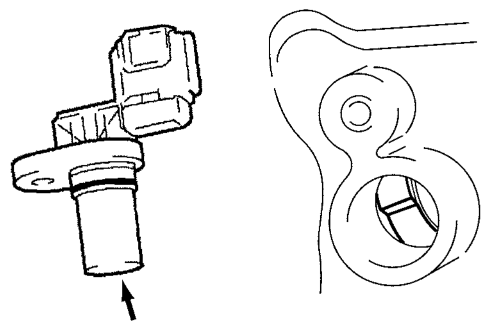
2) Connect connector to CMP sensor securely.
3) Connect negative (–) cable to battery.

Camshaft Position (CMP) Sensor Inspection

S7RS0B1306013

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.

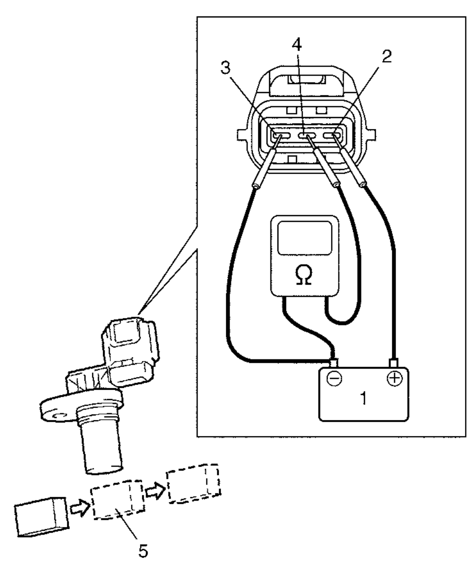


I4RS0B130015-01

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.

<u>CMP sensor resistance</u>
Resistance varies from less than 220 Ω (ON) to infinity (OFF) or from infinity (OFF) to less than 220 Ω (ON)



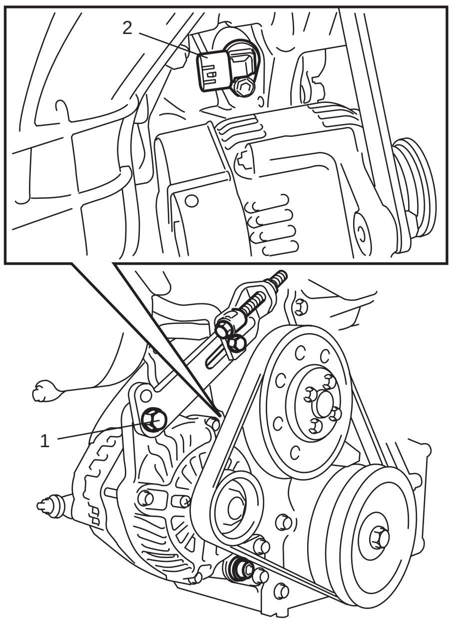
I6RS0C130005-01

CKP Sensor Removal and Installation

S7RS0B1306014

Removal

1) Disconnect negative (–) cable at battery.
2) Remove generator drive belt refer to “Water Pump / Generator Drive Belt Removal and Installation in Section 1J”.
3) Remove generator bracket bolt (1) and move generator rearward.
4) Disconnect connector from CKP sensor.
5) Remove CKP sensor (2) from cylinder block.

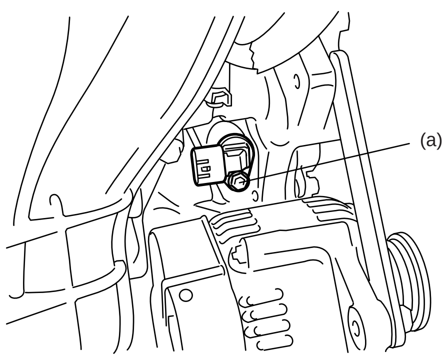


I6RS0C130006-01

Installation

1) Install CKP 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

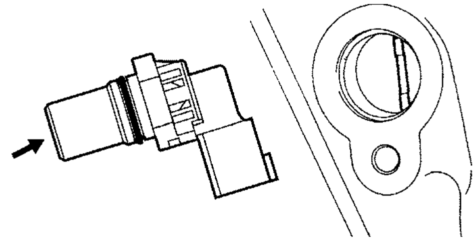
2) Connect connector to CKP sensor securely.
3) Adjust generator drive belt tension referring to “Water Pump / Generator Drive Belt Tension Inspection and Adjustment in Section 1J”.
4) Connect negative (–) cable to battery.

CKP Sensor Inspection

S7RS0B1306015

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.

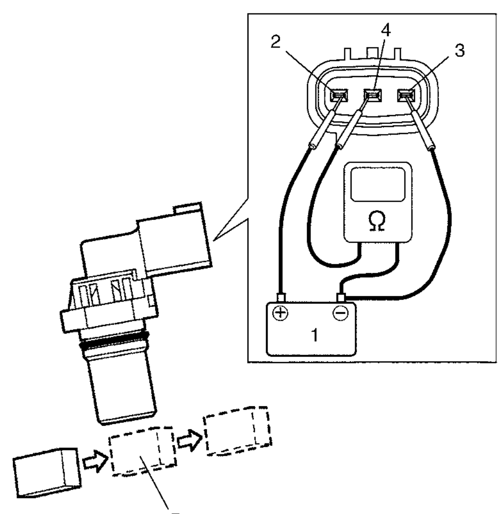


I3RB0A130006-01

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.

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



I4RS0B130017-01

Knock Sensor Removal and Installation

S7RS0B1306016

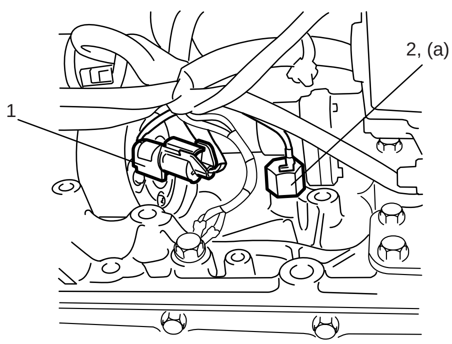
Removal

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)

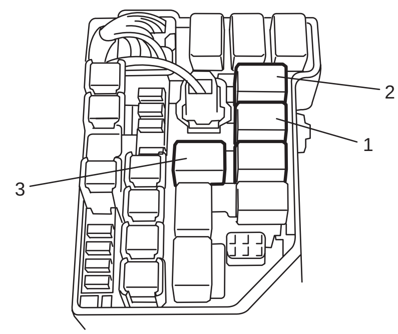


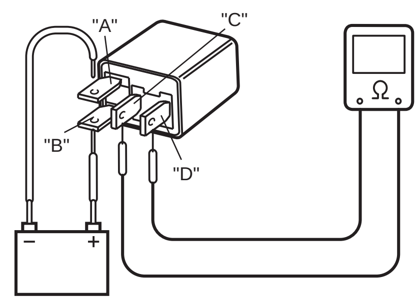
I3RB0A130007-01

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

S7RS0B1306017

1) Disconnect negative (–) cable at battery.
2) Remove main relay (1), fuel pump relay (3) and/or starting motor control relay (2) 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.





I4RS0A130014-01

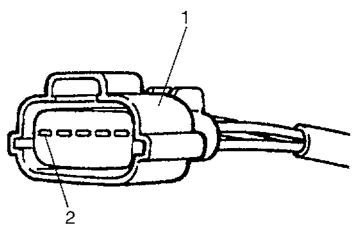
MAF and IAT Sensor On-Vehicle Inspection

S7RS0B1306018

NOTE

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

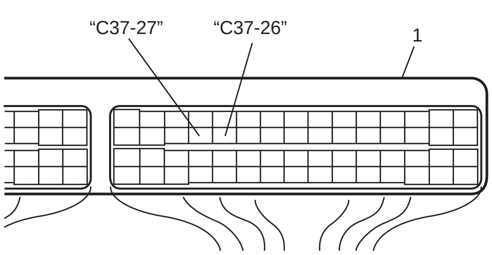
1) Disconnect negative (–) cable at battery.
2) Disconnect MAF and IAT sensor connector.
3) Connect voltmeter to "BLK/RED" wire terminal (2) of MAF and IAT sensor connector (1) disconnected and ground.



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 "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.

   <u>MAF signal voltage between "C37-26" terminal circuit and "C37-27" terminal circuit of special tool</u>
   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.

   <u>MAF signal voltage between "C37-26" terminal circuit and "C37-27" terminal circuit of special tool</u>
   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.

MAF and IAT Sensor Removal and Installation

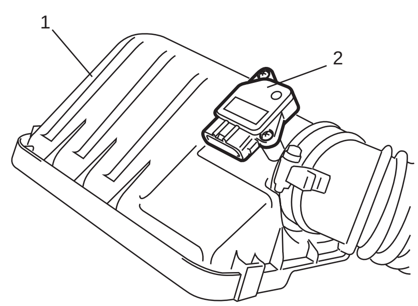
S7RS0B1306019

⚠ 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.



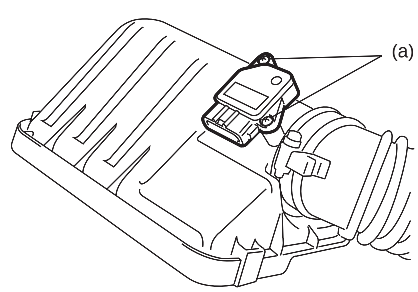
I4RS0A130010-01

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.

MAF and IAT Sensor Inspection

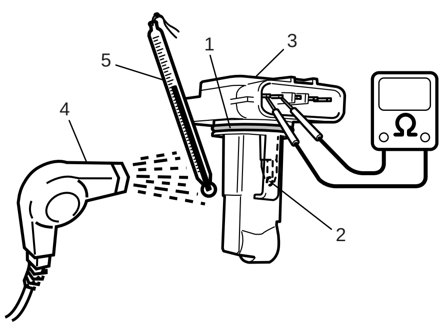
S7RS0B1306020

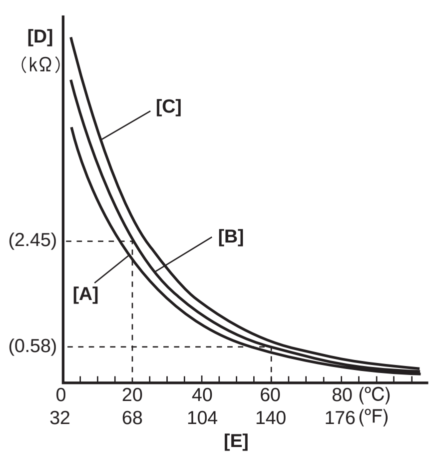
⚠ CAUTION

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.

  IAT 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

Electric Load Current Sensor On-Vehicle Inspection

S7RS0B1306021

Using SUZUKI Scan Tool

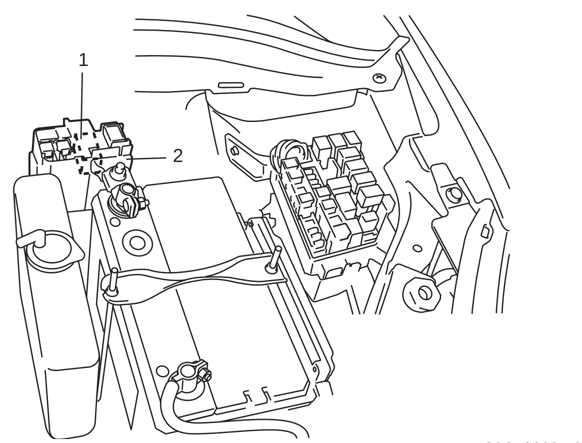
1) Connect scan tool to DLC with ignition switch turned OFF.
2) Check "Battery Current" displayed on scan tool at following condition.

   Battery current
   Ignition switch ON: 6.5 – 7.5 A
   Ignition switch ON, headlight ON: 18.6 – 19.1 A
   Ignition switch ON, headlight ON and blower motor switch is HI position: 27.1 – 27.6 A
   Engine running at idle speed, headlight ON, blower motor switch is HI position and rear defogger switch ON: 38.1 – 41.7 A

If check result is satisfactory, electric load current sensor is in good condition.
If check result is not satisfactory, check the following parts and circuit.

- Electric load current sensor circuit (power, ground and output)
- Following charging system components
  - Battery (refer to "Battery Inspection in Section 1J")
  - Generator (refer to "Generator Inspection in Section 1J")
  - Generator output control circuit (refer to "Generator Test (Undercharged Battery Check) in Section 1J")
  - Generator field coil monitor circuit (refer to "Generator Inspection in Section 1J")

If electric load current sensor circuit and charging system is in good condition, electric load current sensor (1) is faulty.



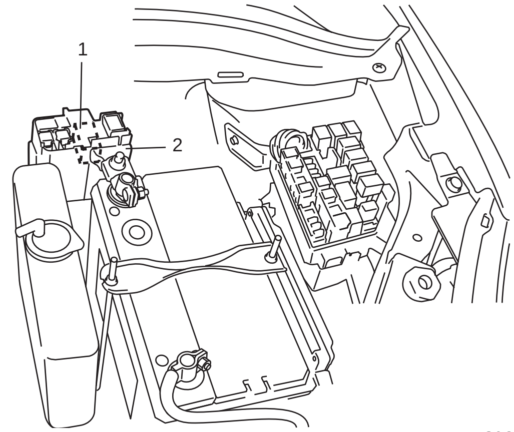
I5RS0C130001-01

2. Main fuse box

Without Using SUZUKI Scan Tool

1) Measure sensor voltage between “C37-23” terminal of ECM connector and vehicle body ground referring to “Inspection of ECM and Its Circuits in Section 1A”.
   If check result is satisfactory, electric load current sensor is in good condition.
   If check result is not satisfactory, check the following parts and circuit.
   - Electric load current sensor circuit (power, ground and output)
   - Following charging system components
     – Battery (refer to “Battery Inspection in Section 1J”)
     – Generator (refer to “Generator Inspection in Section 1J”)
     – Generator output control circuit (refer to “Generator Test (Undercharged Battery Check) in Section 1J”)
     – Generator field coil monitor circuit (refer to “Generator Inspection in Section 1J”)

If electric load current sensor circuit and charging system is in good condition, electric load current sensor (1) is faulty.



2. Main fuse box

Specifications

Tightening Torque Specifications

S7RS0B1307001

Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
ECM mounting bolt	8	0.8	6.0	☞
APP sensor assembly nut	5.5	0.55	4.0	☞
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”.

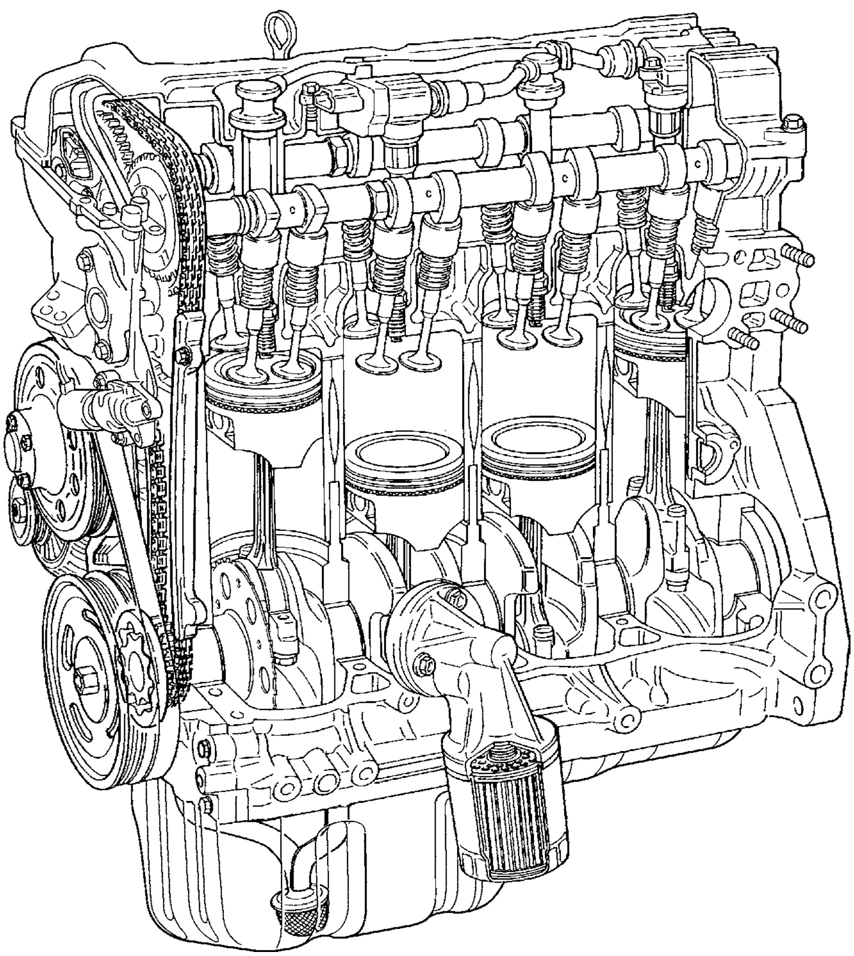
Engine Mechanical

General Description

Engine Construction Description

S7RS0B1401001

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.



I6RS0C140001-02

Camshaft Position Control (VVT Variable Valve Timing) System Description

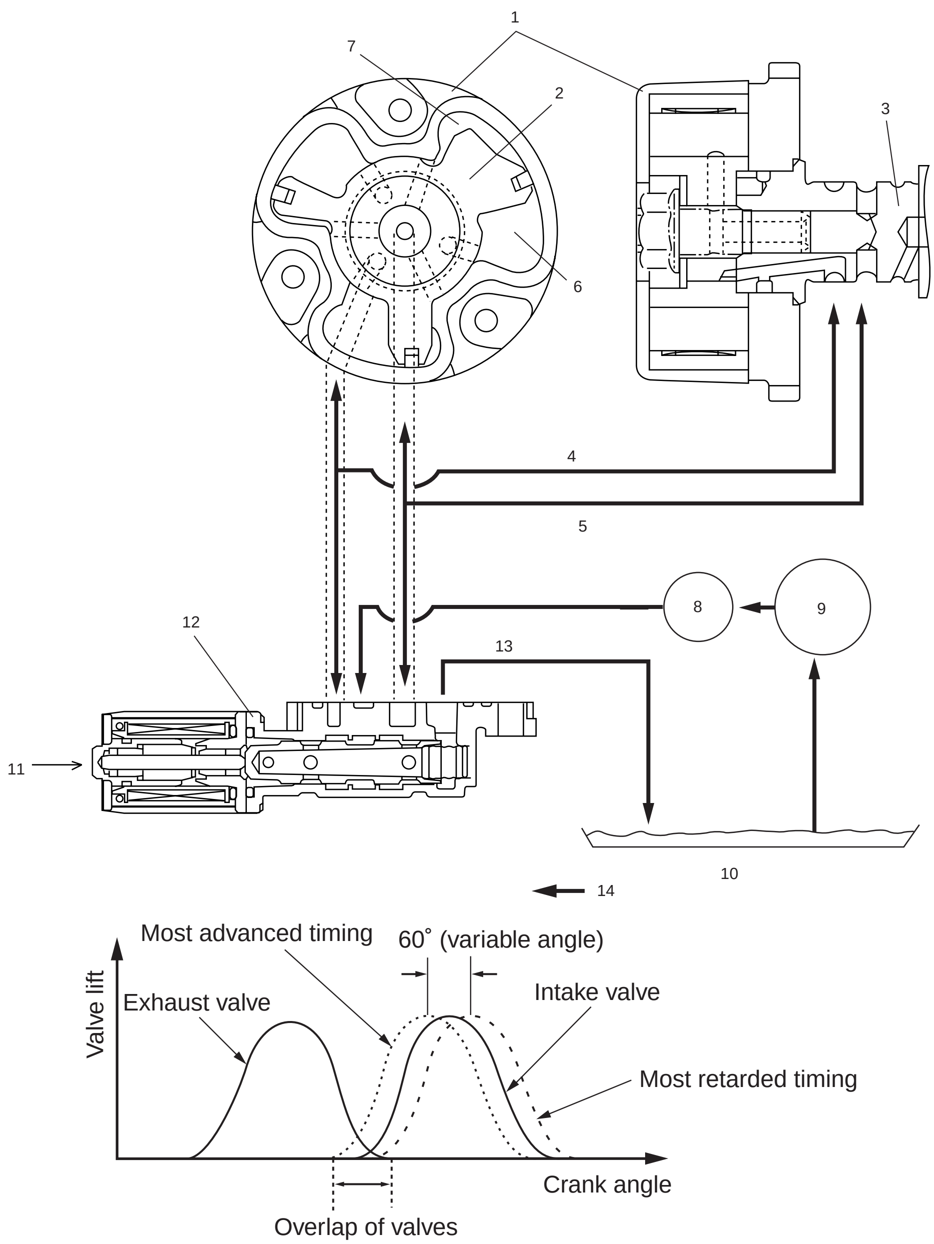
S7RS0B1401002

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).

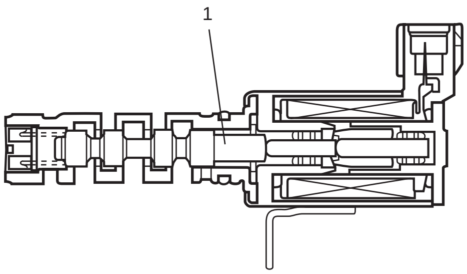


I3RH0B140002-01

4. Oil passage to chamber for timing retarding	8. Oil filter	10. Oil pan	13. Oil return
5. Oil passage to chamber for timing advancing	9. Oil pump	11. Control signal from ECM	14. Oil flow

Oil Control Valve

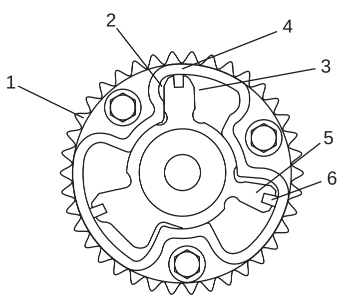
The oil control valve switches and adjusts the hydraulic pressure applied to the cam timing sprocket by moving the spool valve (1) according to the duty pulse signals output from the ECM. By this operation, the intake valve timing is varied continuously. Signals output from the ECM are the duty pulse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

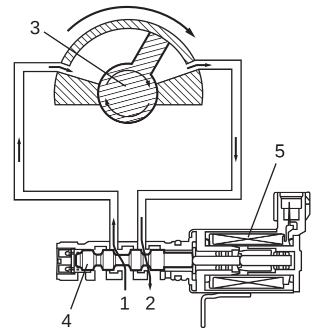


I3RH0B140004-01

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.

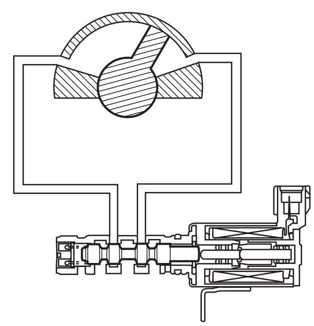


I3RH0B140005-01

2. Drain

Timing Holding

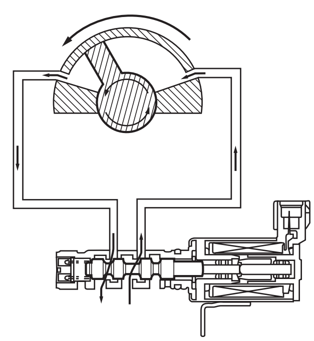
When the duty ratio of the signal output from the ECM shows that of holding, the spool valve of the oil control valve is located at hold position. Because this condition generates no oil pressure changes in both chambers, the rotor is fixed at a target position.



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.
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

S7RS0B1404001

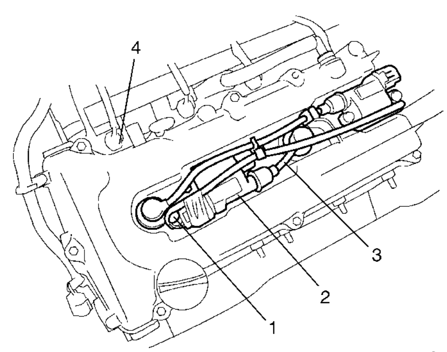
Check compression pressure on all 4 cylinders as follows:

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.

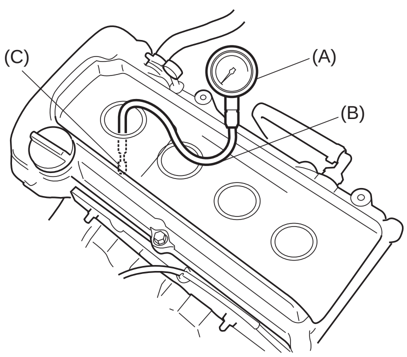
3) Disconnect negative cable at battery.
4) Remove engine cover.
5) Remove air cleaner assembly and air suction hose referring to "Air Cleaner Components".
6) Remove cylinder head upper cover.
7) Disconnect ignition coil couplers (1).
8) Remove ignition coil assemblies (2) with high-tension cord (3).
9) Remove all spark plugs.
10) Disconnect fuel injector wires (4) at the coupler.



I2RH0B140003-01

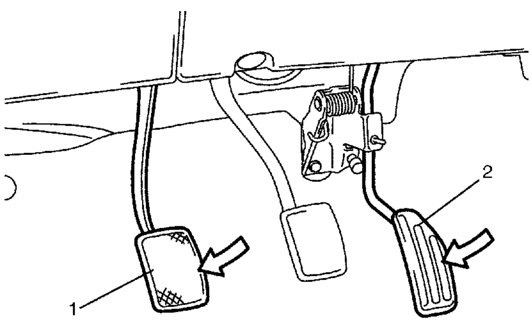
11) Connect negative cable at battery.
12) Install special tools (Compression gauge) into spark plug hole.

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



I3RH0B140009-01

13) 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

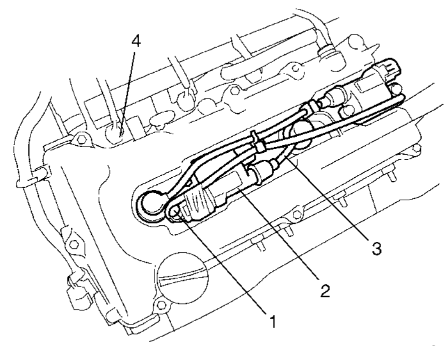
14) Crank engine with fully charged battery, and read the highest pressure on compression gauge.

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/cm^2, 14.2 psi)

15) Carry out Steps 12) through 14) on each cylinder to obtain 4 readings.
16) Disconnect negative cable at battery.
17) After checking, install spark plugs and ignition coil assemblies (2) with high-tension cord (3).
18) Connect ignition coil couplers (1).
19) Connect fuel injector wires (4) at the coupler.



I2RH0B140003-01

20) Install cylinder head upper cover.
21) Install air cleaner assembly and air suction hose referring to “Air Cleaner Components”.
22) Install engine cover.
23) Connect negative cable at battery.

Engine Vacuum Check

S7RS0B1404002

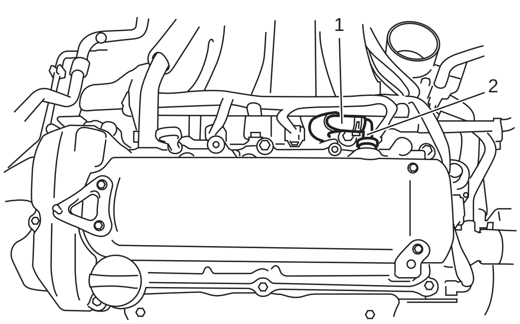
The engine vacuum that develops in the intake line is a good indicator of the condition of the engine. The vacuum checking procedure is as follows:

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 engine cover.
4) Remove air cleaner assembly and air suction hose referring to “Air Cleaner Components”.
5) Remove PCV hose (1) from PCV valve (2).

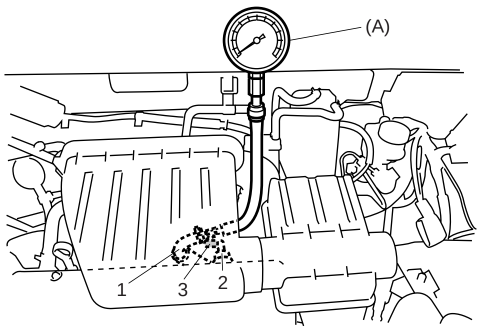


I6RS0B141001-01

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

   Special tool
   (A): 09915–67311

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



I3RM0A140003-01

8) Install air cleaner assembly and air suction hose referring to “Air Cleaner Components”.
9) Run engine at specified idle speed and read vacuum gauge. Vacuum should be within specification.

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

10) Remove air cleaner assembly and air suction hose referring to “Air Cleaner Components”.
11) Disconnect special tool (vacuum gage) from PCV valve.
12) Detach blind cap from PCV valve, and connect PCV hose to PCV valve.
13) Install air cleaner assembly and air suction hose referring to “Air Cleaner Components”.
14) Install engine cover.

Valve Lash (Clearance) Inspection

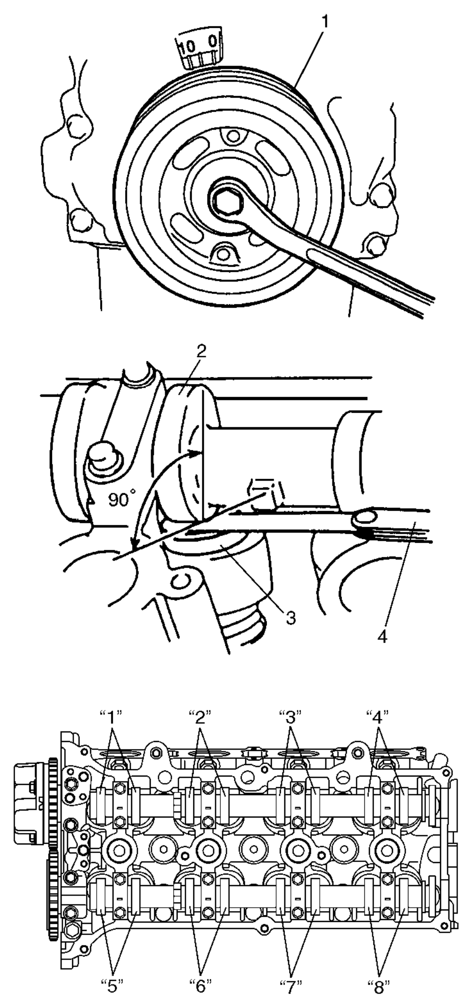
S7RS0B1404003

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.

<u>Valve clearance specification</u>
When cold (Coolant temperature is 15 – 25 °C (59 – 77 °F)):
- **Intake: 0.18 – 0.22 mm (0.007 – 0.009 in.)**
- **Exhaust: 0.28 – 0.32 mm (0.011 – 0.013 in.)**

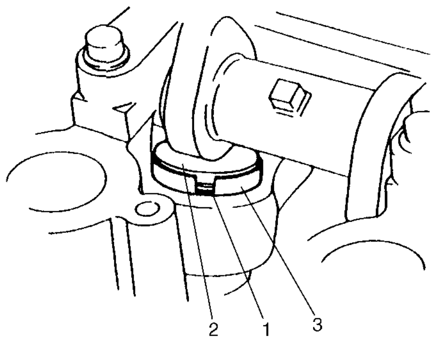
When hot (Coolant temperature is 60 – 68 °C (140 – 154 °F)):
- **Intake: 0.21 – 0.27 mm (0.008 – 0.011 in.)**
- **Exhaust: 0.30 – 0.36 mm (0.012 – 0.014 in.)**



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.

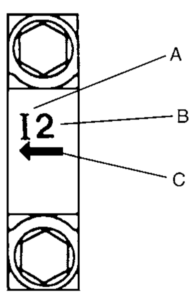


I2RH0B140006-01

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

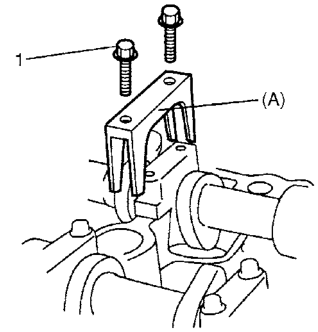


I2RH0B140011-01

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 by hand.

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

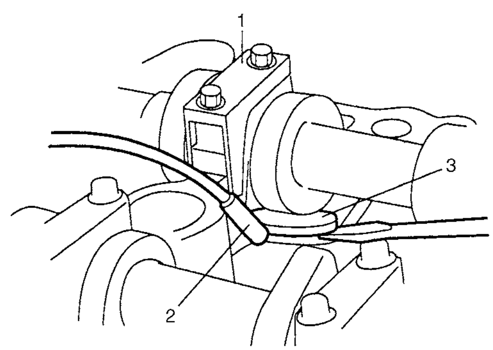


I6RS0B141028-01

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

⚠ WARNING

Never put in the hand between camshaft and tappet.

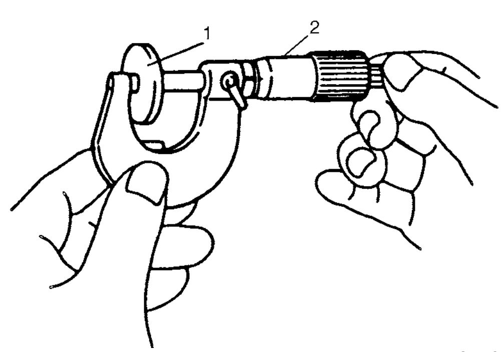


I2RH0B140013-01

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.)

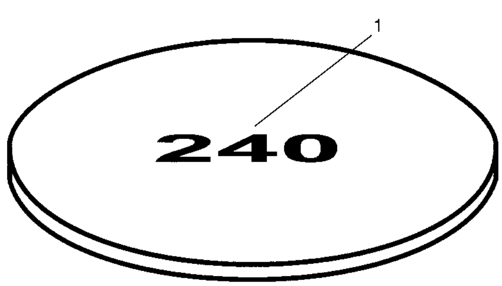
Calculated thickness of new shim = 2.65 mm (0.104 in.)

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**

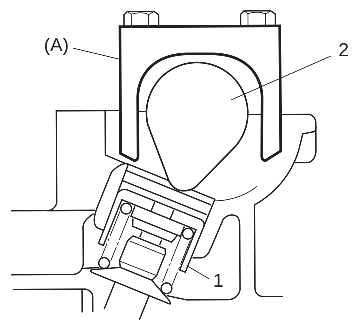
7) Install new shim facing shim No. side with tappet.



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

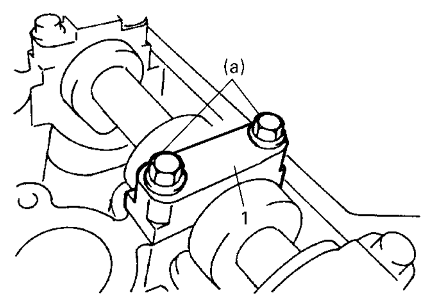


I3RM0A140006-01

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.

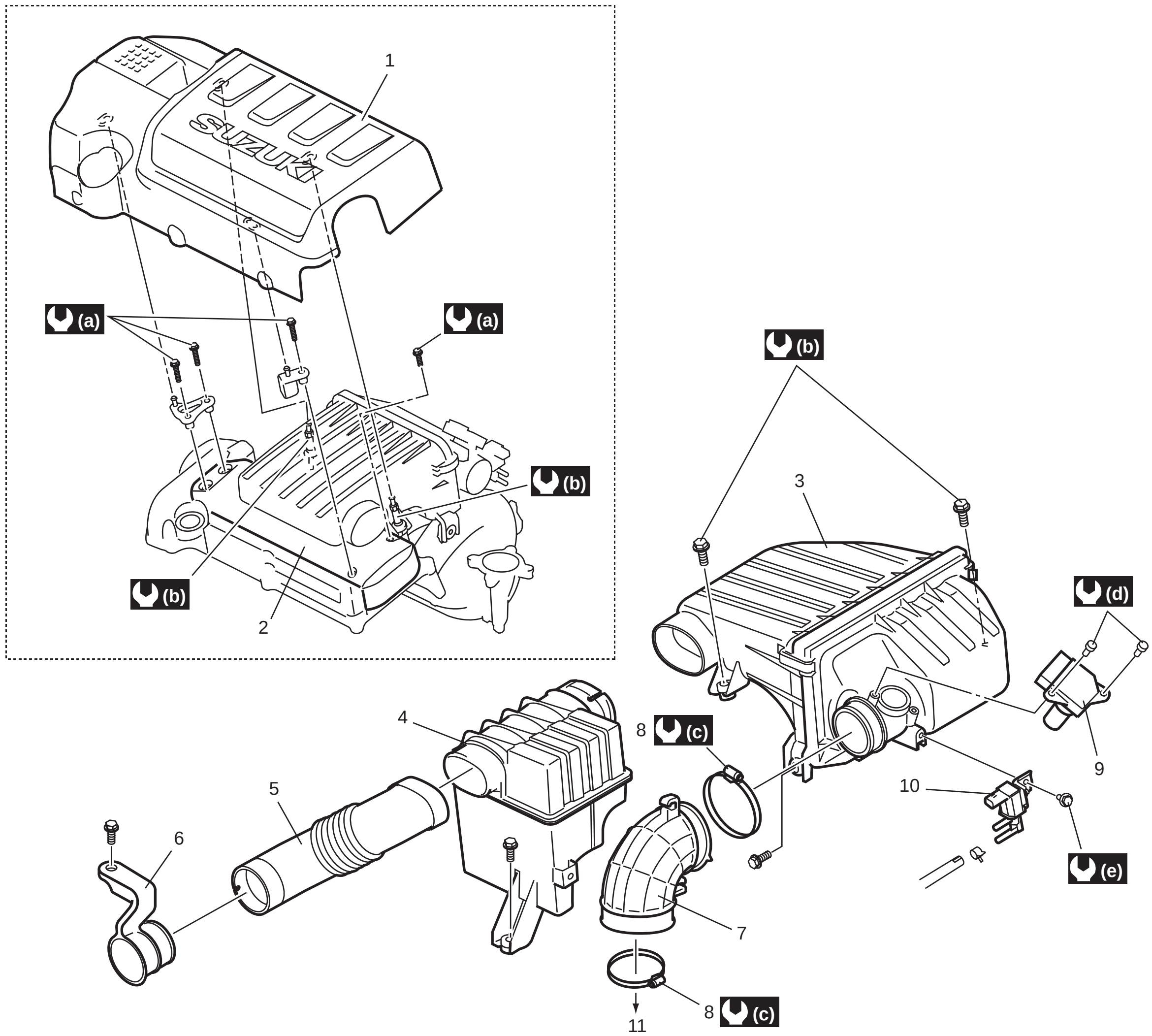
11) After checking and adjusting all valves.

12) Install cylinder head cover referring to “Cylinder Head Cover Removal and Installation”.

Repair Instructions

Air Cleaner Components

S7RS0B1406001



I7RS0B140001-01

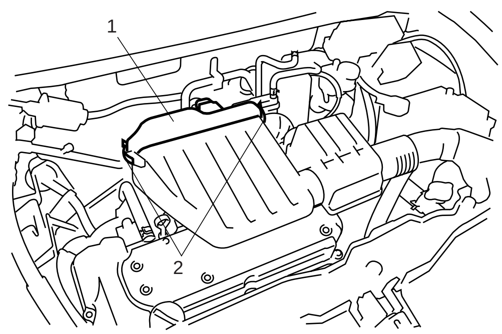
1.	Engine Cover	7.	Air cleaner outlet hose	(b) :	11 N·m (1.1 kgf-m, 8.0 lb-ft)
2.	Cylinder head upper cover	8.	Hose clamp	(c) :	3 N·m (0.3 kgf-m, 2.5 lb-ft)
3.	Air cleaner assembly	9.	MAF sensor	(d) :	1.5 N·m (0.15 kgf-m, 1.0 lb-ft)
4.	Air intake pipe	10.	EVAP canister purge valve	(e) :	5 N·m (0.5 kgf-m, 4.0 lb-ft)
5.	Air suction hose	11.	To throttle body		
6.	Air cleaner suction pipe	(a) :	8 N·m (0.8 kgf-m, 6.0 lb-ft)		

Air Cleaner Element Removal and Installation

S7RS0B1406002

Removal

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



I3RM0A140007-01

Installation

Reverse removal procedure for installation.

Air Cleaner Element Inspection and Cleaning

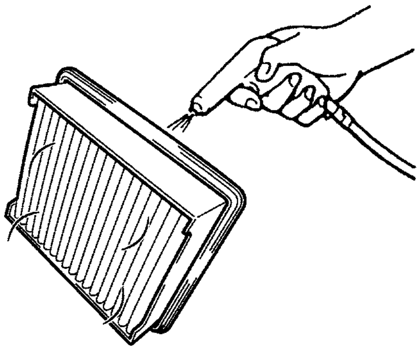
S7RS0B1406003

Inspection

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

Cleaning

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



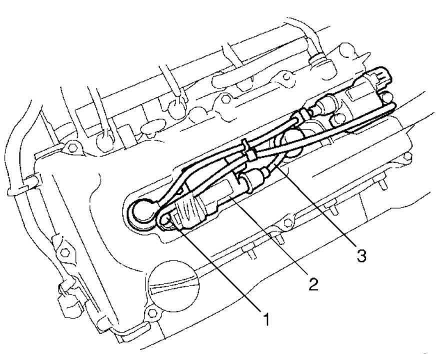
I2RH0B140150-01

Cylinder Head Cover Removal and Installation

S7RS0B1406004

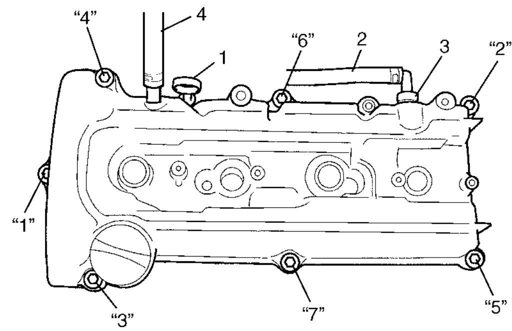
Removal

1) Disconnect negative cable at battery.
2) Remove air cleaner assembly and air suction hose referring to "Air Cleaner Components".
3) Remove cylinder head upper cover.
4) Disconnect ignition coil couplers (1).
5) Remove ignition coil assemblies (2) with high-tension cord (3).
6) Remove wire harness clamp from cylinder head cover.



I2RH0B140032-01

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



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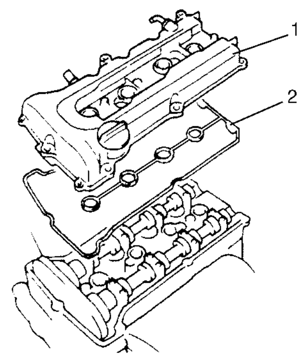
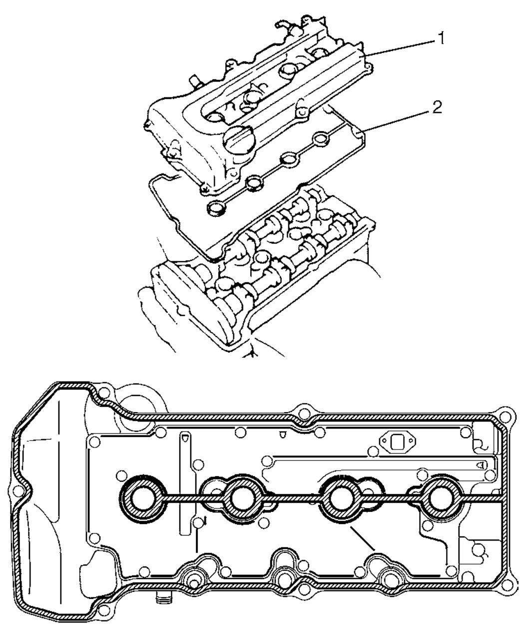
10) Remove cylinder head cover (1) with cylinder head cover gasket (2).



I6RS0B141004-01

Installation

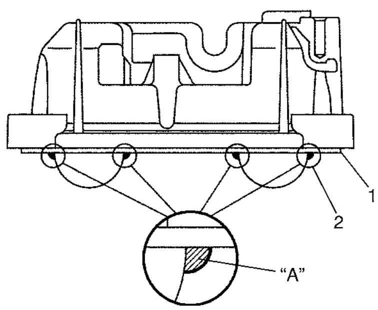
1) Install new cylinder head cover gasket (2) to cylinder head cover (1) as shown in figure.



I6RS0B141005-01

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 (SUZUKI Bond No.1207F)



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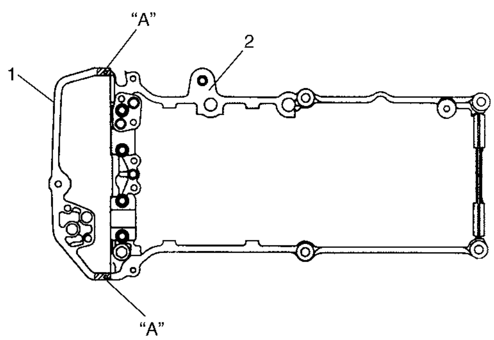
   - Timing chain cover (1) and cylinder head (2) mating surface as shown.

     “A”: Water tight sealant 99000–31250 (SUZUKI Bond No.1207F)



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3) Install cylinder head cover to cylinder head.

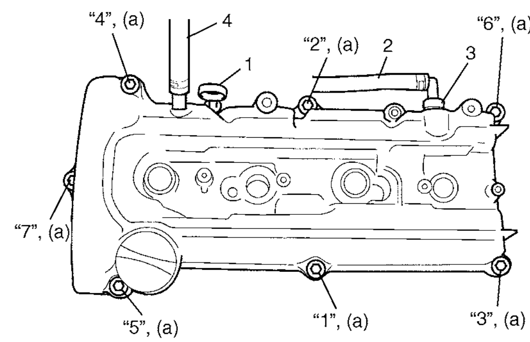
NOTE

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) Tighten cylinder head cover bolts as follows.
   a) Tighten cylinder head cover bolts to 3 N·m (0.3 kgf-m, 2.5 lb-ft) according to numerical order (“1” through “7”) as shown in figure.
   b) In the same manner as in Step, a) tighten them to 5 N·m (0.5 kgf-m, 4.0 lb-ft).
   c) Retighten them by turning through 8 N·m (0.8 kgf-m, 6.0 lb-ft) in same manner as Step a).

Tightening torque
Cylinder head cover bolt (a): Tighten 3 N·m (0.3 kgf-m, 2.5 lb-ft), 5 N·m (0.5 kgf-m, 4.0 lb-ft) and 8 N·m (0.8 kgf-m, 6.0 lb-ft) by the specified procedure

5) Connect PCV hose (2) to PCV valve (3).
6) Connect breather hose (4).
7) Install oil level gauge (1).

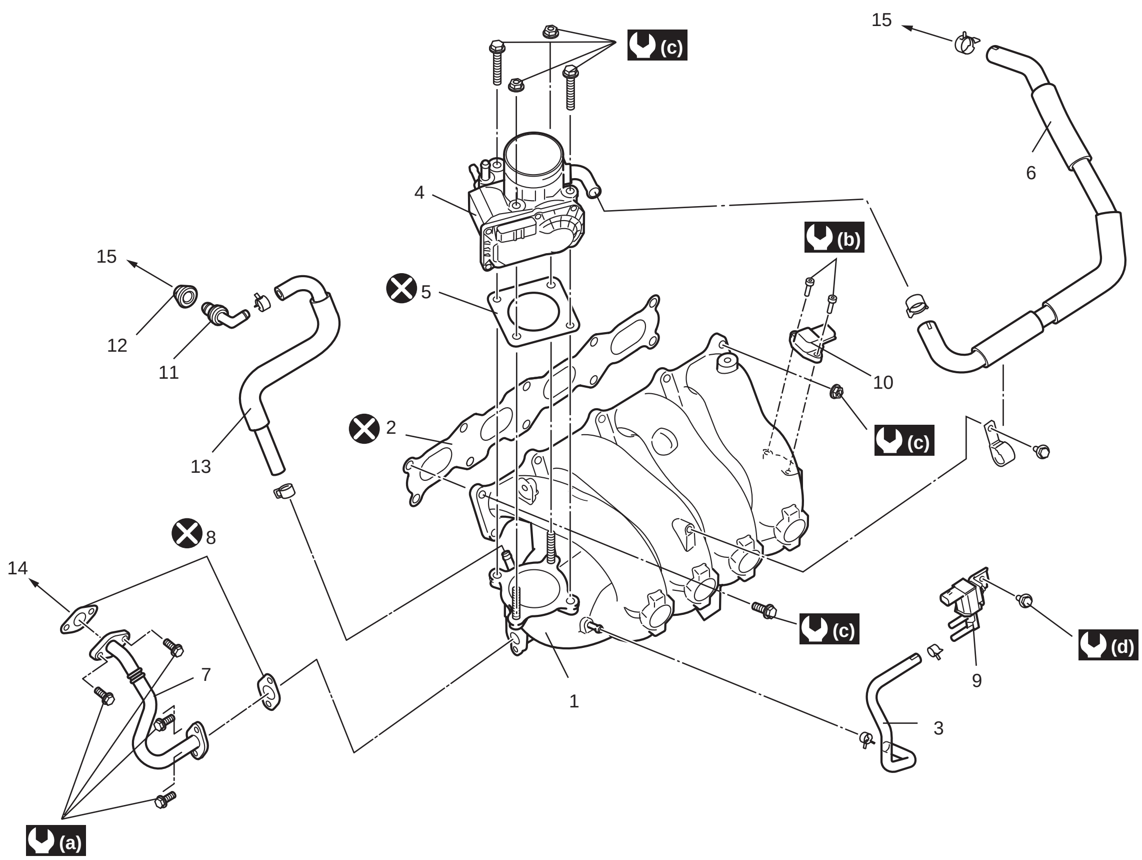


I3RH0B140016-01

8) Install wire harness clamp to cylinder head cover.
9) Install ignition coil assemblies with high-tension cord referring to “Ignition Coil Assembly (Including ignitor) Removal and Installation in Section 1H”.
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.

Throttle Body and Intake Manifold Components

S7RS0B1406005



I7RS0B140002-02

1.	Intake manifold	6.	Breather hose	11.	PCV valve	(a)	:	11 N·m (1.1 kgf-m, 8.0 lb-ft)
2.	Intake manifold gasket	7.	EGR pipe	12.	PCV valve seal	(b)	:	8 N·m (0.8 kgf-m, 6.0 lb-ft)
3.	EVAP canister purge valve hose	8.	Gasket	13.	PCV hose	(c)	:	23 N·m (2.3 kgf-m, 17.0 lb-ft)
4.	Throttle body	9.	EVAP canister purge valve	14.	To EGR valve	(d)	:	5 N·m (0.5 kgf-m, 4.0 lb-ft)
5.	Throttle body gasket	10.	MAP sensor	15.	To cylinder head cover		:	Do not reuse.

Throttle Body On-Vehicle Inspection

S7RS0B1406006

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 in Section 1C".

Electric Throttle Body Assembly Removal and Installation

S7RS0B1406007

⚠ CAUTION

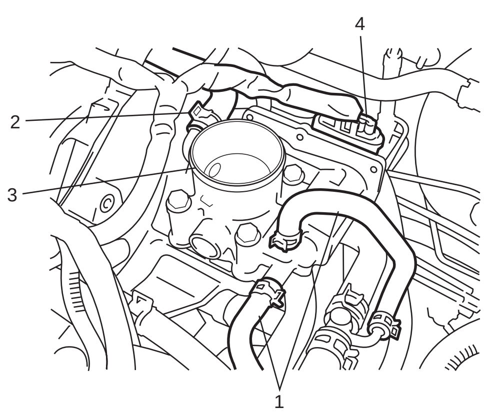
Never disassemble electric throttle body. Disassembly will spoil its original performance. If faulty condition is found, replace it with new one.

NOTE

After replacing electric throttle body assembly, perform calibration of throttle valve referring to "Electric Throttle Body System Calibration in Section 1C".

Removal

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

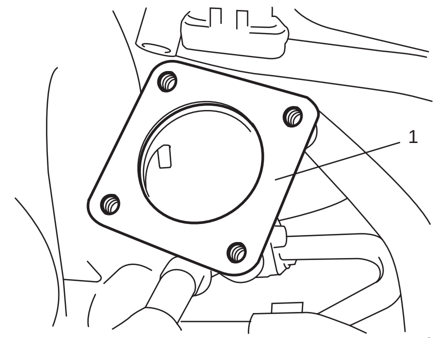


I4RS0B140004-02

7) Remove electric throttle body assembly from intake manifold.

Installation

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



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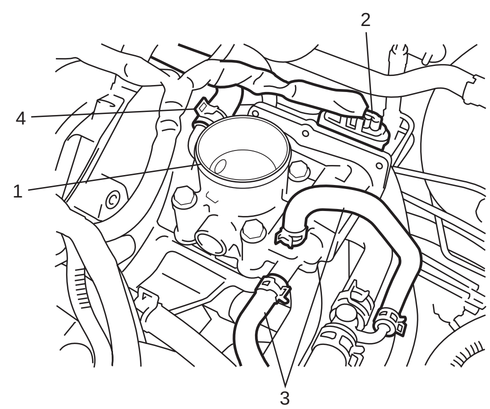
2) Install electric throttle body assembly (1) to intake manifold.
3) Connect connector (2) to electric throttle body assembly securely.
4) Connect engine coolant hoses (3) and breather hose (4) to electric throttle body assembly (1).



I4RS0B140006-01

5) Install air cleaner assembly referring to "Air Cleaner Components".
6) Install EVAP canister and purge valve chamber and air cleaner outlet hose.
7) Refill coolant referring to "Cooling System Flush and Refill in Section 1F".
8) Connect negative cable at battery.

Throttle Body Cleaning

S7RS0B1406008

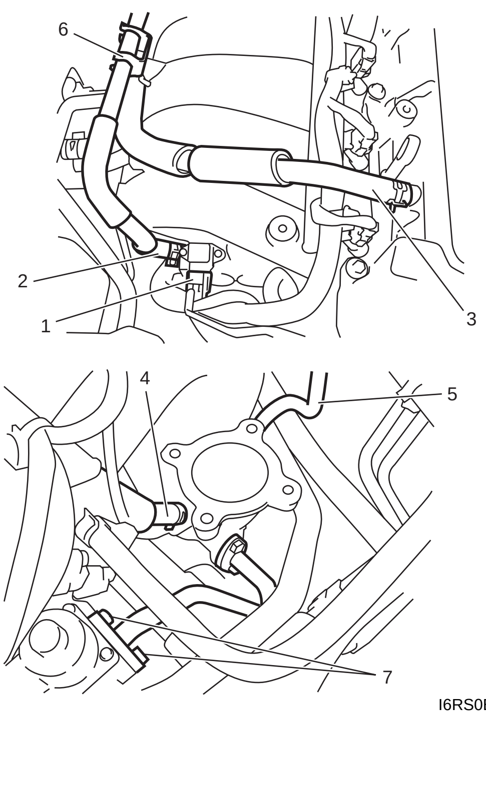
Clean electric throttle body assembly referring to “Throttle Valve Visual Check” under “Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”.

Intake Manifold Removal and Installation

S7RS0B1406009

Removal

1) Remove cowl top plate referring to “Cowl Top Components in Section 9K”.
2) Remove throttle body referring to “Electric Throttle Body Assembly Removal and Installation”.
3) Disconnect MAP sensor coupler (1).
4) Disconnect the following hoses:
   - Brake booster hose (2) from cylinder head cover
   - Breather hose (3) from cylinder head cover
   - PCV hose (4) from intake manifold
   - EVAP canister purge valve hose (5) from intake manifold
5) Remove hose clamp (6) from intake manifold.
6) Remove EGR pipe bolt (7) from EGR valve.



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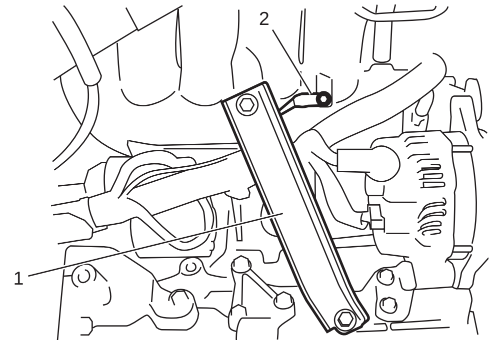
7) Remove stiffener (1) and ground terminal (2) from intake manifold.



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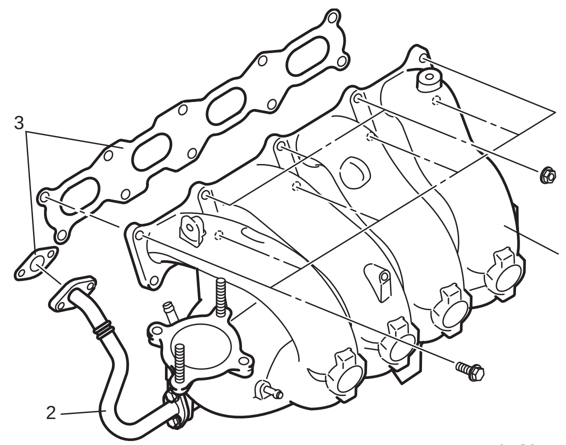
8) Remove intake manifold (1) with EGR pipe (2) from cylinder head, and then remove their gaskets (3).



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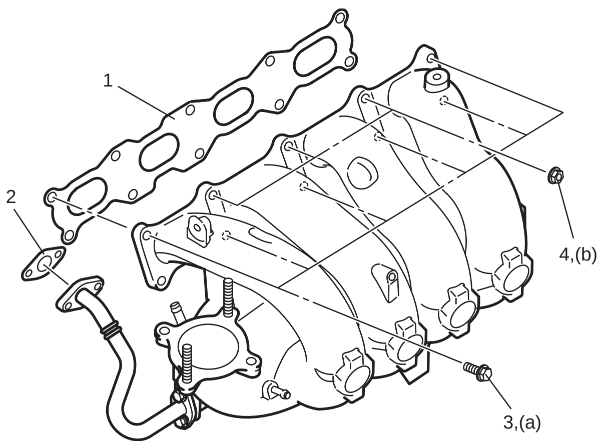
9) Remove EGR pipe from intake manifold, if necessary.

Installation

Reverse removal procedure for installation noting the followings.

- Use new intake manifold gasket (1).
- Use new EGR pipe gasket (2).
- Install intake manifold bolts (3) and nuts (4) to specified torque.

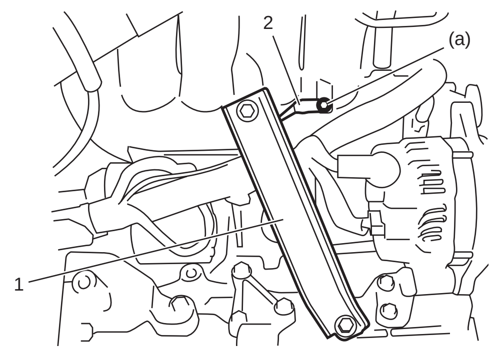
  Tightening torque
  Intake manifold bolt (a): 23 N·m (2.3 kgf-m, 17.0 lb-ft)
  Intake manifold nut (b): 23 N·m (2.3 kgf-m, 17.0 lb-ft)



I6RS0B141011-01

- Install intake manifold rear stiffener (1) as shown in figure.
- Connect ground terminal (2) to intake manifold to specified torque.

  Tightening torque
  Intake manifold ground terminal bolt (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)

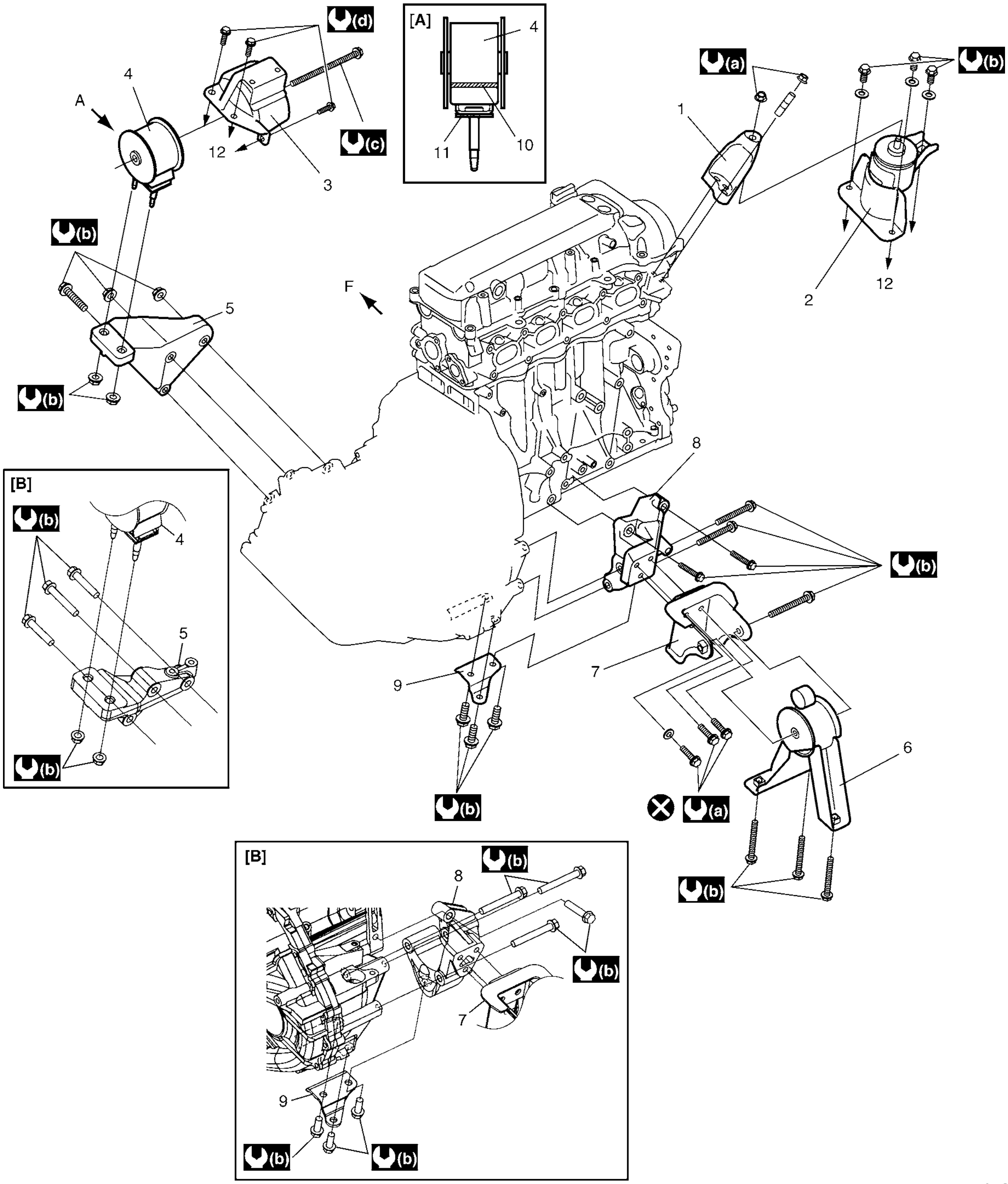


I6RS0B141012-01

- Install throttle body referring to “Electric Throttle Body Assembly Removal and Installation”.
- Install cowl top plate referring to “Cowl Top Components in Section 9K”.
- Refill cooling system referring to “Cooling System Flush and Refill in Section 1F”.
- Upon completion of installation, turn ignition switch ON but engine OFF and check for fuel leaks.
- Finally, start engine and check for engine coolant leaks.

Engine Mountings Components

S7RS0B1406010



[A]:	View A	5.	Engine left mounting No.2 bracket	12.	To vehicle body
[B]:	For A/T model	6.	Engine rear mounting	(a) :	65 N·m (6.5 kgf-m, 47.0 lb-ft)
F:	Vehicle front	7.	Engine rear mounting No.1 bracket	(b) :	55 N·m (5.5 kgf-m, 40.0 lb-ft)
1.	Engine right mounting bracket	8.	Engine rear mounting No.2 bracket	(c) :	85 N·m (8.5 kgf-m, 61.5 lb-ft)
2.	Engine right mounting	9.	Engine rear mounting stiffener	(d) :	25 N·m (2.5 kgf-m, 18.0 lb-ft)
3.	Engine left mounting No.1 bracket	10.	Yellow mark	:	Do not reuse.
4.	Engine left mounting	11.	Front mark		

Engine Assembly Removal and Installation

S7RS0B1406011

NOTE

After replacing electric throttle body assembly, perform calibration of throttle valve referring to "Electric Throttle Body System Calibration in Section 1C".

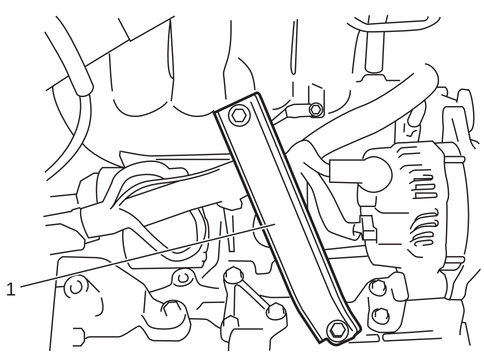
Removal

1) Relieve fuel pressure according to "Fuel Pressure Relief Procedure in Section 1G".
2) Disconnect negative and positive cable at battery.
3) Remove battery and tray.
4) Remove engine hood after disconnecting windshield washer hose.
5) Remove right and left side engine under covers.
6) Remove A/C compressor belt by referring to "Compressor Drive Belt Removal and Installation in Section 7B" or "Compressor Drive Belt Removal and Installation in Section 7B".
7) Drain engine oil, transaxle oil and coolant.
8) Remove cowl top plate referring to "Cowl Top Components in Section 9K".
9) Remove air cleaner assembly referring to "Air Cleaner Components".
10) With hose connected, detach A/C compressor from its bracket (A/C model) referring to "Compressor Assembly Removal and Installation in Section 7B" or "Compressor Assembly Removal and Installation in Section 7B".

⚠ CAUTION

Suspend removed A/C compressor at a place where no damage will be caused during removal and installation of engine assembly.

11) Remove intake manifold rear stiffener (1) from intake manifold and cylinder block.

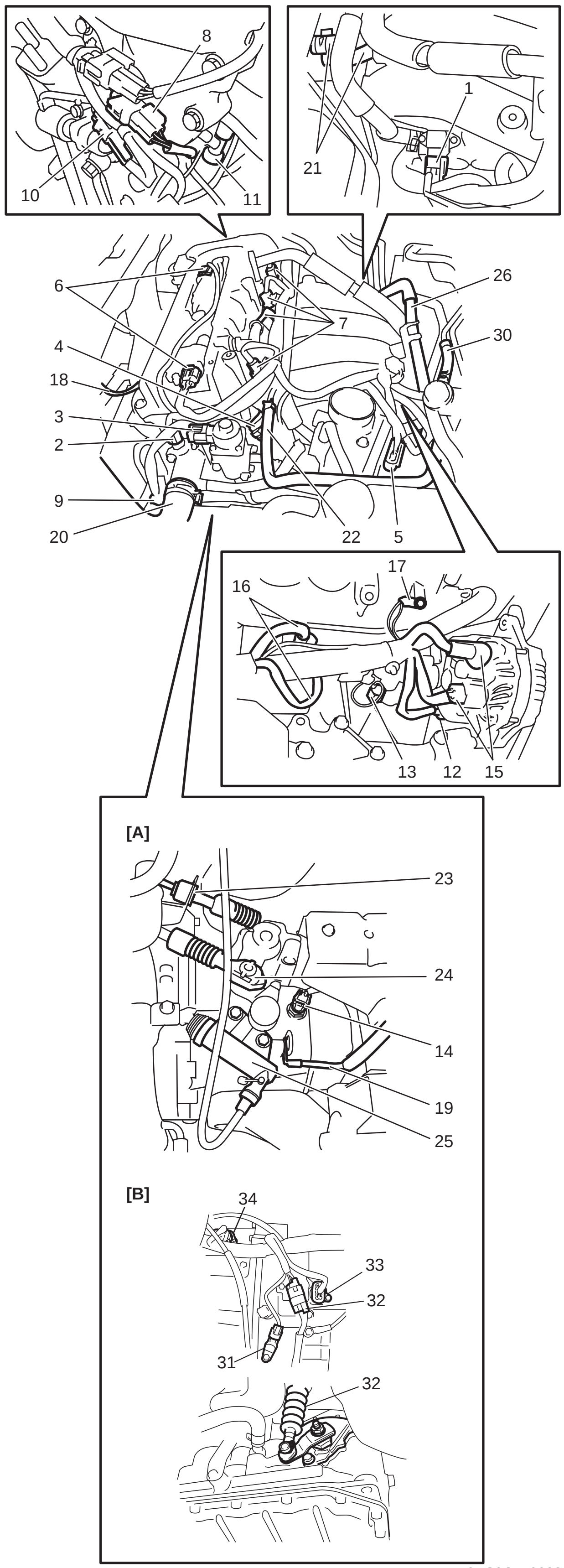


I6RS0B141014-01

12) Disconnect the following electric wires:
    - MAP sensor (1)
    - ECT sensor (2)
    - EGR valve (3)
    - CMP sensor (4)
    - Electric throttle body assembly (5)
    - Ignition coil assembly (6)
    - Injectors (7)
    - Heated oxygen sensor No. 2 (8) and No. 1 (9)
    - Oil control valve (10)
    - Engine oil pressure switch (11)
    - CKP sensor (12)
    - Knock sensor (13)
    - Back up light switch (14)
    - Generator (15)
    - Starting motor (16)
    - Ground terminal (17) from intake manifold
    - Battery ground terminal (18) from exhaust manifold
    - Battery ground cable (19) from transaxle
    - Magnet clutch switch of A/C compressor (A/C model)
    - Each wire harness clamps
    - Output shaft speed sensor (VSS) (34) (A/T model)
    - Solenoid valve (33) (A/T model)
    - Transmission range sensor (32) (A/T model)
    - Input shaft speed sensor (31) (A/T model)
13) Remove fuse box from its bracket.
14) Disconnect the following cables:
    - Gear select control cable (23) (M/T model)
    - Gear shift control cable (24) (M/T model)
    - A/T select cable (A/T model)
15) Disconnect the following hoses:
    - Brake booster hose (26) from intake manifold
    - Radiator inlet and outlet hoses (20) from each pipe
    - Heater inlet and outlet hoses (21) from each pipe
    - Fuel feed hoses (22) from fuel feed pipe
    - EVAP canister purge valve hose (30) from purge pipe
    - A/T fluid cooler hoses (A/T model)
16) With hose connected, detach clutch operating cylinder (25). (M/T model)

⚠ CAUTION

Suspend removed clutch operating cylinder at a place where no damage will be caused during removal and installation of engine assembly.



I6RS0C140028-01

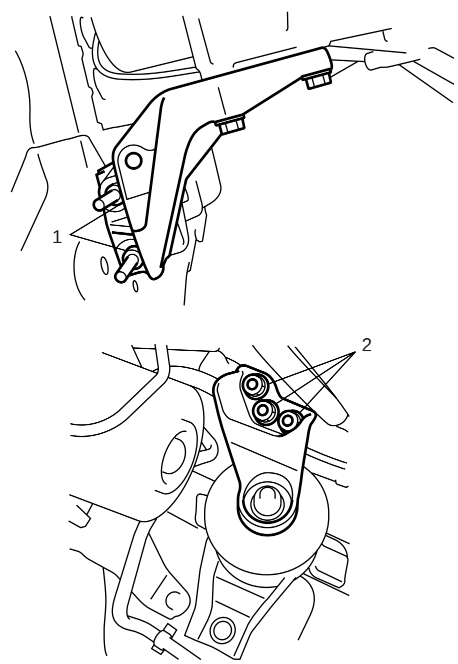
[A]:	M/T model
[B]:	A/T model

17) Disconnect right and left drive shaft joints from differential gear referring to “Front Drive Shaft Assembly Removal and Installation in Section 3A”.

NOTE

For engine and transaxle removal, it is not necessary to remove drive shafts from steering knuckle.

18) Remove exhaust No.1, No.2 and center pipes referring to “Exhaust Pipe and Muffler Removal and Installation in Section 1K”.
19) Support engine assemble by using chain hoist.
20) Remove suspension frame referring to “Front Suspension Frame, Stabilizer Bar and/or Bushings Removal and Installation in Section 2B”.
21) Remove engine rear mounting from engine rear mounting No.1 bracket.
22) Support engine and transaxle with jack, and then remove chain hoist.
23) Remove engine left mounting bracket nuts (1) and engine right mounting nuts (2).

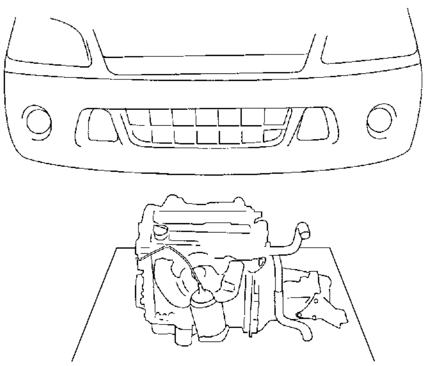


I4RS0A140008-01

24) Before removing engine with transaxle from engine compartment, recheck to make sure all hoses, electric wires and cables are disconnected from engine and transaxle.
25) Lower engine with transaxle from engine compartment.

⚠ CAUTION

Before lowering engine, to avoid damage to A/C compressor and clutch operating cylinder, make clearance by rising them. Be sure not to damage suspended A/C compressor and clutch operating cylinder.



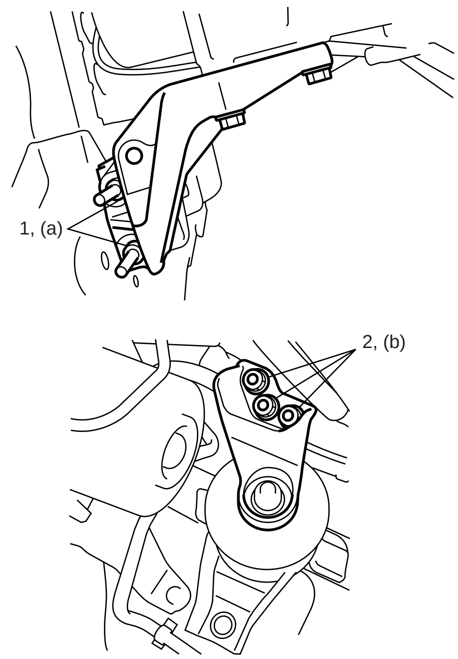
I4RS0A140009-01

26) Disconnect transaxle from engine, referring to “Manual Transaxle Unit Dismounting and Remounting in Section 5B” or “Automatic Transaxle Unit Dismounting and Remounting in Section 5A”.
27) For M/T model, remove clutch cover and clutch disk referring to “Clutch Cover, Clutch Disc and Flywheel Removal and Installation in Section 5C”.

Installation

1) For M/T model, install clutch cover and clutch disk referring to “Clutch Cover, Clutch Disc and Flywheel Removal and Installation in Section 5C”.
2) Connect transaxle to engine referring to “Manual Transaxle Unit Dismounting and Remounting in Section 5B” or “Automatic Transaxle Unit Dismounting and Remounting in Section 5A”.
3) Lift engine and transaxle into engine compartment with jack.
4) Install engine left mounting bracket nuts (1) and engine right mounting nuts (2).Tighten these nuts to specified torque.

Tightening torque
Engine left mounting bracket nut (a): 55 N·m (5.5 kgf-m, 40.0 lb-ft)
Engine right mounting nut (b): 65 N·m (6.5 kgf-m, 47.0 lb-ft)



I4RS0A140010-01

5) Support engine assemble by using chain hoist.
6) Install engine rear mounting to engine rear mountingNo.1 bracket.

Tightening torque
Engine rear mounting bush bolt: 55 N·m (5.5 kgf-m, 40.0 lb-ft)

7) Install suspension frame referring to “Front Suspension Frame, Stabilizer Bar and/or Bushings Removal and Installation in Section 2B”.
8) Remove chain hoist.
9) Install exhaust No.1, No.2 and center pipes referring to “Exhaust Pipe and Muffler Removal and Installation in Section 1K”.
10) Connect drive shaft joints referring to “Front Drive Shaft Assembly Removal and Installation in Section 3A”.
11) Reverse disconnected hoses, cables and electric wires for connection noting the followings.
    - Tighten nuts to specified torque.

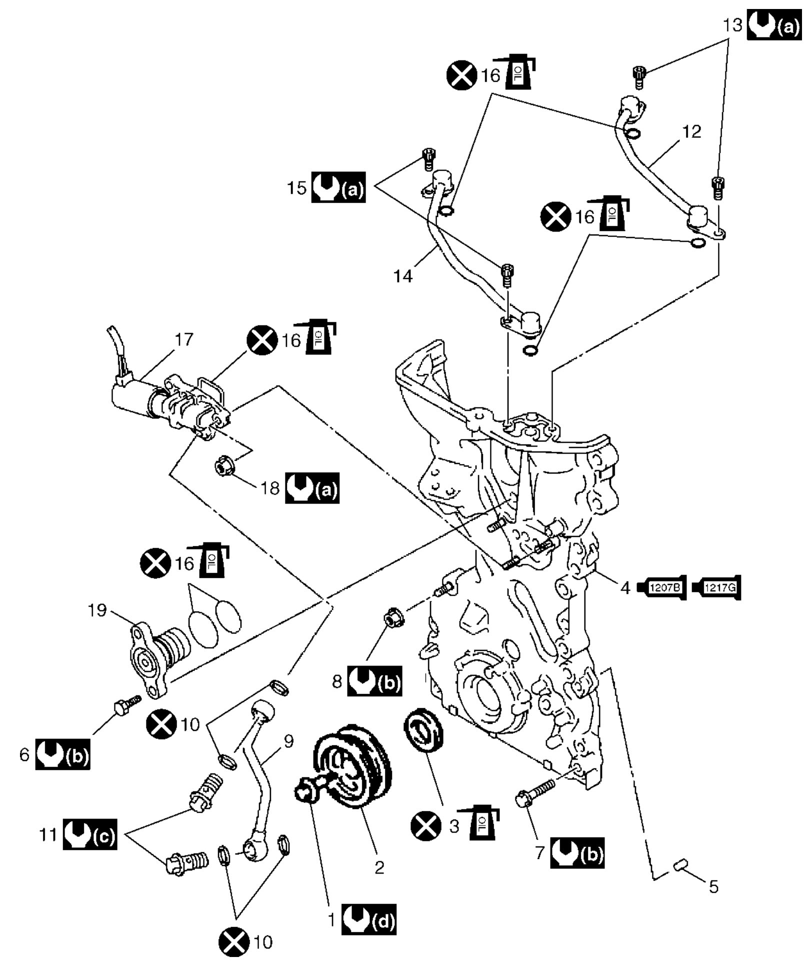
Tightening torque
Starting motor terminal nut: 11 N·m (1.1 kgf-m, 8.0 lb-ft)
Generator terminal nut: 6 N·m (0.6 kgf-m, 4.5 lb-ft)
Intake manifold ground terminal bolt: 11 N·m (1.1 kgf-m, 18.0 lb-ft)

12) Install intake manifold rear stiffener to intake manifold and cylinder block.
13) Install air cleaner assembly referring to “Air Cleaner Components”.
14) Install cowl top referring to “Cowl Top Components in Section 9K”.

15) Install A/C compressor to its bracket (if equipped) referring to “Compressor Assembly Removal and Installation in Section 7B” or “Compressor Assembly Removal and Installation in Section 7B”.
16) Adjust A/C compressor belt tension (if equipped) referring to “Compressor Drive Belt Inspection and Adjustment in Section 7B” or “Compressor Drive Belt Inspection and Adjustment in Section 7B”.
17) Check to ensure that all removed parts are back in place.
Reinstall any necessary parts which have not been reinstalled.
18) Refill cooling system with coolant referring to “Cooling System Flush and Refill in Section 1F”.
19) Refill engine with engine oil referring to “Engine Oil and Filter Change in Section 0B”.
20) Refill transaxle with transaxle oil referring to“Manual Transaxle Oil Change in Section 5B” or “A/T Fluid Change in Section 5A”.
21) Install battery and tray.
22) Connect positive and negative cable at battery.
23) Install engine hood and connect windshield washer hose.
24) Verify that there is no fuel leakage, coolant leakage, oil leakage and exhaust gas leakage at each connection.

Timing Chain Cover Components

S7RS0B1406012



I6RS0C140015-02

	1. Crankshaft pulley bolt		13. Oil gallery pipe No.2 bolt
	2. Crankshaft pulley		14. Oil gallery pipe No.3
OIL	3. Oil seal : Apply engine oil to oil seal lip.		15. Oil gallery pipe No.3 bolt
1207B 1217G	4. Timing chain cover : Apply sealant 99000-31140 to the mating surface of cylinder and cylinder head. : Apply sealant 99000-31260 to the mating surface of timing chain cover referring to the figure of Step 4) of “Installation” under “Timing Chain Cover Removal and Installation”.	OIL	16. O-ring : Apply engine oil.
	5. Pin		17. Oil control valve
	6. Cap bolt		18. Oil control valve mounting nut
	7. Timing chain cover mounting bolts		19. Cap
	8. Timing chain cover mounting nut	(a) :	11 N·m (1.1 kgf-m, 8.0 lb-ft)
	9. Oil gallery pipe No.1	(b) :	25 N·m (2.5 kgf-m, 18.0 lb-ft)

10. Copper washer	(c) : 30 N·m (3.0 kgf-m, 22.0 lb-ft)
11. Oil gallery pipe No.1 bolt	(d) : 150 N·m (15.0 kgf-m, 108.5 lb-ft)
12. Oil gallery pipe No.2	: Do not reuse.

Timing Chain Cover Removal and Installation

S7RS0B1406013

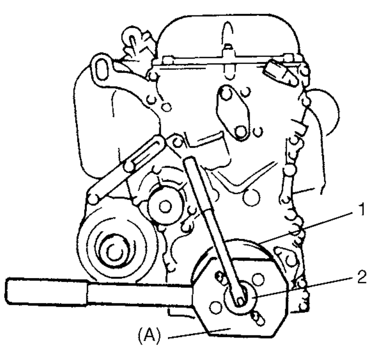
⚠ CAUTION

- **Keep working table, tools and hands clean while overhauling.**
- **Use special care to handle aluminum parts so as not to damage them.**
- **Do not expose removed parts to dust. Keep them always clean.**

Removal

1) Remove engine assembly from vehicle referring to "Engine Assembly Removal and Installation".
2) Remove water pump / generator drive belt referring to "Water Pump / Generator Drive Belt Removal and Installation in Section 1J".
3) Remove crankshaft pulley bolt.
   To lock crankshaft pulley (1), use special tool with it as shown in figure.

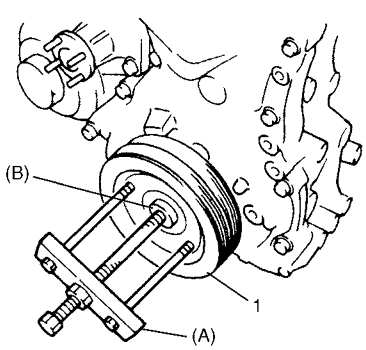
   Special tool
   (A): 09917–68221



I2RH0B140051-01

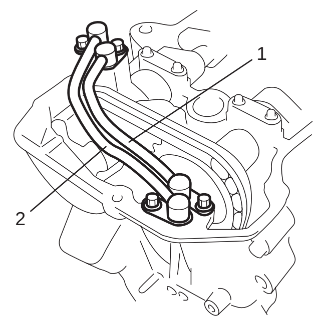
4) Remove crankshaft pulley (1).
   If it is hard to remove, use special tools as shown in figure.

   Special tool
   (A): 09944–36011
   (B): 09926–58010



I2RH0B140052-01

5) Remove cylinder head cover referring to "Cylinder Head Cover Removal and Installation".
6) Remove oil pan referring to "Oil Pan and Oil Pump Strainer Removal and Installation in Section 1E".
7) Remove water pump pulley.
8) Remove A/C bracket from cylinder block.
9) Remove oil gallery pipes No.2 (1) and No.3 (2).



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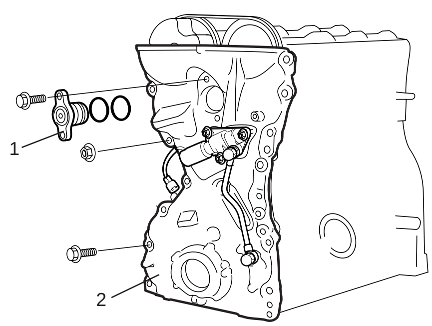
10) Remove cap (1) from timing chain cover (2).
11) Remove timing chain cover (2).



I3RH0B140022-01

12) Remove oil control valve from timing chain cover referring to "Oil Control Valve Removal and Installation".

Installation

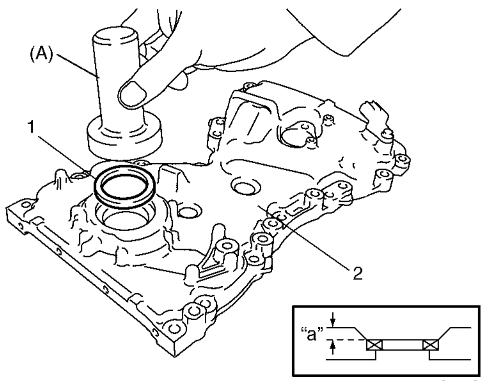
1) Clean sealing surface on timing chain cover, cylinder block and cylinder head.
   Remove oil, old sealant and dust from sealing surface.
2) Install oil seal (1) to timing chain cover, if removed.

   NOTE

   When installing new oil seal, press fit to timing chain cover (2) by using special tool (bearing installer) as shown in figure.

   Drive in dimension
   "a": 1.5 mm (0.06 in.)

   Special tool
   (A): 09913–75810

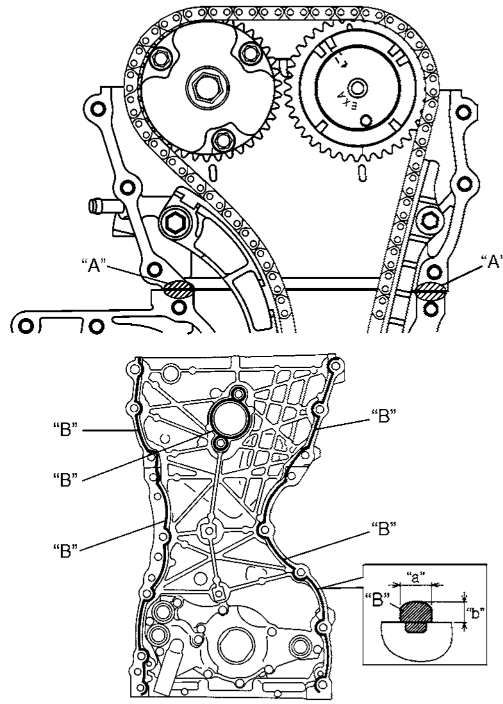


I2RH0B140058-01

3) Install oil control valve to timing chain cover referring to "Oil Control Valve Removal and Installation".
4) Apply sealant "A" to mating surface of cylinder and cylinder head and "B" to mating surface of timing chain cover as shown in figure.

   "A": Water tight sealant 99000–31140 (SUZUKI Bond No.1207B)
   "B": Sealant 99000–31260 (SUZUKI Bond No.1217G)

   Sealant amount for timing chain cover
   Width "a": 3 mm (0.12 in.)
   Height "b": 2 mm (0.08 in.)



I3RH0B140025-01

5) Apply engine oil to oil seal lip, then install timing chain cover (1). Tighten bolts and nut to specified torque.

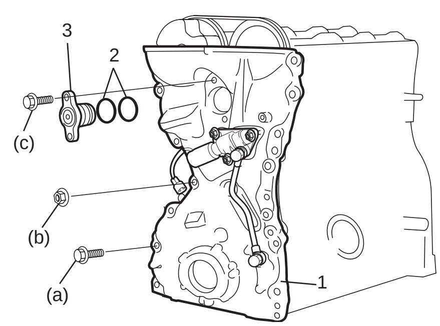
   NOTE

   Before installing timing chain cover, check that pin is securely fitted.

   Tightening torque
   Timing chain cover bolt (a): 25 N·m (2.5 kgf-m, 18.0 lb-ft)
   Timing chain cover nut (b): 25 N·m (2.5 kgf-m, 18.0 lb-ft)

6) Apply engine oil to new O-rings (2) and install them to cap (3).
7) Install cap (3) to timing chain cover (1).
   Tighten bolts to specified torque.

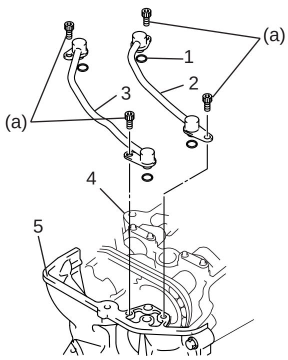
   Tightening torque
   Cap bolt (c): 25 N·m (2.5 kgf-m, 18.0 lb-ft)



I4RS0B140011-02

8) Install new O-ring (1) to oil gallery pipes No.2 (2) and No.3 (3).
9) Install oil gallery pipes No.2 and No.3 to cylinder head (4) and timing chain cover (5).
   Tighten bolts to specified torque.

   Tightening torque
   Oil gallery pipe No.2 and No.3 bolt (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)

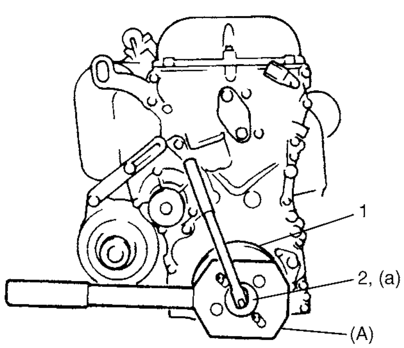


I3RH0B140027-01

10) Install water pump pulley.
11) Install cylinder head cover referring to “Cylinder Head Cover Removal and Installation”.
12) Install oil pan referring to “Oil Pan and Oil Pump Strainer Removal and Installation in Section 1E”.
13) Install crankshaft pulley (1). Tighten bolt (2) to specified torque. To lock crankshaft pulley, use special tool with it as shown in figure.

   Special tool
   (A): 09917–68221

   Tightening torque
   Crankshaft pulley bolt (a): 150 N·m (15.0 kgf-m, 108.5 lb-ft)



I2RH0B140056-01

14) Install engine assembly to vehicle referring to “Engine Assembly Removal and Installation”.

Timing Chain Cover Inspection

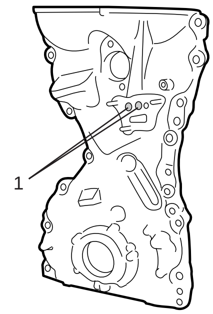
S7RS0B1406014

Oil Seal

Check oil seal lip for fault or other damage. Replace as necessary.

Timing Chain Cover

Inspect strainer (1) of oil passage for driving intake cam timing sprocket assembly (VVT actuator).
If clog or foreign matter exists, clean strainer.



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Oil Control Valve Removal and Installation

S7RS0B1406015

Removal

Remove oil gallery pipe No.1 (1) and oil control valve (2) from timing chain cover (3).

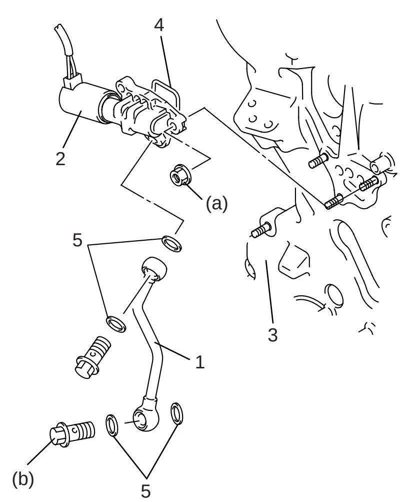
Installation

1) Install new O-ring (4) to oil control valve.
2) Install oil control valve to timing chain cover.
   Tighten nuts to specification.

   Tightening torque
   Oil control valve mounting nut (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)

3) Install oil gallery pipe No.1 with new copper washers (5) to timing chain cover.
   Tighten bolts to specification.

   Tightening torque
   Oil gallery pipe No.1 bolt (b): 30 N·m (3.0 kgf-m, 21.5 lb-ft)



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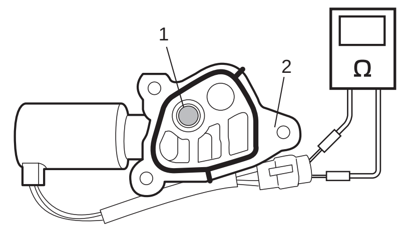
Oil Control Valve Inspection

S7RS0B1406016

Oil Control Valve

1) Inspect strainer (1) and mating surface (2) of oil control valve for clog or damage. Clean oil control valve if clog or foreign matter is present on strainer or mating surface of oil control valve.
   Replace oil control valve if its mating surface is damaged.
2) Check resistance between terminals of oil control valve.

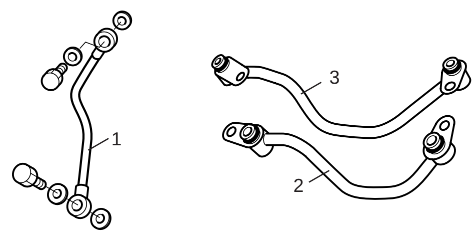
   Oil control valve resistance
   6.7 – 7.7 Ω (at 20 °C (68 °F))



I3RM0A140028-01

Oil Gallery Pipe

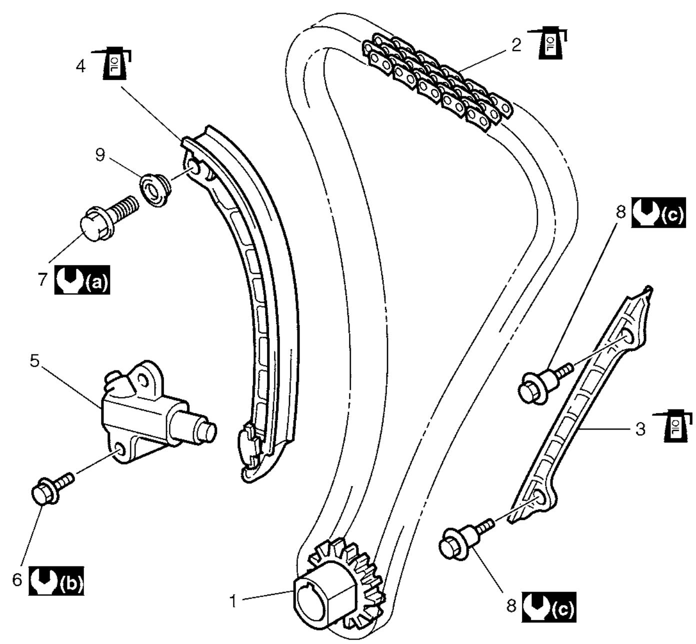
Inspect oil gallery pipes No.1, No.2 (2) and No.3 (3).
Replace if crack, deformation or clog exists.



I3RH0B140030-01

Timing Chain and Chain Tensioner Components

S7RS0B1406017



I4RS0A140012-04

1. Crankshaft timing sprocket	5. Timing chain tensioner adjuster assembly	9. Spacer
2. Timing chain : Apply engine oil.	6. Chain tensioner adjuster mounting bolt	(a) : 25 N·m (2.5 kgf-m, 18.0 lb-ft)
3. Timing chain No.1 guide : Apply engine oil to sliding surface.	7. Timing chain tensioner bolt	(b) : 11 N·m (1.1 kgf-m, 8.0 lb-ft)
4. Timing chain tensioner : Apply engine oil to sliding surface.	8. Timing chain No.1 guide bolt	(c) : 9 N·m (0.9 kgf-m, 6.5 lb-ft)

Timing Chain and Chain Tensioner Removal and Installation

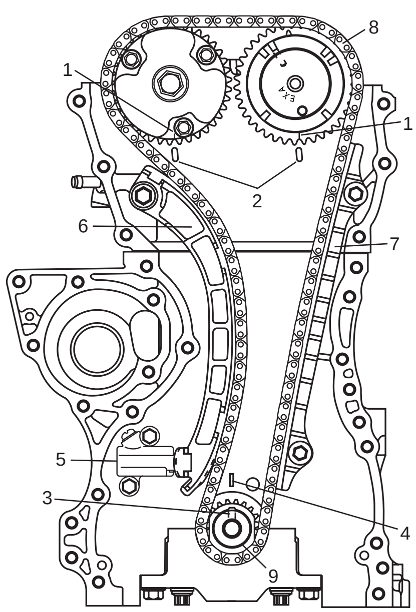
S7RS0B1406018

Removal

⚠ CAUTION

After timing chain is removed, never turn crankshaft and camshafts independently more than its allowable turning range described in “Installation”.
If turned, interference may occur between piston and valves and valves themselves, and parts related to piston and valves may be damaged.

1) Remove timing chain cover referring to “Timing Chain Cover Removal and Installation”.
2) By turning crankshaft, align camshafts and crankshaft at specific position as follows.
   a) Align both intake and exhaust camshaft timing sprocket marks (1) with notches (2) of cylinder head respectively.
   b) Align crankshaft sprocket key (3) with notch of cylinder block (4).
   Position crankshaft sprocket key (3) at upside of crankshaft as shown in figure.
3) Remove timing chain tensioner adjuster assembly (5).
4) Remove timing chain tensioner (6).
5) Remove timing chain No.1 guide (7).
6) Remove timing chain (8) with crankshaft timing sprocket (9).



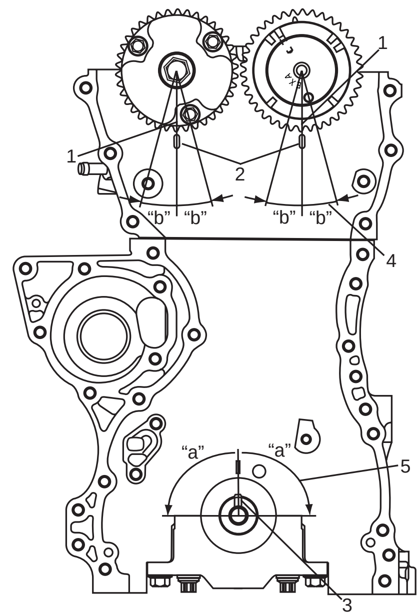
I3RH0B140032-01

Installation

⚠ CAUTION

After timing chain is removed, never turn crankshaft and camshafts independently more than such an extent (“a”, “b”) as shown in figure.
If turned, interference may occur between piston and valves and valves themselves, and parts related to piston and valves may be damaged.

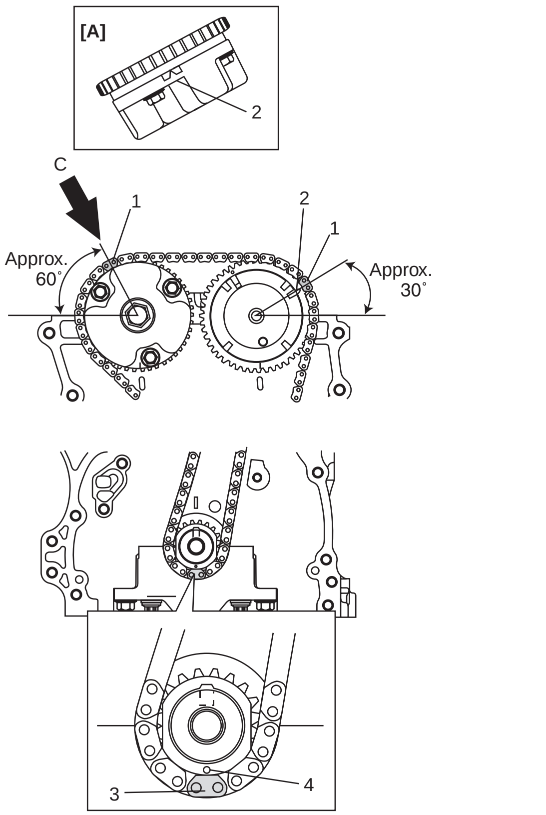
1) Check that match marks (1) on intake and exhaust camshaft timing sprockets are in match with notches (2) on cylinder head as shown in figure.
2) Set key (3) and turn crankshaft to position key on upside of crankshaft.



I4RS0A140021-01

“a”: 90°	4. Camshaft (IN and EX) allowable turning range. By marks on camshaft timing sprocket within 15° from notches on cylinder head on both right and left.
“b”: 15°	5. Crankshaft allowable turning range. By key on crankshaft, within 90° from top on both right and left.

3) Install timing chain by aligning dark blue plate (1) of timing chain and triangle mark (2) on camshaft timing sprocket as shown in figure.
4) Fit crankshaft timing sprocket to timing chain by aligning gold plate (3) of timing chain and circle mark (4) on crankshaft timing sprocket. Then install crankshaft timing sprocket fitted with chain to crankshaft.

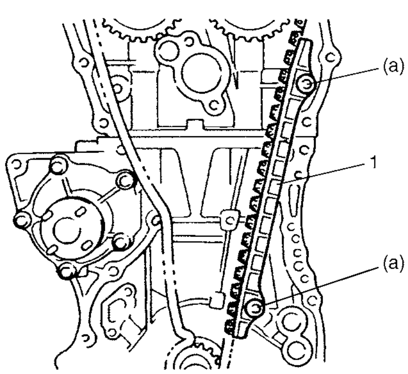


I6RS0C140016-02

[A]:	View C

5) Apply engine oil to sliding surface of timing chain No.1 guide (1) and install it as shown in figure. Tighten guide bolts to specified torque.

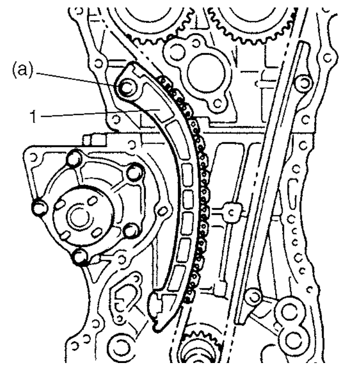
Tightening torque
Timing chain No.1 guide bolt (a): 9 N·m (0.9 kgf-m, 6.5 lb-ft)



I2RH0B140062-01

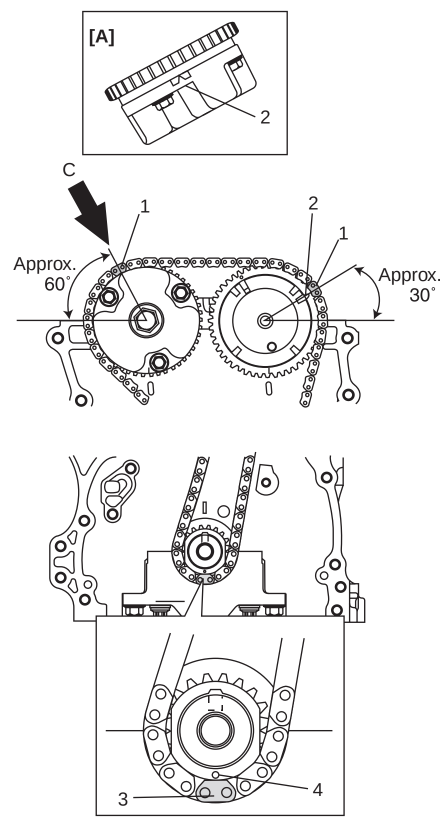
6) Apply engine oil to sliding surface of chain tensioner (1) and install chain tensioner and spacer. Tighten tensioner bolt to specified torque.

Tightening torque
Timing chain tensioner bolt (a): 25 N·m (2.5 kgf-m, 18.0 lb-ft)



I2RH0B140063-01

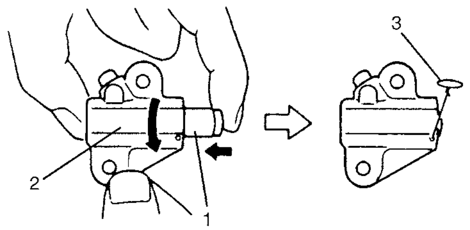
7) Check that match marks (2) on intake and exhaust camshaft timing sprockets are in match with dark blue plates (1) of timing chain and match mark (4) on crankshaft timing sprocket is in match with gold plate (3) of timing chain.



I6RS0C140016-02

[A]:	View C

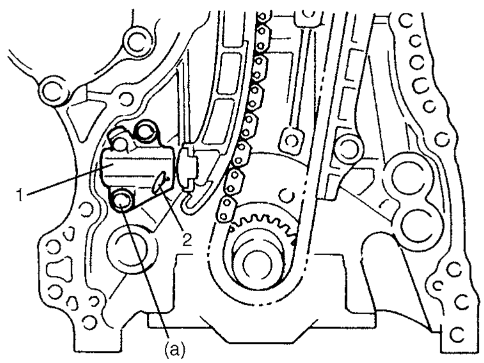
8) Screw in plunger (1) by turning body (2) in arrow direction and install a retainer (3) (wire) to hold plunger in place.



I2RH0B140065-01

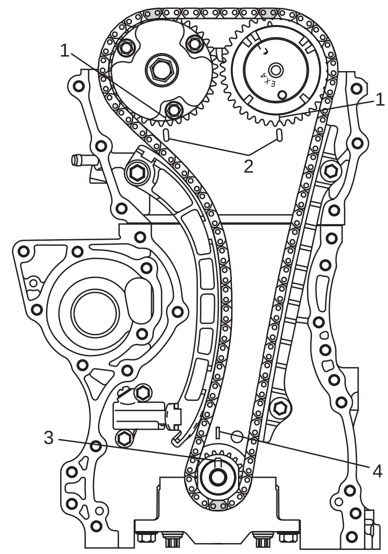
9) Install timing chain tensioner adjuster assembly (1) with a retainer (2).
Tighten adjuster bolts to specified torque and then remove a retainer from chain tensioner adjuster assembly.

Tightening torque
Timing chain tensioner adjuster bolt (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)



I2RH0B140066-01

10) Apply engine oil to timing chain, and then turn crankshaft clockwise by 2 revolutions and check that match marks (1) are at the following specific positions.
    - Intake and exhaust camshaft timing sprockets makes (1) are in match with notches (2) on cylinder head.
    - Crankshaft sprocket key (3) is in match with notch of cylinder block (4).
    - Crankshaft sprocket key (3) is on upside of crankshaft as shown in figure.



I6RS0C140017-01

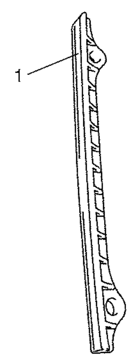
11) Install timing chain cover referring to “Timing Chain Cover Removal and Installation”.

Timing Chain and Chain Tensioner Inspection

S7RS0B1406019

Timing Chain No.1 Guide

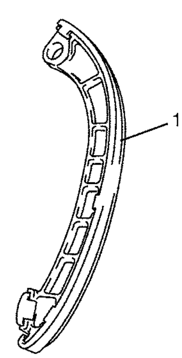
Check shoe (1) for wear or damage.



I2RH0B140068-01

Timing Chain Tensioner

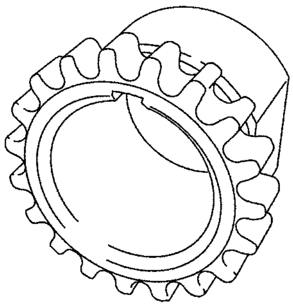
Check shoe (1) for wear or damage.



I2RH0B140069-01

Crankshaft Timing Sprocket

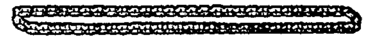
Check teeth of sprocket for wear or damage.



I2RH0B140070-01

Timing Chain

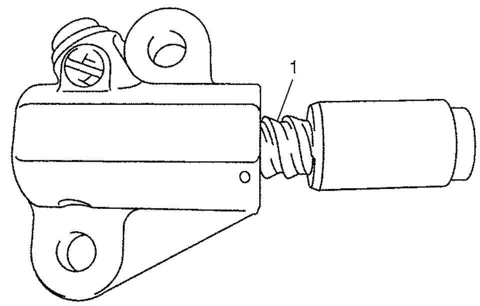
Check timing chain for wear or damage.



I2RH01140077-01

Timing Chain Tensioner Adjuster

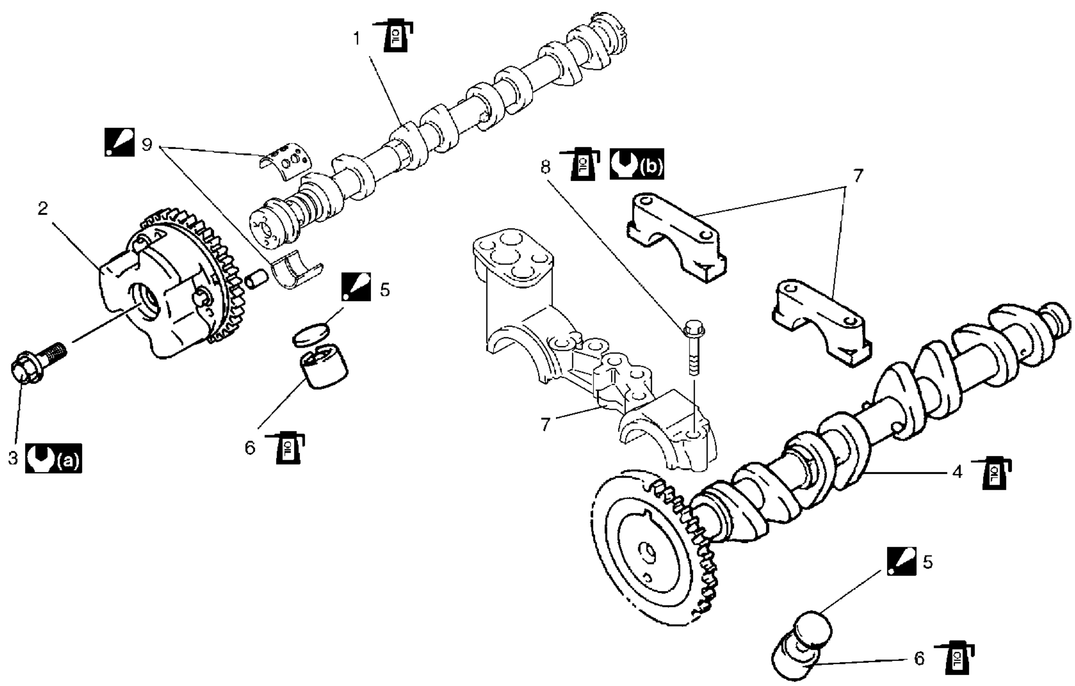
Check that tooth surface (1) are free from damage.



I2RH0B140071-01

Camshaft, Tappet and Shim Components

S7RS0B1406020



I6RS0C140018-01

1. Intake camshaft	5. Shim : Shim No. on it faces tappet side.	9. Camshaft bearing : Install a bearing half with some holes to upper side of intake camshaft No.1 bearing.
2. Intake camshaft sprocket assembly	6. Tappet	(a) : 60 N·m (6.0 kgf-m, 43.5 lb-ft)
3. Intake camshaft sprocket bolt	7. Camshaft housing	(b) : Tighten 5 N·m (0.5 kgf-m, 4.0 lb-ft) and 11 N·m (1.1 kgf-m, 8.0 lb-ft) by the specified procedure.
4. Exhaust camshaft	8. Camshaft housing bolt	: Apply engine oil to sliding surface of each part.

Camshaft, Tappet and Shim Removal and Installation

S7RS0B1406021

⚠ CAUTION

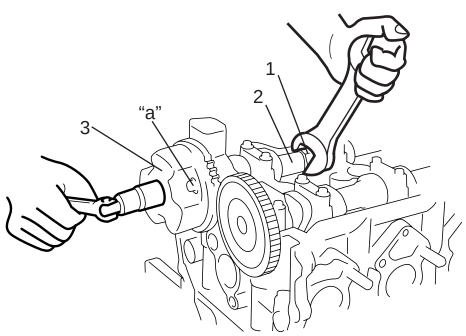
- **Keep working table, tools and hands clean while overhauling.**
- **Use special care to handle aluminum parts so as not to damage them.**
- **Do not expose removed parts to dust. Keep them always clean.**

Removal

1) Remove timing chain cover referring to "Timing Chain Cover Removal and Installation".
2) Remove timing chain referring to "Timing Chain and Chain Tensioner Removal and Installation".
3) With hexagonal section (1) of intake camshaft (2) held stationary with spanner or the like, loosen mounting bolt of intake cam timing sprocket assembly (3) and remove it.

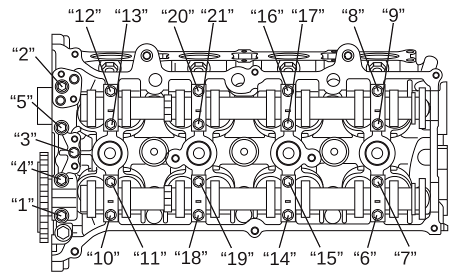
⚠ CAUTION

Never attempt to loosen mounting bolt with intake cam timing sprocket assembly held stationary. Failure to follow this could result in damage to lock pin.
Do not loosen bolt "a" because intake cam timing sprocket assembly is not serviceable.



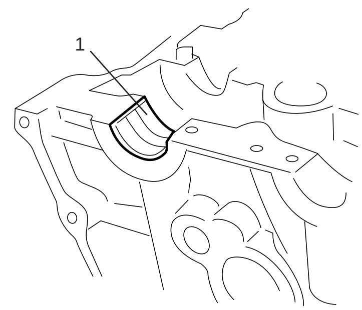
I3RM0A140030-01

4) Loosen camshaft housing bolts in such order as indicated in the figure and remove them.



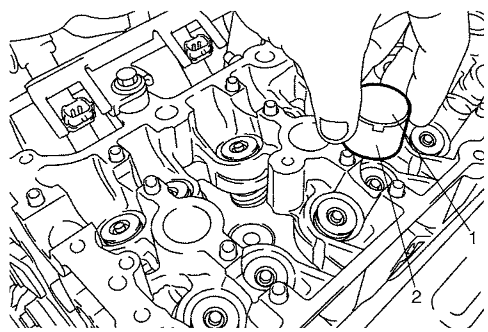
I3RM0A140031-01

5) Remove camshaft housings.
6) Remove intake and exhaust camshafts.
7) Remove camshaft bearing (1).



I3RH0B140039-01

8) Remove tappets (2) with shims (1).



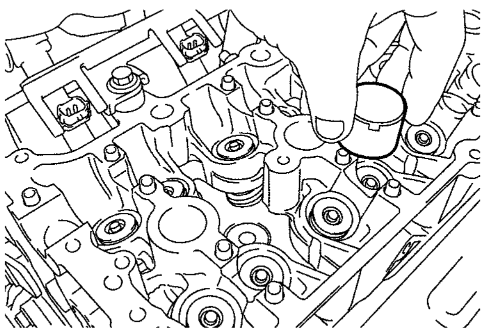
I2RH0B140074-01

Installation

1) Install tappets and shims to cylinder head.
   Apply engine oil around tappet and then install it to cylinder head.

   NOTE

   When installing shim, make sure to direct shim No. side toward tappet.

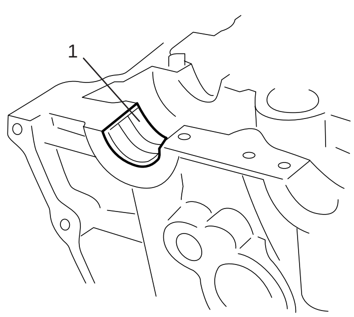


I2RH0B140075-01

2) Install camshaft bearing (1) to cylinder head.

   ⚠ CAUTION

   Do not apply engine oil to camshaft bearing back.
   Only a upper half bearing of intake camshaft bearing No.1 has some holes. Other bearings.

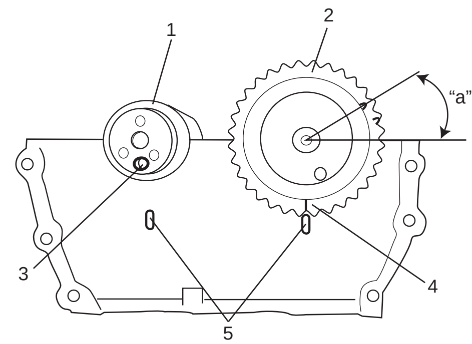


I3RH0B140039-01

3) Install intake camshaft (1) and exhaust camshaft (2).
   Align knock pin (3) and match mark (4) with notches (5) as shown in figure.

NOTE

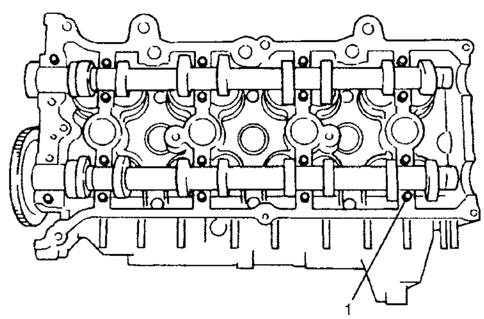
Before installing camshafts, turn crankshaft until key position faces upward.
Refer to “Timing Chain and Chain Tensioner Removal and Installation”.



I6RS0C140019-01

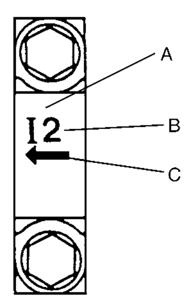
“a”:	Approx. 30°

4) Apply engine oil to sliding surface of each camshaft and camshaft journal then install them as shown in figure.
5) Install camshaft housing pins (1) as shown in figure.



I3RM0A140033-01

6) Check position of camshaft housings.
   Embossed marks are provided on each camshaft housing, indicating position and direction for installation. Install housings as indicated by these marks.

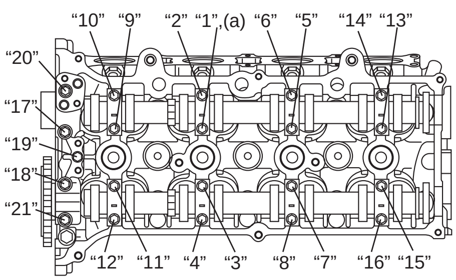


I2RH0B140078-01

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

7) Install camshaft housing.
8) Tighten camshaft housing bolts as follows.
   a) Apply engine oil to camshaft housing bolts.
   b) Tighten camshaft housing bolts by hand.
   c) Tighten camshaft housing bolts to 5 N·m (0.5 kgf-m, 4.0 lb-ft) according to numerical order ("1" through "21") as shown in figure.
   d) Retighten them by turning through 11 N·m (1.1 kgf-m, 8.0 lb-ft) in same manner as Step c).

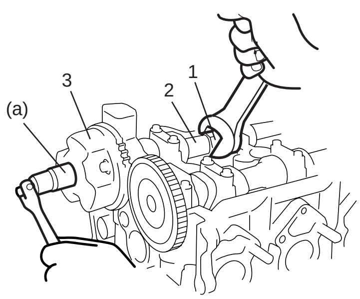
   Tighting torque
   Camshaft housing bolt (a): 5 N·m (0.5 kgf-m, 4.0 lb-ft) and 11 N·m (1.1 kgf-m, 8.0 lb-ft) by the specified procedure



I3RH0B140041-01

9) With hexagonal section (1) of intake camshaft (2) held stationary with spanner or the like, tighten bolt of intake cam timing sprocket assembly (3) to specification.

   Tightening torque
   Intake cam timing sprocket bolt (a): 60 N·m (6.0 kgf-m, 43.5 lb-ft)



I3RH0B140042-01

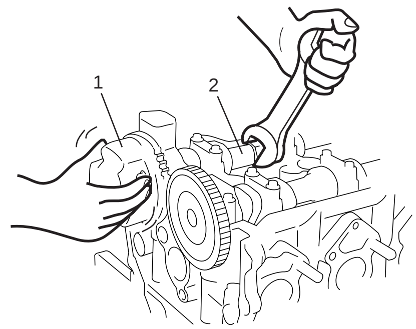
10) Install timing chain with crankshaft sprocket referring to "Timing Chain and Chain Tensioner Removal and Installation".
11) Install timing chain cover referring to "Timing Chain Cover Removal and Installation".
12) Check valve lashes referring to "Valve Lash (Clearance) Inspection".
13) Perform Steps 9) to 14) of "Installation" of "Timing Chain Cover Removal and Installation".

Camshaft, Tappet and Shim Inspection

S7RS0B1406022

Intake Cam Timing Sprocket Assembly

Fit intake cam timing sprocket assembly to camshaft (2) and hold hexagonal section of camshaft by using spanner or the like.
Check if sprocket (1) is not turned by hand.
If moved, replace intake cam timing sprocket assembly.



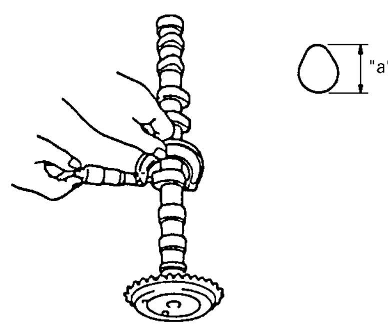
I3RH0B140043-01

Cam Wear

Using a micrometer, measure cam height "a". If measured height underruns its limit, replace camshaft.

Cam height "a"

Cam height	Standard	Limit
Intake cam	**45.424 – 45.584 mm (1.789 – 1.794 in.)**	**45.30 mm (1.783 in.)**
Exhaust cam	**45.030 – 45.190 mm (1.773 – 1.779 in.)**	**44.91 mm (1.768 in.)**

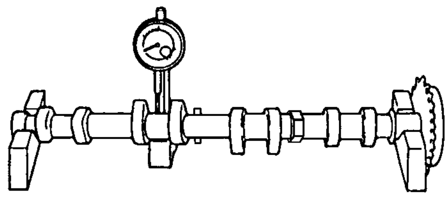


I2RH0B140080-01

Camshaft Runout

Set camshaft between two "V" blocks, and measure its runout by using a dial gauge.
If measured runout exceeds limit, replace camshaft.

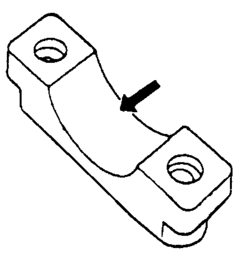
Camshaft runout limit
0.10 mm (0.0039 in.)



I2RH0B140081-01

Camshaft Journal Wear

Check camshaft journals and camshaft housings for pitting, scratches, wear or damage.
If any malcondition is found, replace camshaft or cylinder head with housing. Never replace cylinder head without replacing housings.



I2RH0B140082-01

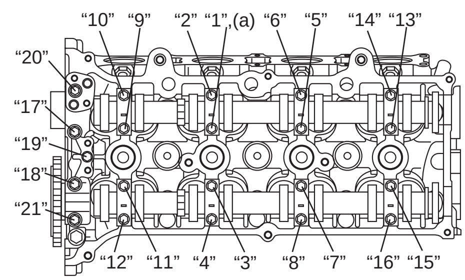
Check clearance by using gauging plastic. Checking procedure is as follows.

1) Clean housings and camshaft journals.
2) Remove all tappets with shims.
3) Install camshafts to cylinder head.
4) Place a piece of gauging plastic to full width of journal of camshaft (parallel to camshaft).
5) Install camshaft housing.
6) Install camshaft housing as follows.
   After applying engine oil to camshaft housing bolts, tighten them temporarily first. Then tighten them as follows.
   a) Tighten camshaft housing bolts to 5 N·m (0.5 kgf-m, 4.0 lb-ft) according to numerical order ("1" through "21") as shown in figure.
   b) Retighten them by turning through 11 N·m (1.1 kgf-m, 8.0 lb-ft) in same manner as Step a).

NOTE

Do not rotate camshaft while gauging plastic is installed.

Tightening torque
Camshaft housing bolt (a): 5 N·m (0.5 kgf-m, 4.0 lb-ft) and 11 N·m (1.1 kgf-m, 8.0 lb-ft) by the specified procedure

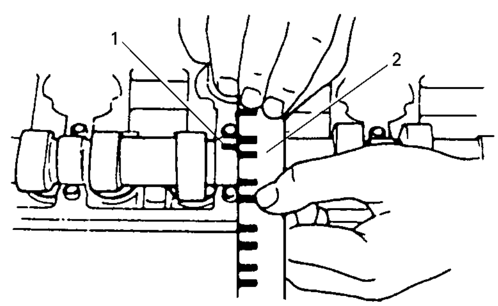


I3RH0B140041-01

1) Remove housing, and using scale (2) on gauging plastic envelop, measure gauging plastic (1) width at its widest point.

Camshaft journal clearance

	Standard	Limit
Intake side No.1 housing	**0.020 – 0.072 mm (0.0008 – 0.0028 in.)**	**0.10 mm (0.0039 in.)**
Others	**0.045 – 0.087 mm (0.0018 – 0.0034 in.)**	**0.12 mm (0.0047 in.)**



I2RH0B140083-01

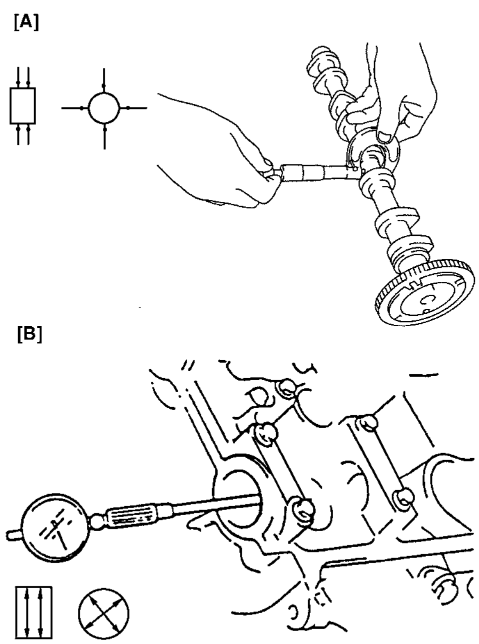
If measured camshaft journal clearance exceeds limit, measure journal (housing) bore and outside diameter of camshaft journal. Replace camshaft or cylinder head assembly whichever the difference from specification is greater.

Camshaft journal diameter [A]

Item	Standard
Intake side No.1 housing	26.940 – 26.955 mm (1.0606 – 1.0612 in.)
Exhaust side No.1 housing	26.934 – 26.955 mm (1.0604 – 1.0612 in.)
Others	22.934 – 22.955 mm (0.9029 – 0.9037 in.)

Camshaft journal bearing bore [B]

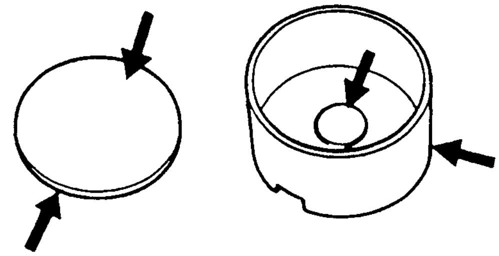
Item	Standard
Intake side No.1 housing	—
Exhaust side No.1 housing	27.000 – 27.021 mm (1.0630 – 1.0638 in.)
Others	23.000 – 23.021 mm (0.9055 – 0.9063 in.)



I2RH0B140084-01

Wear of Tappet and Shim

Check tappet and shim for pitting, scratches, or damage. If any malcondition is found, replace.



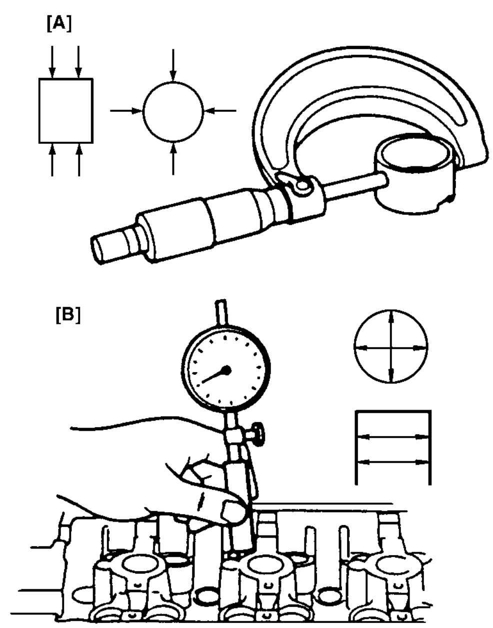
I2RH0B140085-01

Measure cylinder head bore and tappet outside diameter to determine cylinder head-to-tappet clearance. If clearance exceeds limit, replace tappet or cylinder head.

Cylinder head to tappet clearance
Standard: 0.025 – 0.066 mm (0.0010 – 0.026 in.)
Limit: 0.15 mm (0.0059 in.)

Tappet outside diameter [A]
Standard: 30.959 – 30.975 mm (1.2189 – 1.2195 in.)

Cylinder head tappet bore [B]
Standard: 31.000 – 31.025 mm (1.2205 – 1.2215 in.)



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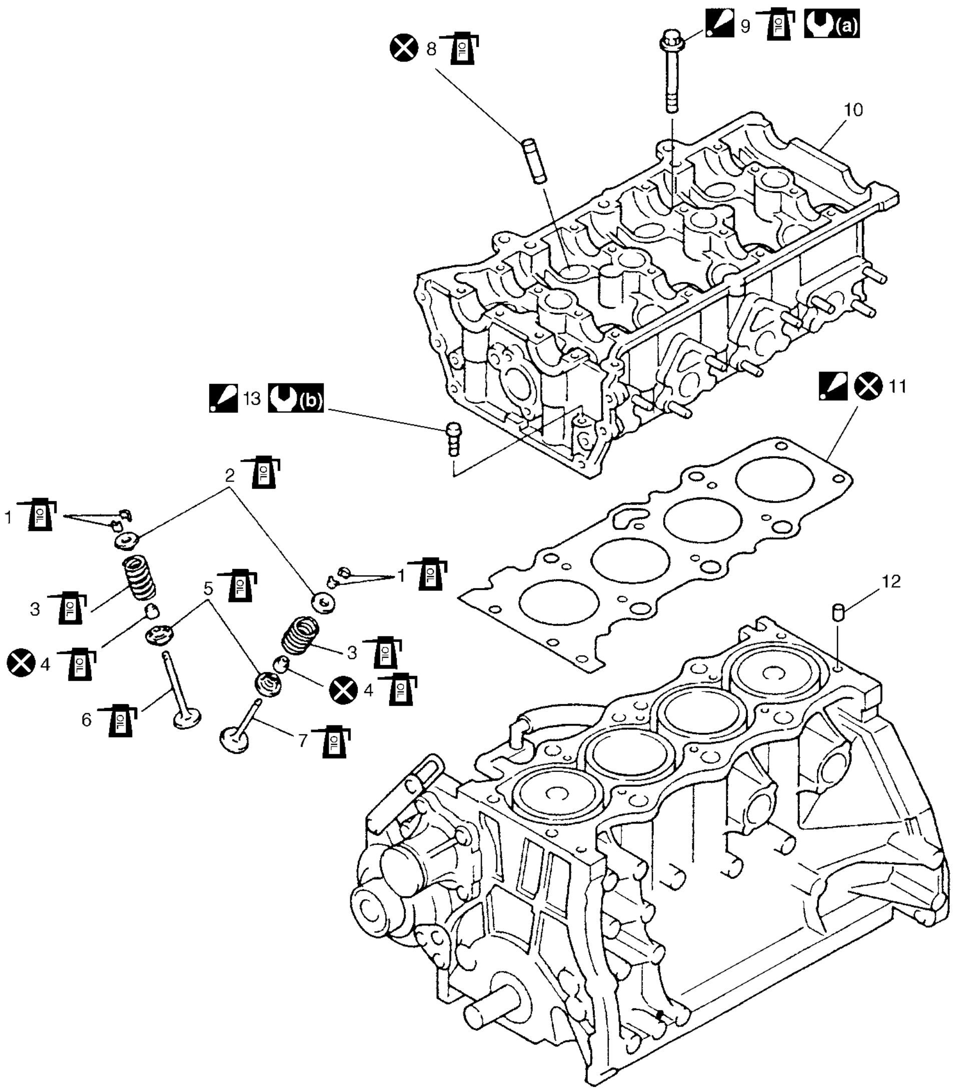
Valves and Cylinder Head Components

S7RS0B1406023



I4RS0A140015-01

1. Valve cotters	7. Exhaust valve	13. Cylinder head bolt (M8) : Be sure to tighten cylinder head bolt (M8) after securing the other cylinder head bolt (M10).
2. Valve spring retainer	8. Valve guide	(a) : Tighten 20 N·m (2.0 kgf-m, 14.5 lb-ft), 40 N·m (4.0 kgf-m, 29.0 lb-ft), 60° and 60° by the specified procedure.
3. Valve spring	9. Cylinder head bolt (M10) : Never reuse cylinder head bolts once disassembled it due to plastic deformation tightening. Be sure to use new cylinder head bolts when installing.	(b) : 25 N·m (2.5 kgf-m, 18.0 lb-ft)
4. Valve stem seal	10. Cylinder head	: Do not reuse.
5. Valve spring seat	11. Cylinder head gasket : “TOP” mark provided on gasket comes to crankshaft pulley side, facing up.	OIL : Apply engine oil to sliding surface of each part.
6. Intake valve	12. Dowel pin	

Valves and Cylinder Head Removal and Installation

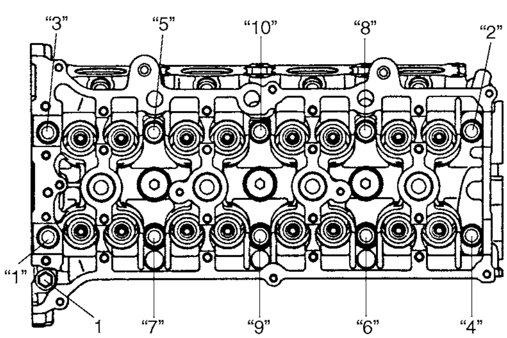
S7RS0B1406024

Removal

1) Remove engine assembly from vehicle referring to “Engine Assembly Removal and Installation”.
2) Remove oil pan referring to “Oil Pan and Oil Pump Strainer Removal and Installation in Section 1E”.
3) Remove cylinder head cover referring to “Cylinder Head Cover Removal and Installation”.
4) Remove timing chain cover referring to Steps 2) to 11) of “Removal” in “Timing Chain Cover Removal and Installation”.
5) Remove timing chain referring to Steps 2) to 6) of “Removal” in “Timing Chain and Chain Tensioner Removal and Installation”.
6) Remove intake and exhaust camshafts referring to Steps 3) to 8) of “Removal” in “Camshaft, Tappet and Shim Removal and Installation”.
7) Loosen cylinder head bolts in such order as indicated in the figure by using a 12 corner socket wrenches and remove them.

NOTE

- **Don’t forget to remove bolt (M8) (1) as shown in figure.**
- **Never reuse cylinder head bolts once disassembled it due to plastic deformation tightening. Be sure to use new cylinder head bolts when installing.**

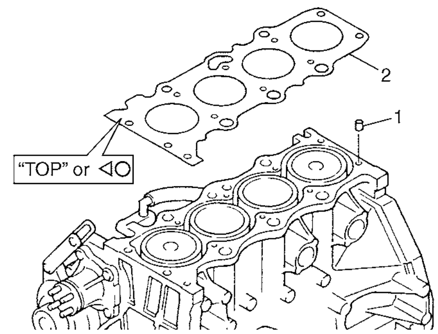


I2RH0B140088-01

8) Check all around cylinder head for any other parts required to be removed or disconnected and remove or disconnect whatever necessary.
9) Remove exhaust manifold, if necessary referring to “Exhaust Manifold Removal and Installation in Section 1K”.
10) Remove cylinder head with intake manifold and exhaust manifold. Use lifting device, if necessary.

Installation

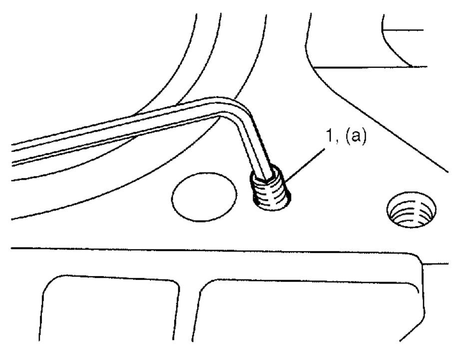
1) Clean mating surface of cylinder head and cylinder block. Remove oil, old gasket and dust from mating surface.
2) Install knock pins (1) to cylinder block.
3) Install new cylinder head gasket (2) to cylinder block. “Top” or “Triangle/circle” mark provided on gasket comes to crankshaft pulley side, facing up (toward cylinder head side).



I4RS0B140018-01

4) Make sure that oil jet (venturi plug) (1) is not clogged. If it is not installed, install it as specified torque.

Tightening torque
Venturi plug (a): 3.5 N·m (0.35 kgf-m, 3.0 lb-ft)



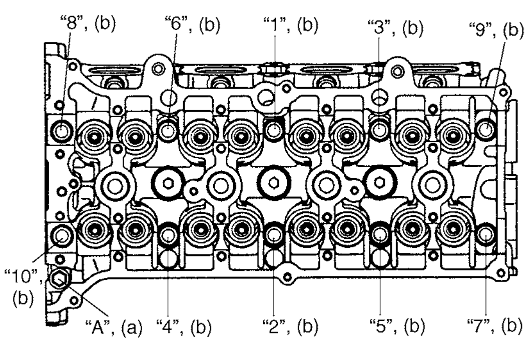
I2RH0B140089-01

5) Install cylinder head to cylinder block.
Apply engine oil to new cylinder head bolts and tighten them gradually as follows.
   a) Tighten cylinder head bolts (“1” – “10”) to 20 N·m (2.0 kgf-m, 14.5 lb-ft) according to numerical order as shown by using a 12 corner socket wrenches.
   b) In the same manner as in Step a), tighten them to 40 N·m (4.0 kgf-m, 29.0 lb-ft).
   c) Turn all bolts 60° according to numerical order in the figure.
   d) Repeat Step c).
   e) Tighten bolt “A” to specified torque.

NOTE

Be sure to tighten M8 bolt “A” after securing the other bolts.

Tightening torque
Cylinder head bolt for M8 (a): 25 N·m (2.5 kgf-m, 18.0 lb-ft)
Cylinder head bolt for M10 (b): 20 N·m (2.0 kgf-m, 14.5 lb-ft), 40 N·m (4.0 kgf-m, 29.0 lb-ft) and then retighten by turning through to 60° twice



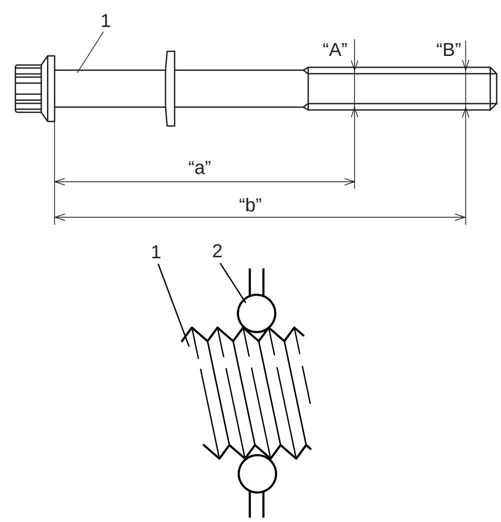
I2RH0B140091-01

NOTE

- **If they are reused, check thread diameters of cylinder head bolt (1) for deformation according to the follows and replace them with new ones if thread diameter difference exceeds limit.**
- **Measure each thread diameter of cylinder head bolt (1) at “A” on 83.5 mm (2.81 in.) from seat side of flange bolt and “B” on 115 mm (4.53 in.) from seat side of flange bolt by using a micrometer (2).**
  Then calculate difference in diameters (“A” – “B”). If it exceeds limit, replace with new one.

Cylinder head bolt diameter measurement points
“a”: 83.5 mm (2.81 in.)
“b”: 115 mm (4.53 in.)

Cylinder head bolt diameter difference (deformation)
Limit (“A” – “B”): 0.1 mm (0.004 in.)



I2RH0B140092-01

6) Install camshafts, tappet and shim referring to “Camshaft, Tappet and Shim Removal and Installation”.
7) Install timing chain referring to “Timing Chain and Chain Tensioner Removal and Installation”.
8) Install timing chain cover referring to “Timing Chain Cover Removal and Installation”.
9) Install cylinder head cover referring to “Cylinder Head Cover Removal and Installation”.
10) Install oil pan referring to “Oil Pan and Oil Pump Strainer Removal and Installation in Section 1E”.

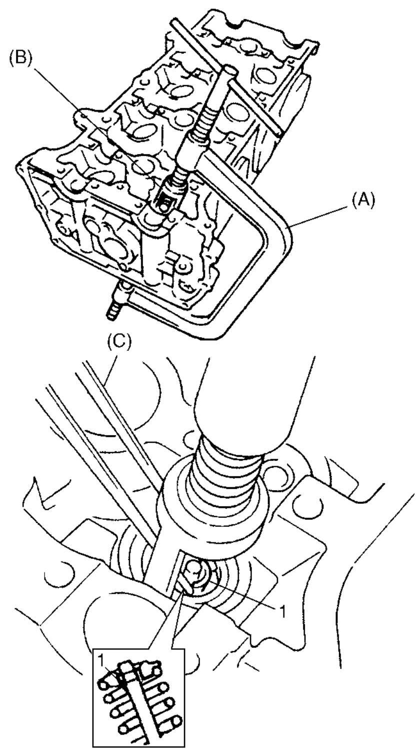
Valves and Cylinder Head Disassembly and Assembly

S7RS0B1406025

Disassembly

1) For ease in servicing cylinder head, remove intake manifold, injectors, exhaust manifold from cylinder head.
2) Using special tools (Valve lifter), compress valve spring and then remove valve cotters (1) also by using special tool (Forceps).

Special tool
(A): 09916–14510
(B): 09916–14521
(C): 09916–84511

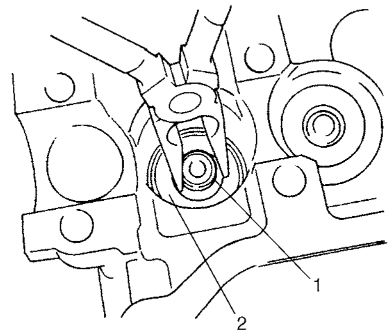


I2RH0B140093-01

3) Release special tools (Valve lifter), and remove spring retainer and valve spring.
4) Remove valve from combustion chamber side.
5) Remove valve stem seal (1) from valve guide and valve spring seat (2).

NOTE

Do not reuse valve stem seal once disassembled. Be sure to use new seal when assembling.



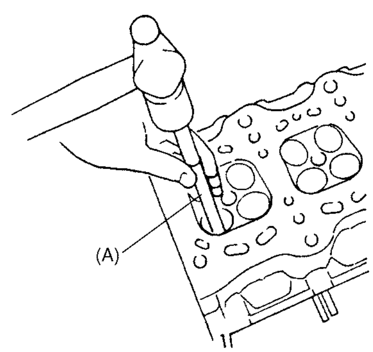
I2RH0B140094-01

6) Using special tool (Valve guide remover), drive valve guide out from combustion chamber side to valve spring side.

Special tool
(A): 09916–44910

NOTE

Do not reuse valve guide once disassembled. Be sure to use new valve guide (oversize) when assembling.



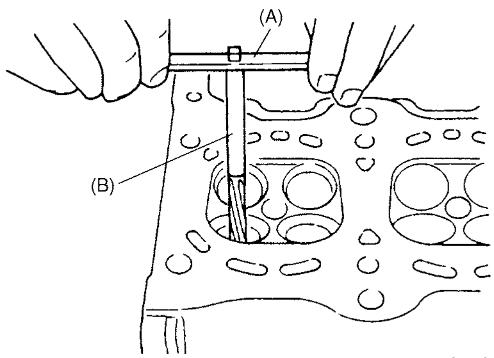
I2RH0B140095-01

7) Place disassembled parts except valve stem seal and valve guide in order so that they can be installed in their original position.

Assembly

1) Before installing valve guide into cylinder head, ream guide hole with special tool (10.5 mm reamer) so as to remove burrs and make it truly round.

Special tool
(A): 09916–34542
(B): 09916–37320



I2RH0B140096-01

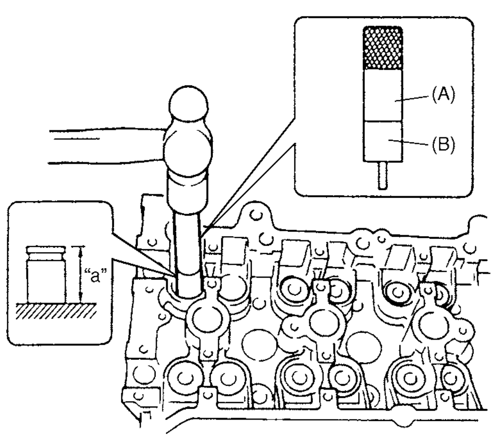
2) Install valve guide to cylinder head.
Heat cylinder head uniformly at a temperature of 80 to 100 °C (176 to 212 °F) so that head will not be distorted, and drive new valve guide into hole with special tools.
Drive in new valve guide until special tool (Valve guide installer) contacts cylinder head.
After installing, make sure that valve guide protrudes by specified dimension “a” from cylinder head.

Special tool
(A): 09916–58210
(B): 09916–56011

NOTE

- **Never reuse valve guide once disassembled. Make sure to install new valve guide (Oversize).**
- **Intake and exhaust valve guides are identical.**

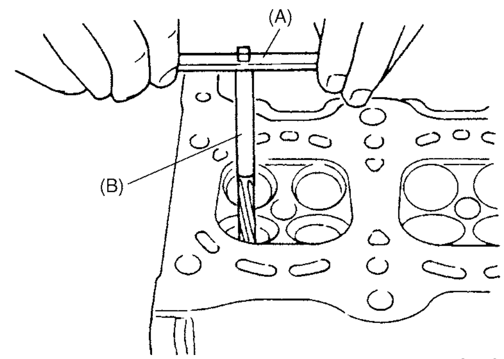
Valve guide protrusion (In and Ex)
“a”: 11.3 mm (0.44 in.)



I2RH0B140097-01

3) Ream valve guide bore with special tool (5.5 mm reamer). After reaming, clean bore.

Special tool
(A): 09916–34542
(B): 09916–34550



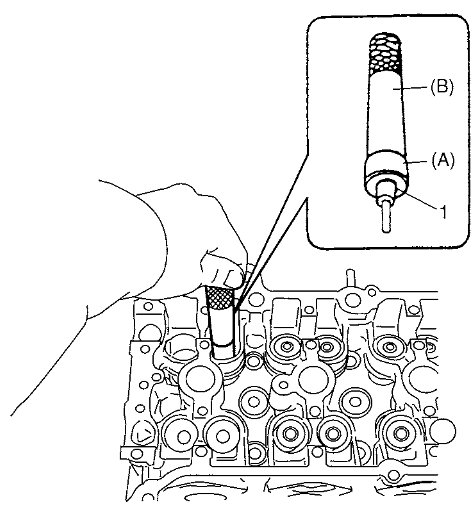
I2RH0B140096-01

4) Install valve spring seat to cylinder head.
5) Install new valve stem seal (1) to valve guide.
After applying engine oil to seal and spindle of special tool (Valve guide installer handle), fit oil seal to spindle, and then install seal to valve guide by pushing special tool by hand.
After installing, check to be sure that seal is properly fixed to valve guide.

Special tool
(A): 09917–98221
(B): 09916–58210

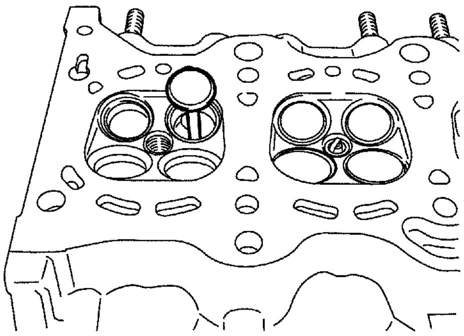
NOTE

- **Do not reuse seal once disassembled. Be sure to install new seal.**
- **When installing, never tap or hit special tool with a hammer or else. Install seal to guide only by pushing special tool by hand. Tapping or hitting special tool may cause damage to seal.**



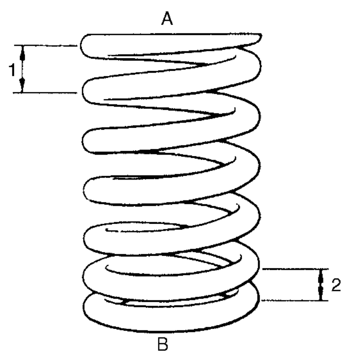
I2RH0B140098-01

6) Install valve to valve guide.
   Before installing valve to valve guide, apply engine oil to stem seal, valve guide bore and valve stem.



I2RH0B140099-01

7) Install valve spring and spring retainer.
   Each valve spring has top end (large-pitch end (1)) and bottom end (small-pitch end (2)). Be sure to position spring in place with its bottom end (small-pitch end) facing the bottom (valve spring seat side).



I2RH0B140100-01

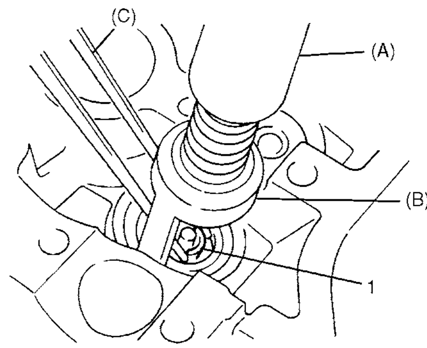
A:	Valve spring retainer side
B:	Valve spring seat side

8) Using special tools (Valve lifter), compress valve spring and fit two valve cotters (1) into groove in valve stem.

NOTE

When compressing the valve spring, be carefully to free from damage in inside face of tappet installing hole.

Special tool
(A): 09916–14510
(B): 09916–14521
(C): 09916–84511



I2RH0B140101-01

9) Install intake manifold referring to “Engine Assembly Removal and Installation”.
10) Install fuel injectors referring to “Fuel Injector Removal and Installation in Section 1G”.
11) Install exhaust manifold referring to “Exhaust Manifold Removal and Installation in Section 1K”.

Valves and Valve Guides Inspection

S7RS0B1406026

Valve Guide

Valve stem-to-guide clearance

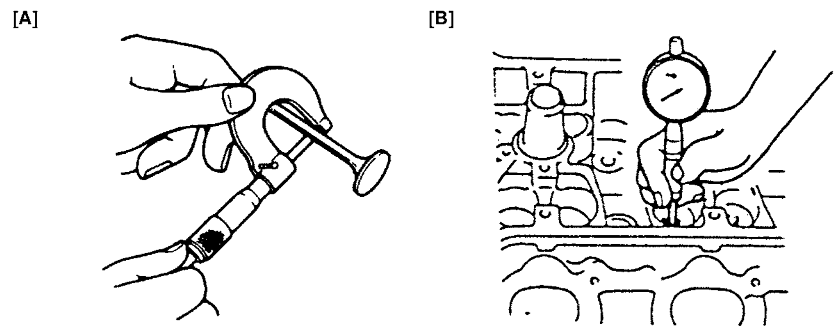
Using a micrometer and bore gauge, take diameter readings on valve stems and guides to check stem-to-guide clearance.

Be sure to take reading at more than one place along the length of each stem and guide.

If clearance exceeds limit, replace valve and valve guide.

Valve stem and valve guide specification

Item		Standard	Limit
Valve stem diameter [A]	In	5.465 – 5.480 mm (0.2150 – 0.2157 in.)	—
	Ex	5.440 – 5.455 mm (0.2142 – 0.2148 in.)	—
Valve guide bore [B]	In & Ex	5.500 – 5.512 mm (0.2165 – 0.2170 in.)	—
Stem-to-guide clearance	In	0.020 – 0.047 mm (0.0008 – 0.0018 in.)	0.070 mm (0.0028 in.)
	Ex	0.045 – 0.072 mm (0.0017 – 0.0028 in.)	0.090 mm (0.0035 in.)



I4RS0B140016-01

Valve stem end deflection

If bore gauge is not available, check end deflection of valve stem with a dial gauge instead.

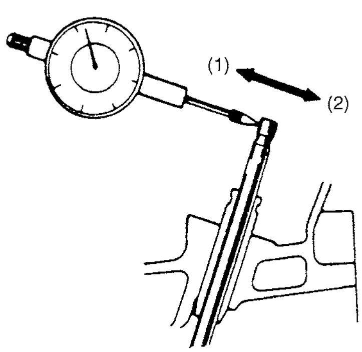
Move stem end in directions (1) and (2) to measure end deflection.

If deflection exceeds its limit, replace valve stem and valve guide.

Valve stem end deflection limit

In: 0.14 mm (0.005 in.)

Ex: 0.18 mm (0.007 in.)



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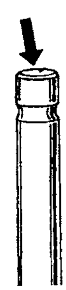
Valve

Visual inspection

- Remove all carbon from valves.
- Inspect each valve for wear, burn or distortion at its face and stem end, as necessary, replace it.
- Inspect valve stem end face for pitting and wear. If pitting or wear is found there, valve stem end may be resurfaced, but not too much to grind off its chamber. When it is worn out too much that its chamber is gone, replace valve.

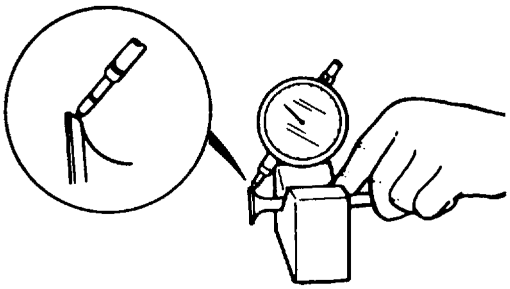


I2RH01140135-01

Valve head radial runout

Check each valve for radial runout with a dial gauge and "V" block. To check runout, rotate valve slowly. If runout exceeds its limit, replace valve.

<u>Valve head radial runout</u>
Limit: 0.08 mm (0.003 in.)

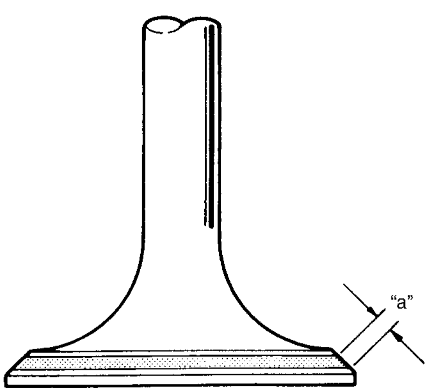


I2RH01140136-01

Seating contact width

Create contact pattern on each valve in the usual manner, i.e., by giving uniform coat of marking compound to valve seat and by rotatingly tapping seat with valve head. Valve lapper (tool used in valve lapping) must be used.
Pattern produced on seating face of valve must be a continuous ring without any break, and the width of pattern must be within specified range.

<u>Standard seating width "a" revealed by contact pattern on valve face</u>
Intake and Exhaust: 1.0 – 1.4 mm (0.0389 – 0.0551 in.)



I2RH0B140103-01

Valve seat repair

A valve seat not producing a uniform contact with its valve or showing width of seating contact that is out of specified range must be repaired by regrinding or by cutting and regrinding and finished by lapping.

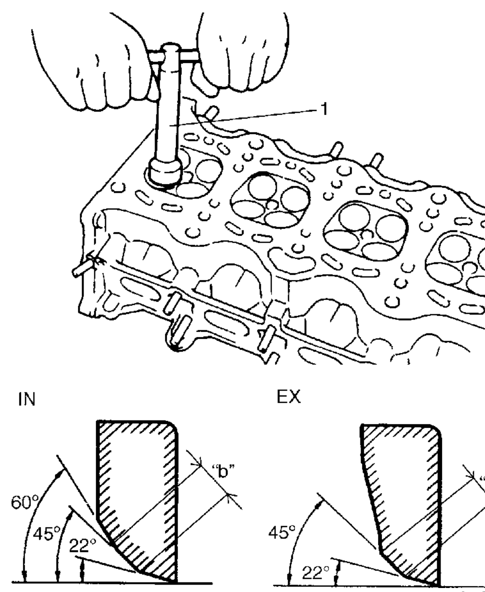
1) **Exhaust valve seat:**
   Use valve seat cutters (1) to make two cuts as illustrated in the figure. Two cutters must be used: the first for making 22° angle, and the second for making 45° angle. The second cut must be made to produce desired seat width.

   <u>Seat width for exhaust valve seat</u>
   "a": 1.0 – 1.4 mm (0.0389 – 0.0551 in.)

2) **Intake valve seat:**
   Use valve seat cutters (1) to make three cuts as illustrated in the figure. Three cutters must be used: the 1st for making 22° angle, the 2nd for making 60° angle, and 3rd for making 45° angle. The 3rd cut (45°) must be made to produce desired seat width.

   <u>Seat width for intake valve seat</u>
   "b": 1.0 – 1.4 mm (0.0389 – 0.0551 in.)

3) **Valve lapping:**
   Lap valve on seat in two steps, first with coarse size lapping compound applied to face and the second with fine-size compound, each time using valve lapper according to usual lapping method.



I6RS0C140020-01

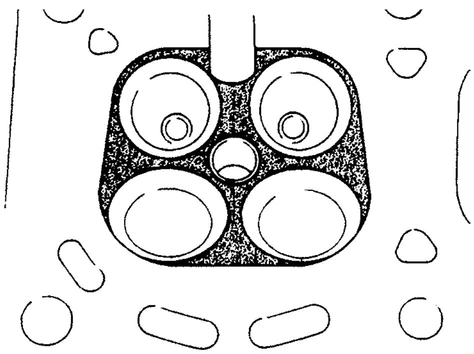
Cylinder Head Inspection

S7RS0B1406027

- Remove all carbon deposits from combustion chambers.

NOTE

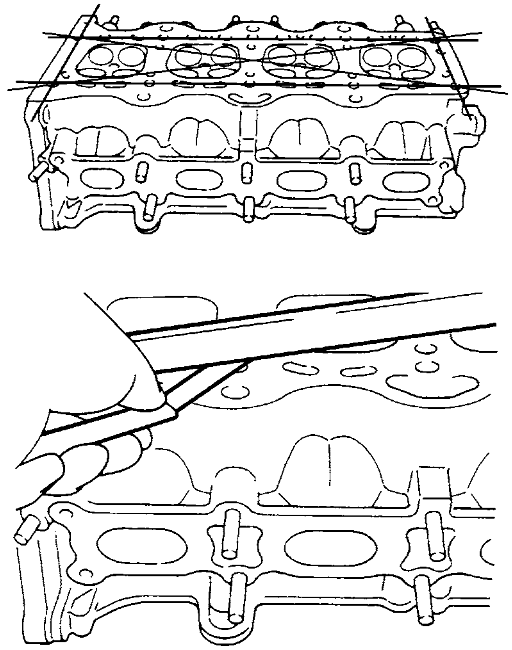
Do not use any sharp-edged tool to scrape off carbon deposits. Be careful not to scuff or nick metal surfaces when decarbonizing. The same applies to valves and valve seats, too.



I2RH0B140105-01

- Check cylinder head for cracks on intake and exhaust ports, combustion chambers, and head surface. Using a straightedge and thickness gauge, check flatness of gasketed surface at a total of 6 locations. If distortion limit is exceeded, correct gasketed surface with a surface plate and abrasive paper of about #400 (Waterproof silicon carbide abrasive paper): place abrasive paper on and over surface plate, and rub gasketed surface against paper to grind off high spots. Should this fail to reduce thickness gauge readings to within limit, replace cylinder head.
  Leakage of combustion gases from this gasketed joint is often due to warped gasketed surface: such leakage results in reduced power output.

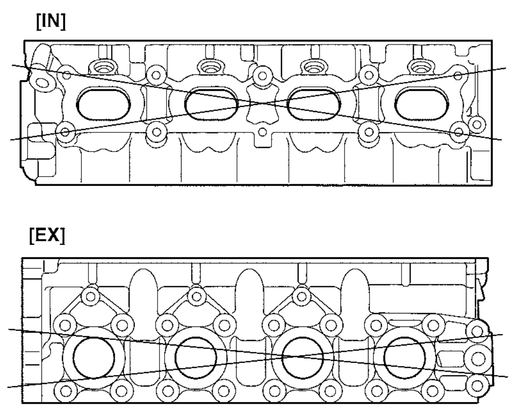
  <u>Distortion for cylinder head surface on piston side</u>
  Limit: 0.03 mm (0.001 in.)



I2RH0B140106-01

- Distortion of manifold seating faces:
  Check seating faces of cylinder head for manifolds, using a straightedge and thickness gauge, in order to determine whether these faces should be corrected or cylinder head replaced.

  <u>Distortion for cylinder head surface on intake and exhaust manifold</u>
  Limit: 0.05 mm (0.002 in.)



I2RH0B140107-01

Valve Spring Inspection

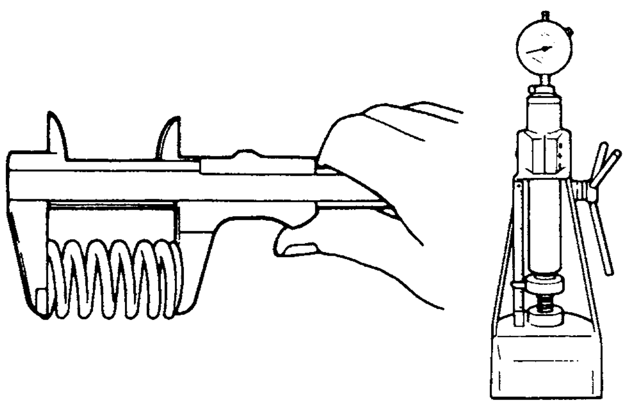
S7RS0B1406028

Valve Spring Free Length and Preload

Referring to data, check to be sure that each spring is in sound condition, free of any evidence of breakage or weakening. Remember, weakened valve springs can cause chatter, not to mention possibility of reducing power output due to gas leakage caused by decreased seating pressure.

Valve spring free length
Standard: 39.37 mm (1.550 in.)
Limit: 36.49 mm (1.437 in.)

Valve spring preload
Standard: 161– 185 N (16.1 – 18.5 kg)
(35.4 – 40.7 lb / 1.240 in.)
Limit: 159 N (15.9 kg) for 31.50 mm (35.1 lb / 1.240 in.)

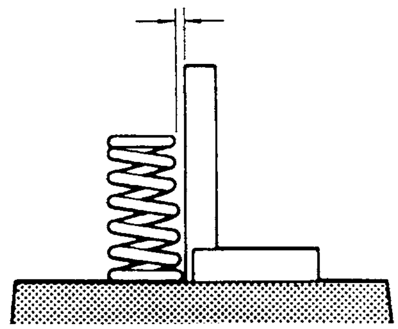


I2RH01140143-01

Spring Squareness

Use a square and surface plate to check each spring for squareness in terms of clearance between end of valve spring and square. Valve springs found to exhibit a larger clearance than limit must be replaced.

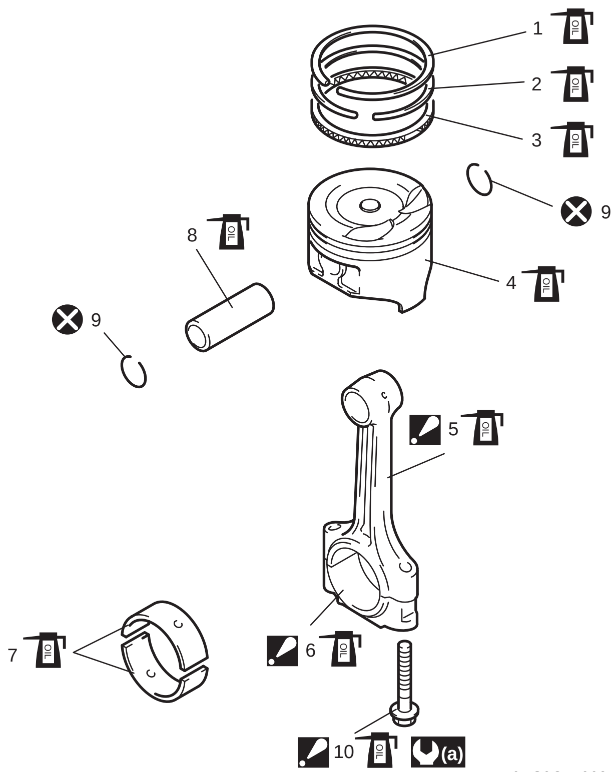
Valve spring squareness
Limit: 1.7 mm (0.067 in.)



I2RH01140144-01

Pistons, Piston Rings, Connecting Rods and Cylinders Components

S7RS0B1406029



I6RS0C140021-02

1. Top ring	6. Connecting rod bearing cap : See "B"	(a) : Tighten15 N·m (1.5 kgf-m, 11.0 lb-ft), 45° and 45° by the specified procedure.
2. 2nd ring	7. Connecting rod bearing	: Apply engine oil to sliding surface of each part.
3. Oil ring	8. Piston pin	: Do not reuse.
4. Piston	9. Piston pin circlip	
5. Connecting rod : See "A"	10. Connecting rod bearing cap bolt : See "C"	
"A": Apply engine oil to sliding surface except inner surface of big end.		
"B": Point arrow mark on cap to crankshaft pulley side.		
"C": Make sure bearing cap bolt diameter when reuse it due to plastic deformation tightening. Refer to "Piston Pins and Connecting Rods Inspection".		

Pistons, Piston Rings, Connecting Rods and Cylinders Removal and Installation

S7RS0B1406030

Removal

1) Remove engine assembly from vehicle referring to “Engine Assembly Removal and Installation”.
2) Remove cylinder head referring to “Valves and Cylinder Head Removal and Installation”.
3) Mark cylinder number on all pistons, connecting rods and connecting rod caps using silver pencil or quick drying paint.
4) Remove rod bearing caps.
5) Decarbonize top of cylinder bore before removing piston from cylinder.
6) Push piston and connecting rod assembly out through the top of cylinder bore.

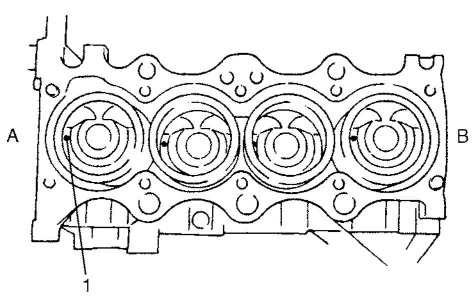
Installation

1) Apply engine oil to pistons, rings, cylinder walls, connecting rod bearings and crank pins.

NOTE

Do not apply oil between connecting rod and bearing or between bearing cap and bearing.

2) When installing piston and connecting rod assembly into cylinder bore, point front mark or arrow mark (1) on piston head to crankshaft pulley side.

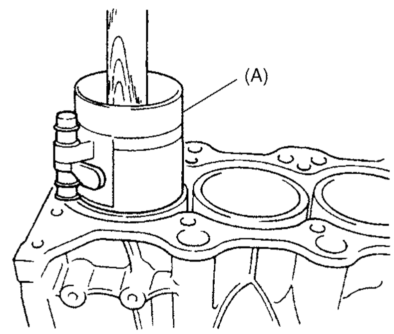


I2RH0B140110-01

A:	Crankshaft pulley side
B:	Flywheel side

3) Install piston and connecting rod assembly into cylinder bore. Use special tool (Piston ring compressor) to compress rings. Guide connecting rod into place on crankshaft.
Using a hammer handle, tap piston head to install piston into bore. Hold ring compressor firmly against cylinder block until all piston rings have entered cylinder bore.

Special tool
(A): 09916–77310



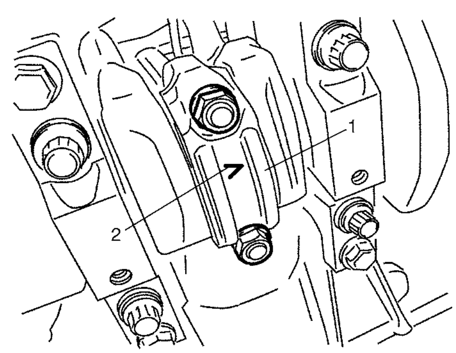
I2RH0B140111-01

4) Install bearing cap (1):
Point arrow mark (2) on cap to crankshaft pulley side.
After applying engine oil to bearing cap bolts and tighten bolts gradually as follows.
   a) Tighten all bolts to 15 N·m (1.5 kgf-m, 11.0 lb-ft).
   b) Retighten them to 45°.
   c) Repeat Step b) once again.

NOTE

Before installing bearing cap, make sure that checking for bearing cap bolt deformation. Refer to “Piston Pins and Connecting Rods Inspection”.

Tightening torque
Connecting rod bearing cap bolt: 15 N·m (1.5 kgf-m, 11.0 lb-ft) and then retighten by turning through 45° twice



I6RS0B141025-01

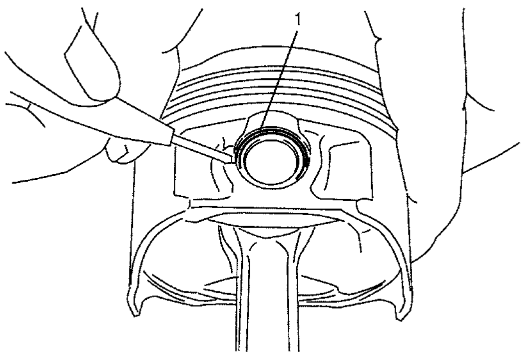
5) Install cylinder head referring to “Valves and Cylinder Head Removal and Installation”.

Pistons, Piston Rings, Connecting Rods and Cylinders Disassembly and Assembly

S7RS0B1406031

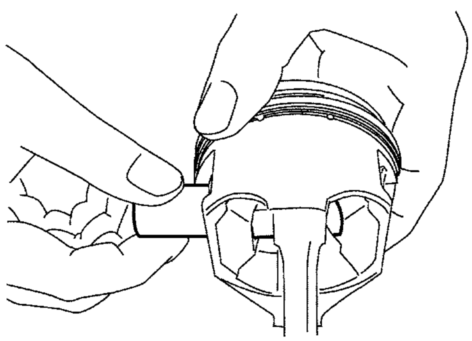
Disassembly

1) Using piston ring expander, remove two compression rings (Top and 2nd) and oil ring from piston.
2) Remove piston pin from connecting rod as follows.
   a) Ease out piston pin circlip (1), as shown.



I2RH0B140113-01

   b) Force piston pin out.



I2RH0B140114-01

Assembly

1) Decarbonize piston head and ring grooves using a suitable tool.
2) Install piston pin to piston (1) and connecting rod (2):
   a) After applying engine oil to piston pin and piston pin holes in piston and connecting rod.
   b) Fit connecting rod as shown in figure.

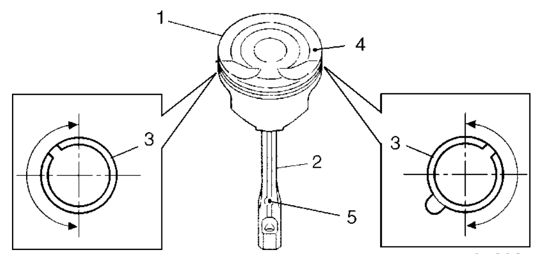
NOTE

Be sure to position front mark or arrow mark (4) on piston and oil hole (5) of connecting rod at specified position as shown in figure.

   c) Insert piston pin to piston and connecting rod.
   d) Install piston pin circlips (3).

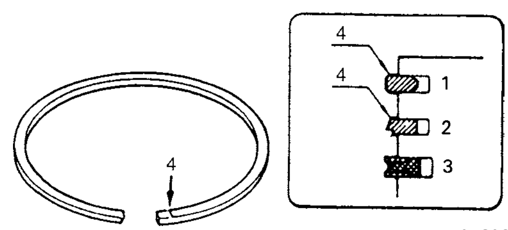
NOTE

Circlip should be installed with its cut part facing as shown in figure. Install so that circlip end gap comes within such range as indicated by arrow.



I6RS0C140022-01

3) Install piston rings to piston:
   - As indicated in the figure, 1st and 2nd rings have discrimination mark (4) respectively. When installing these piston rings to piston, direct marked side of each ring toward top of piston.
   - 1st ring (1) differs from 2nd ring (2) in thickness, shape and color of surface contacting cylinder wall.
     Distinguish 1st ring from 2nd ring by referring to the figure.
   - When installing oil ring (3), install spacer first and then two rails.



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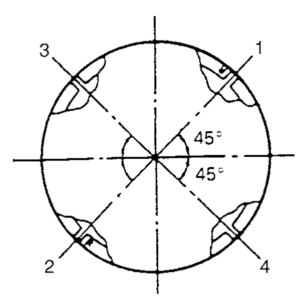
4) After installing three rings (1st, 2nd and oil rings), distribute their end gaps as shown in figure.



I6RS0B141018-01

1. 1st ring end gap	3. Oil ring upper rail gap
2. 2nd ring end gap and oil ring spacer gap	4. Oil ring lower rail gap

Cylinders, Pistons and Piston Rings Inspection

S7RS0B1406032

Cylinder

Visual inspection

Inspect cylinder walls for scratches, roughness or ridges which indicate excessive wear. If cylinder bore is very rough or deeply scratched, or ridged, rebore cylinder and use over size piston.

Cylinder bore diameter, taper and out-of-round

Using a cylinder gauge (1), measure cylinder bore in thrust and axial directions at two positions (“a” and “b”) as shown in figure.
If any of the following conditions is noted, rebore cylinder.

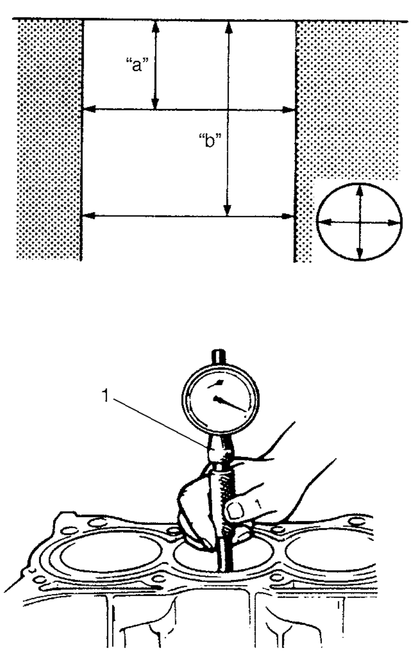
1) Cylinder bore dia. exceeds limit.
2) Difference of measurements at two positions exceeds taper limit.
3) Difference between thrust and axial measurements exceeds out-of-round limit.

<u>**Cylinder bore diameter**</u>
Standard: 78.000 – 78.014 mm (3.0709 – 3.0714 in.)
Limit: 78.114 mm (3.075 in.)

<u>**Cylinder taper and out-of-round**</u>
Limit: 0.10 mm (0.004 in.)

NOTE

If any one of four cylinders has to be rebored, rebore all four to the same next oversize. This is necessary for the sake of uniformity and balance.



I2RH0B140117-01

“a”: 50 mm (1.96 in.)	“b”: 95 mm (3.74 in.)

Piston

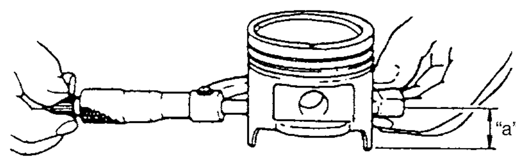
Visual inspection

Inspect piston for faults, cracks or other damages. Damaged or faulty piston should be replaced.

Piston diameter

As indicated in the figure, piston diameter should be measured at a position “a” from piston skirt end in the direction perpendicular to piston pin.

<u>**Piston diameter specification**</u>
Standard size (used piston):
77.953 – 77.968 mm (3.0690 – 3.0696 in.)
Standard size (new piston with coating):
77.963 – 77.990 mm (3.0694 – 3.0704 in.)
Oversize (0.05 mm (0.0196 in.)):
78.453 – 78.468 mm (3.0887 – 3.0893 in.)



I2RH01140157-01

“a”: 7.0 mm (0.28 in.)

Piston clearance

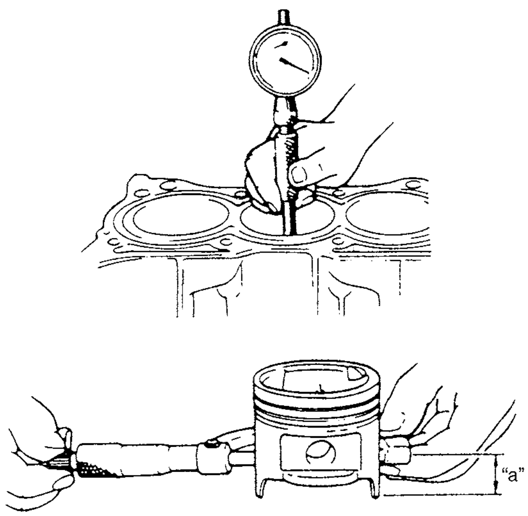
Measure cylinder bore diameter and piston diameter to find their difference which is piston clearance. Piston clearance should be within specification as follows. If it is out of specification, rebore cylinder and use oversize piston.

NOTE

Cylinder bore diameters used here are measured in thrust direction at two positions.

Piston clearance

Standard (used piston): 0.032 – 0.061 mm (0.0013 – 0.0024 in.)
Standard (new piston with coating): 0.010 – 0.051 mm (0.0004 – 0.0020 in.)
Limit: 0.161 mm (0.0063 in.)



I4RS0A140022-01

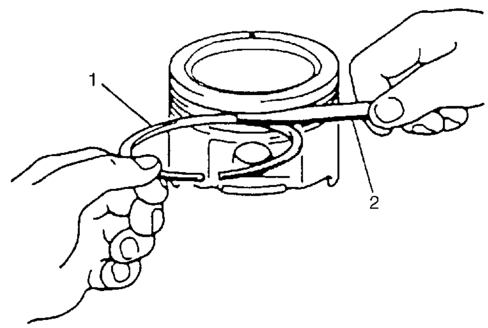
"a": 7.0 mm (0.28 in.)

Ring groove clearance

Before checking, piston grooves must be clean, dry and free of carbon deposits.
Fit new piston ring (1) into piston groove, and measure clearance between ring and ring land by using thickness gauge (2). If clearance is out of specification, replace piston.

Ring groove clearance

	Standard	Limit
Top ring	0.04 – 0.08 mm (0.0016 – 0.0031 in.)	0.12 mm (0.0047 in.)
2nd ring	0.03 – 0.07 mm (0.0012 – 0.0027 in.)	0.10 mm (0.0394 in.)
Oil ring	0.04 – 0.12 mm (0.0016 – 0.0047 in.)	—



I2RH01140159-01

Piston Ring

Piston ring end gap

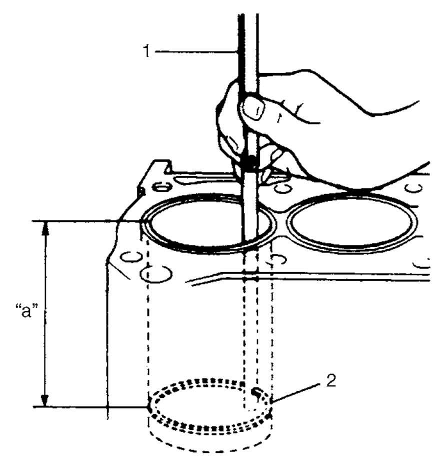
To measure end gap, insert piston ring (2) into cylinder bore and then measure the gap by using thickness gauge (1).
If measured gap exceeds limit, replace ring.

NOTE

Decarbonize and clean top of cylinder bore before inserting piston ring.

Ring groove clearance

Item	Standard	Limit
Top ring	0.20 – 0.33 mm (0.0079 – 0.0129 in.)	0.7 mm (0.0276 in.)
2nd ring	0.43 – 0.56 mm (0.0170 – 0.0220 in.)	1.0 mm (0.0394 in.)
Oil ring	0.10 – 0.40 mm (0.0040 – 0.0157 in.)	0.7 mm (0.0276 in.)



I2RH01140161-01

"a": 120 mm (4.72 in.)

Piston Pins and Connecting Rods Inspection

S7RS0B1406033

Piston Pin

Visual inspection

Check piston pin, connecting rod small end bore and piston bore for wear or damage, paying particular attention to condition of small end bore bush. If pin, connecting rod small end bore or piston bore is badly worn or damaged, replace pin, connecting rod and/or piston.

Piston pin clearance

Check piston pin clearance in small end and piston. Replace connecting rod and/or piston if its small end is badly worn or damaged or if measured clearance exceeds limit.

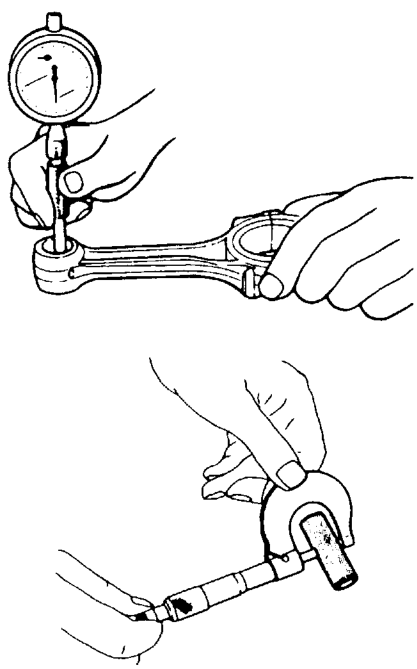
Piston pin clearance in connecting rod small end
Standard: 0.003 – 0.014 mm (0.0001 – 0.0006 in.)

Piston pin clearance in piston
Standard: 0.006 – 0.017 mm (0.00024 – 0.00067 in.)

Small-end bore
20.003 – 20.011 mm (0.7875 – 0.7878 in.)

Piston pin dia.
19.997 – 20.000 mm (0.7873 – 0.7874 in.)

Piston bore
20.006 – 20.014 mm (0.7876 – 0.7880 in.)



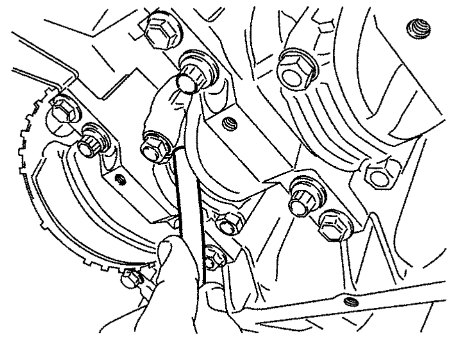
I4RS0A140023-01

Connecting Rod

Big-end side clearance

Check big-end of connecting rod for side clearance, with rod fitted and connected to its crank pin in the normal manner. If measured clearance is found to exceed its limit, replace connecting rod.

Big-end side clearance
Standard: 0.25 – 0.40 mm (0.0098 – 0.0157 in.)
Limit: 0.55 mm (0.0217 in.)

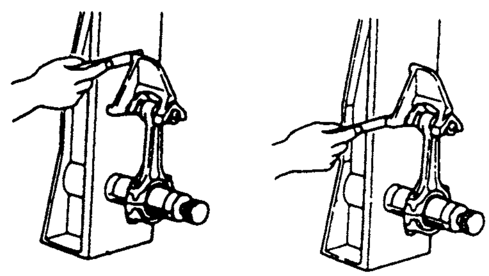


I2RH0B140148-01

Connecting rod alignment

Mount connecting rod on aligner to check it for bow and twist. If measured value exceeds the limit, replace it.

Connecting rod alignment
Limit on bow: 0.05 mm (0.0020 in.)
Limit on twist: 0.10 mm (0.0039 in.)



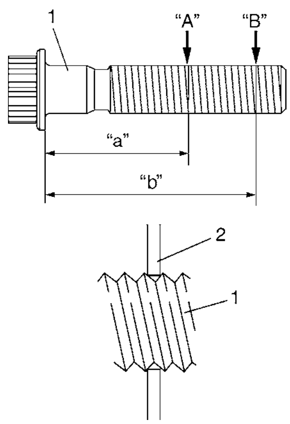
I4RH01140053-01

Connecting rod bearing cap bolt deformation (Plastic deformation tightening bolt)

Measure each thread diameter of connecting rod bearing cap bolt (1) at "A" on 32 mm (1.25 in.) from bolt mounting surface and "B" on 40 mm (1.57 in.) from bolt mounting surface by using a micrometer (2).
Calculate difference in diameters ("A" – "B"). If it is exceeds limit, replace connecting rod bearing cap bolt (1).

Connecting rod bearing cap bolt measurement points
"a": 25 mm (0.98 in.)
"b": 40 mm (1.57 in.)

Connecting rod bearing cap bolt diameter difference
Limit ("A" – "B"): 0.1 mm (0.004 in.)



I6RS0C140024-01

Crank Pin and Connecting Rod Bearings Inspection

S7RS0B1406034

Crank Pin Diameter

Inspect crank pin for uneven wear or damage. Measure crank pin for out-of-round or taper with a micrometer. If crank pin is damaged or out-of round or taper is out of limit, replace crankshaft or regrind crank pin to undersize and use undersize bearing.

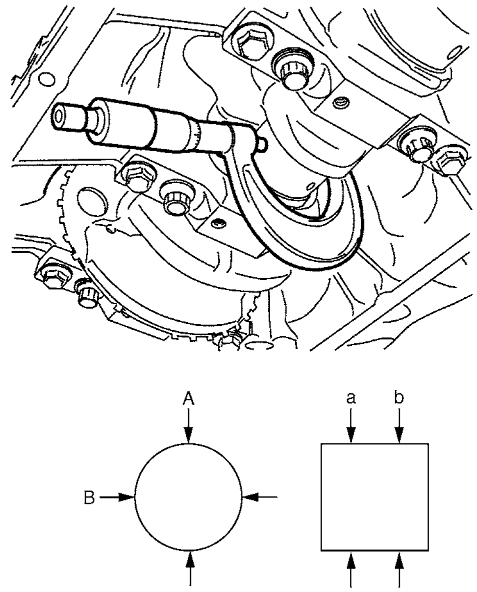
Crank pin diameter

Connecting rod bearing size	Crank pin diameter
Standard	**41.982 – 42.000 mm (1.6528 – 1.6535 in.)**
0.25 mm (0.0098 in.) undersize	**41.732 – 41.750 mm (1.6430 – 1.6437 in.)**

Out-of-round
A – B

Taper
a – b

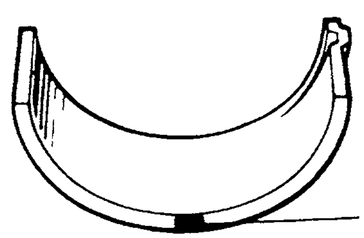
Crank pin taper and out-of-round
Limit: 0.01 mm (0.0004 in.)



I2RH0B140120-01

Connecting Rod Bearing General Information

Service connecting rod bearings are available in standard size and 0.25 mm (0.0098 in.) undersize bearing, and standard size bearing has 5 kinds of bearings differing in tolerance.
For identification of undersize bearing, it is painted red at the position as indicated in the figure, undersize bearing thickness is 1.605 – 1.615 mm (0.0632 – 0.0635 in.) at the center of it.



I2RH01140164-01

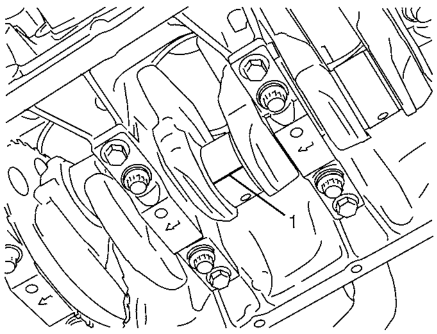
1. Red paint	

Connecting Rod Bearing Visual Inspection

Inspect bearing shells for signs of fusion, pitting, burn or flaking and observe contact pattern. Bearing shells found in defective condition must be replaced.

Connecting Rod Bearing Clearance

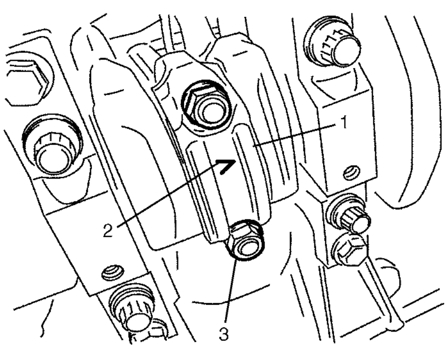
1) Before checking bearing clearance, clean bearing and crank pin.
2) Install bearing in connecting rod and bearing cap.
3) Place a piece of gauging plastic (1) to full width of crank pin as contacted by bearing (parallel to crankshaft), avoiding oil hole.



I2RH0B140121-01

4) Install rod bearing cap (1) to connecting rod. When installing cap, be sure to point arrow mark (2) on cap to crankshaft pulley side, as shown in figure. After applying engine oil to bearing cap bolts (3), tighten bearing cap bolts (3) gradually as follows.
   a) Tighten all bearing cap bolts to 15 N·m (1.5 kgf-m, 11.0 lb-ft)
   b) Retighten them to 45°
   c) Repeat Step b) once again.

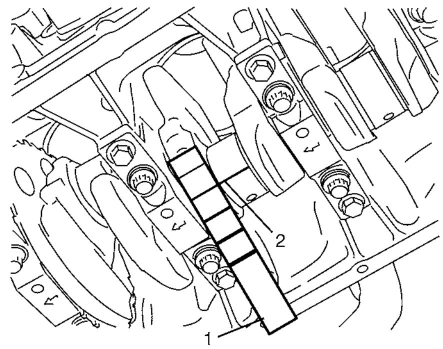
   Tightening torque
   Connecting rod bearing cap bolt: 15 N·m (1.5 kgf-m, 11.0 lb-ft) and then retighten by turning through 45° twice



I6RS0B141026-01

5) Remove cap and using a scale (1) on gauging plastic envelope (2), measure gauging plastic (2) width at the widest point (clearance).
   If clearance exceed its limit, use a new standard size bearing referring to "Selection of Connecting Rod Bearings: ".
   After selecting new bearing, recheck clearance.

   <u>Connecting rod bearing clearance</u>
   Standard: 0.029 – 0.047 mm (0.0011 – 0.0018 in.)
   Limit: 0.065 mm (0.0026 in.)



I2RH0B140123-01

6) If clearance can not be brought to its limit even by using a new standard size bearing, use next thicker bearing and recheck clearance or regrind crank pin to undersize and use 0.25 mm undersize bearing.

Selection of Connecting Rod Bearings

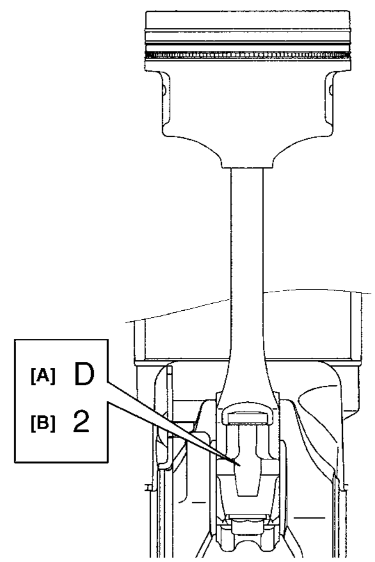
NOTE

- **If bearing is in malcondition, or bearing clearance is out of specification, select a new standard bearing according to the following procedure and install it.**
- **When replacing crankshaft or connecting rod and its bearing due to any reason, select new standard bearings to be installed by referring to numbers stamped on connecting rod and its cap and/or alphabets stamped on crank web of No.3 cylinder.**

1) Check stamped numbers on connecting rod and its cap as shown.
   Three kinds of numbers ("1", "2" and "3") represent the following connecting rod big end inside diameters.
   For example, stamped number "1" indicates that corresponding connecting rod big end inside diameter is 45.000 – 45.006 mm (1.7717 – 1.7718 in.).

   <u>Connecting rod big end inside diameter</u>

Stamped numbers	Connecting rod big end inside diameter
1	45.0000 – 45.0060 mm (1.7717 – 1.7718 in.)
2	45.0061 – 45.0120 mm (1.7719 – 1.7721 in.)
3	45.0121 – 45.0180 mm (1.7722 – 1.7723 in.)



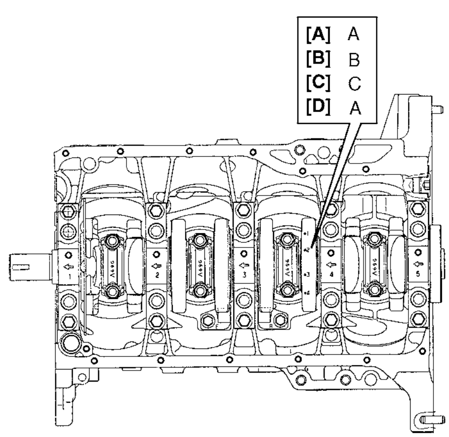
I6RS0B141027-01

[A]:	Weight indication mark
[B]:	Connecting rod big end inside diameter number

2) Next, check crankshaft pin diameter. On crank web No.3, four alphabets are stamped as shown in the figure.
Three kinds of alphabet (“A”, “B” and “C”) represent the following crankshaft pin diameter respectively.
For example, stamped “A” indicates that corresponding crankshaft pin diameter is 41.994 – 42.000 mm (1.6533 – 1.6534 in.).

Crankshaft pin outer diameter

Stamped alphabet	Crankshaft pin diameter
A	41.9940 – 42.0000 mm (1.6533 – 1.6534 in.)
B	41.9880 – 41.9939 mm (1.6531 – 1.6532 in.)
C	41.9820 – 41.9879 mm (1.6529 – 1.6530 in.)



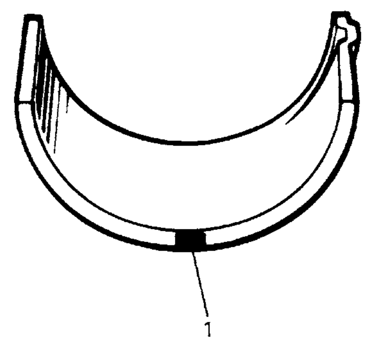
I3RH0A140018-01

[A]:	Crankshaft pin diameter for No.1 cylinder
[B]:	Crankshaft pin diameter for No.2 cylinder
[C]:	Crankshaft pin diameter for No.3 cylinder
[D]:	Crankshaft pin diameter for No.4 cylinder

3) There are five kinds of standard bearings differing in thickness. To distinguish them, they are painted in the following colors at the position as indicated in the figure.
Each color indicated the following thickness at the center of bearing.

Standard size of connecting rod bearing thickness

Color painted	Bearing thickness
Blue	1.4991 – 1.5020 mm (0.05902 – 0.05913 in.)
Yellow	1.4961 – 1.4990 mm (0.05890 – 0.05901 in.)
Nothing	1.4931 – 1.4960 mm (0.05878 – 0.05889 in.)
Black	1.4901 – 1.4930 mm (0.05867 – 0.05877 in.)
Green	1.4870 – 1.4900 mm (0.05855 – 0.05866 in.)



I3RH0A140019-01

1.	Paint

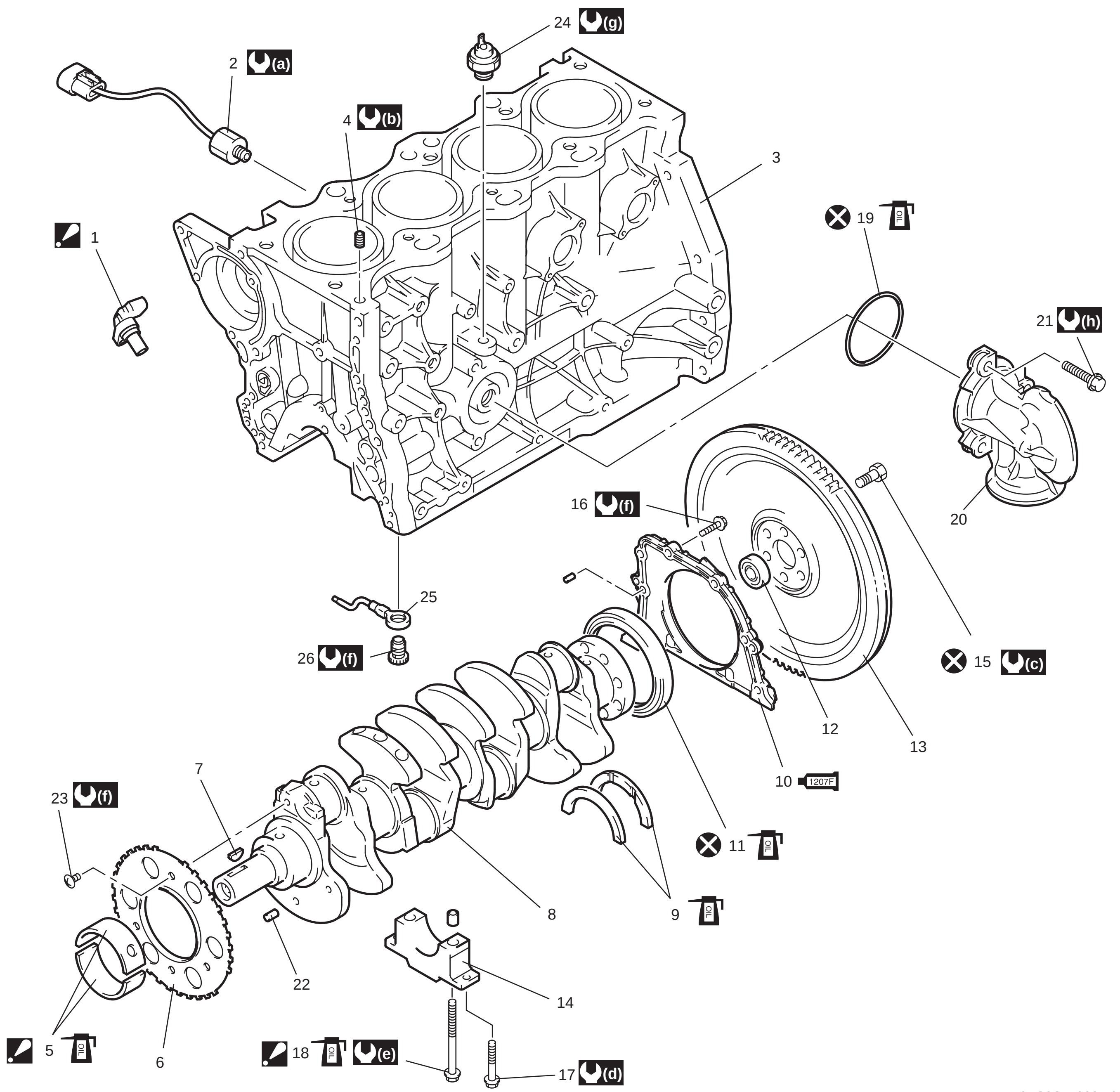
4) From number stamped on connecting rod and its cap and alphabets stamped on crank web No.3, determine new standard bearing to be installed to connecting rod big end inside, by referring to the table.
For example, if number stamped on connecting rod and its cap is “1” and alphabet stamped on crank web No.3 is “B”, install a new standard bearing painted in “Black” to its connecting rod big end inside.

Specification of new standard connecting rod bearing size

		Number stamped on connecting rod and its cap (connecting rod big end inside diameter)		
		1	2	3
Alphabet stamped on crank web No.3 (Crankshaft pin diameter)	A	Green	Black	Nothing
	B	Black	Nothing	Yellow
	C	Nothing	Yellow	Blue
		New standard bearing to be installed.		

Main Bearings, Crankshaft and Cylinder Block Components

S7RS0B1406035



I6RS0C140025-02

1. CKP sensor : See "A"	12. Input shaft bearing	23. Sensor plate bolt
2. Knock sensor	13. Flywheel or drive plate	24. Oil pressure switch
3. Cylinder block	14. Main bearing cap	25. Piston cooling nozzle
4. Venturi plug	15. Flywheel or drive plate bolt	26. Piston cooling valve
5. Main bearing : See "B"	16. Rear oil seal housing mounting bolt	(a) : 22 N·m (2.2 kgf-m, 16.0 lb-ft)
6. Sensor plate	17. Main bearing cap No.2 bolt	(b) : 5 N·m (0.5 kgf-m, 4.0 lb-ft)
7. Crankshaft timing sprocket key	18. Main bearing cap No.1 bolt : See "D"	(c) : 70 N·m (7.0 kgf-m, 51.0 lb-ft)
8. Crankshaft	19. O-ring	(d) : Tighten 25 N·m (2.5 kgf-m, 18.0 lb-ft) by the specified procedure.
9. Thrust bearing	20. Oil filter adapter case	(e) : Tighten 30 N·m (3.0 kgf-m, 22.0 lb-ft), 50 N·m (5.0 kgf-m, 36.5 lb-ft) and 60° by the specified procedure.
1207F 10. Rear oil seal housing : See "C"	21. Oil filter adapter bolt	(f) : 11 N·m (1.1 kgf-m, 8.0 lb-ft)
11. Rear oil seal	22. Spring pin	(g) : 13 N·m (1.3 kgf-m, 9.5 lb-ft)

"A":	When servicing CKP sensor, refer to "CMP Sensor Removal and Installation in Section 1C".	(h) :	25 N·m (2.5 kgf-m, 18.0 lb-ft)
"B":	Upper half of bearing has an oil groove.	:	Do not reuse.
"C":	Apply sealant 99000-31250 to mating surface.	OIL :	Apply engine oil to inside / sliding surface.
"D":	Make sure main bearing cap No.1 bolt deformation when reuse it due to plastic deformation tightening referring to "Main Bearings Inspection".		

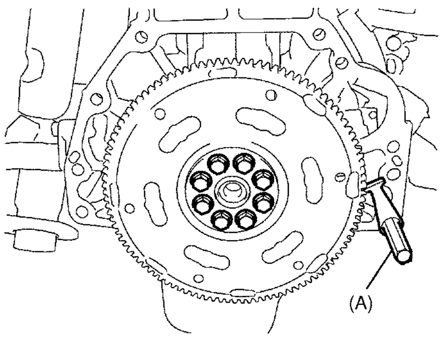
Main Bearings, Crankshaft and Cylinder Block Removal and Installation

S7RS0B1406036

Removal

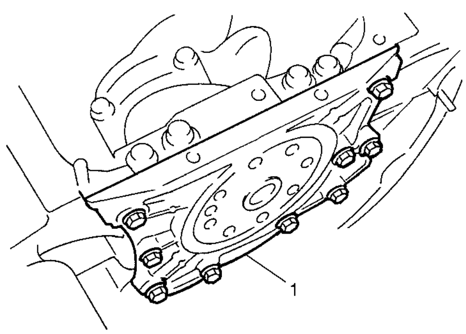
1) Remove engine assembly from vehicle referring to "Engine Assembly Removal and Installation".
2) Remove clutch cover, clutch disc and flywheel (drive plate for A/T) by using special tool.

Special tool
(A): 09924–17811



I2RH0B140125-01

3) Remove piston and connecting rod referring to "Pistons, Piston Rings, Connecting Rods and Cylinders Removal and Installation".
4) Remove rear oil seal housing (1).



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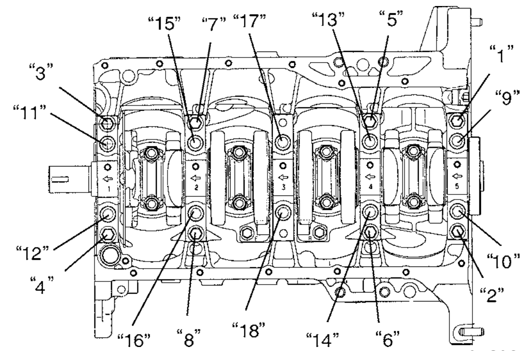
5) Loosen main bearing cap No.1 and No.2 bolts in such order as indicated in figure and remove them.



I6RS0C140026-01

6) Remove crankshaft from cylinder block.
7) Remove piston cooling valves and nozzles, if necessary.

Installation

NOTE

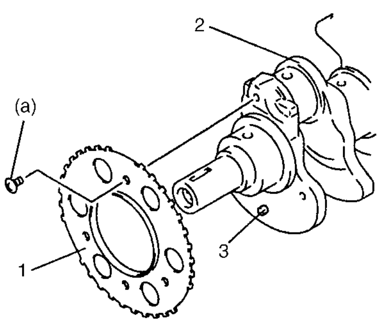
- **Use new bearing cap No.1 bolts. They are deformed once they are used because they are plastic deformation tightening bolts.**
- **All parts to be installed must be perfectly clean.**
- **Be sure to oil crankshaft journals, journal bearings, thrust bearings, crankpins, connecting rod bearings, pistons, piston rings and cylinder bores.**
- **Journal bearings, bearing caps, connecting rods, rod bearings, rod bearing caps, pistons and piston rings are in combination sets. Do not disturb such combination and make sure that each part goes back to where it came from, when installing.**

1) Install sensor plate (1) to crankshaft (2) and tighten bolts to specified torque.

NOTE

When installing sensor plate, align spring pin (3) on crankshaft and hole of sensor plate.

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



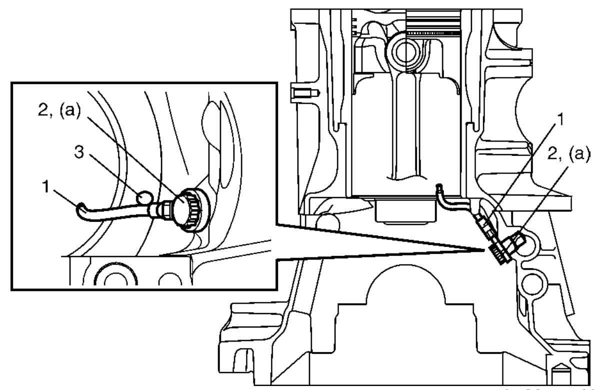
I2RH0B140128-01

2) Install piston cooling valves and nozzles, if removed.

NOTE

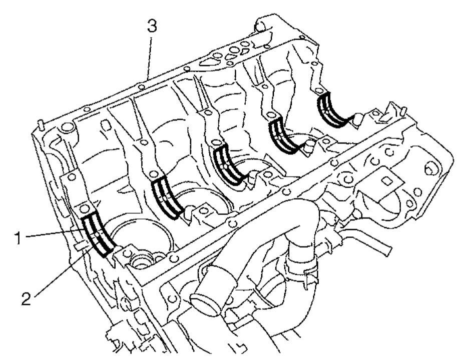
Install piston cooling valve while matching piston cooling nozzle (1) to positioning (3) of cylinder block when installed piston cooling valve (2).

Tightening torque
Piston cooling valve (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)



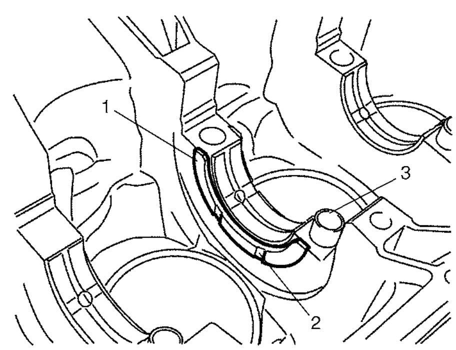
I6RS0B141022-02

3) Install main bearings to cylinder block.
Upper half of bearing (1), has an oil groove (2). Install it to cylinder block (3), and the other half without oil groove to bearing cap.
Make sure that two halves are painted in the same color.



I2RH0B140129-01

4) Confirm that dowel pins (3) are installed to intake side of each journal.



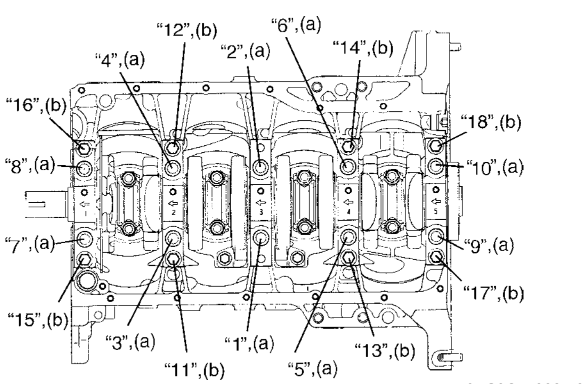
I2RH0B140130-01

5) Install crankshaft to cylinder block.
6) Install thrust bearings (1) to cylinder block between No.2 and No.3 cylinders. Face oil groove (2) sides to crank webs.
7) Install bearing cap to cylinder block, making sure to point arrow mark (on each cap) to crankshaft pulley side. Fit them sequentially in ascending order, 1, 2, 3, 4 and 5, starting from pulley side.
   After applying engine oil to main bearing cap No.1 bolts (a) and main bearing cap No.2 bolts (b), tighten them gradually as follows.
   a) Tighten bolts ("1" through "10") to 30 N·m (3.0 kgf-m, 22.0 lb-ft) according to numerical order as shown by using a 12 corner socket wrenches.
   b) In the same manner as in Step a), tighten them to 50 N·m (5.0 kgf-m, 36.5 lb-ft).
   c) In the same manner as in Step a), retighten them to 60°.
   d) Tighten bolts ("11" through "18") to 25 N·m (2.5 kgf-m, 18.0 lb-ft) according to numerical order as shown.

   Tightening torque
   Main bearing cap No.1 bolt (a): 30 N·m (3.0 kgf-m, 22.0 lb-ft), 50 N·m (5.0 kgf-m, 36.5 lb-ft) and then retighten by turning through 60°
   Main bearing cap No.2 bolt (b): 25 N·m (2.5 kgf-m, 18.0 lb-ft)

⚠ CAUTION

After tightening cap bolts, check to be sure that crankshaft rotates smoothly when turning it by 12 N·m (1.2 kgf-m, 9.0 lb-ft) torque or below.

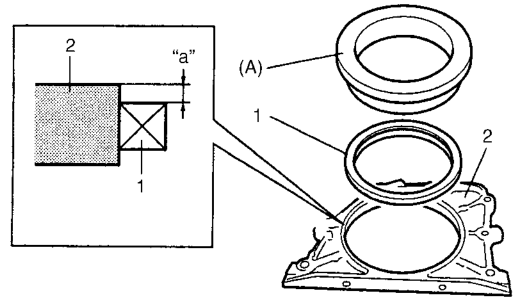


I6RS0C140027-01

8) If necessary, press-fit rear oil seal (1) to oil seal housing (2) by using special tool as shown in figure.

   Special tool
   (A): 09911–97821

   <u>Crank rear oil seal installing position (dimension)</u>
   "a": 2 mm (0.08 in.)

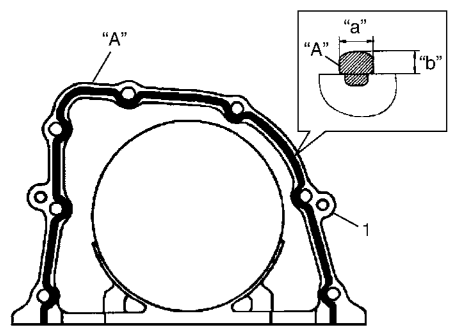


I4RS0A140017-01

9) Apply sealant to mating surface of rear oil seal housing (1).

   "A": Water tight sealant 99000–31250 (SUZUKI Bond No.1207F)

   <u>Sealant amount for rear oil seal housing</u>
   Width: "a": 3 mm (0.12 in.)
   Height "b": 2 mm (0.08 in.)

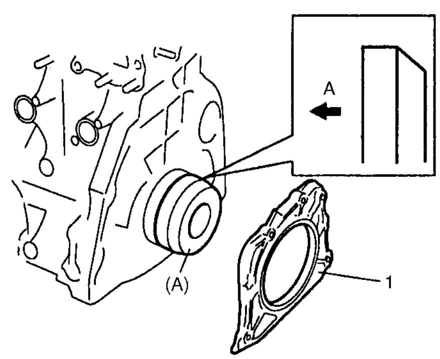


I4RS0A140018-01

10) Install rear oil seal housing (1) and tighten bolts to specified torque by using special tool.

   Special tool
   (A): 09911–97720

   Tightening torque
   Rear oil seal housing bolt: 11 N·m (1.1 kgf-m, 8.0 lb-ft)



I4RS0A140019-01

A:	Crankshaft side

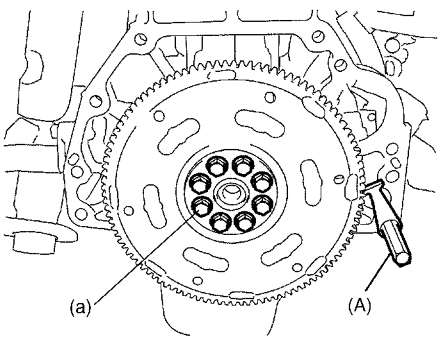
11) Install flywheel (drive plate for A/T).
    Using special tool, lock flywheel or drive plate, and tighten flywheel or drive plate bolts to specified torque.

    NOTE

    Use new flywheel or drive plate bolts.

    Special tool
    (A): 09924–17811

    Tightening torque
    Flywheel or drive plate bolt (a): 70 N·m (7.0 kgf-m, 51.0 lb-ft)



I6RS0B141029-01

12) Install piston and connecting rod referring to “Pistons, Piston Rings, Connecting Rods and Cylinders Removal and Installation”.
13) Install cylinder head referring to “Valves and Cylinder Head Removal and Installation”.
14) Install camshafts, tappet and shim referring to “Camshaft, Tappet and Shim Removal and Installation”.
15) Install timing chain referring to “Timing Chain and Chain Tensioner Removal and Installation”.
16) Install timing chain cover referring to “Timing Chain Cover Removal and Installation”.
17) Install cylinder head cover referring to “Cylinder Head Cover Removal and Installation”.
18) Install oil pan referring to “Oil Pan and Oil Pump Strainer Removal and Installation in Section 1E”
19) Install engine assembly to vehicle referring to “Engine Assembly Removal and Installation”.

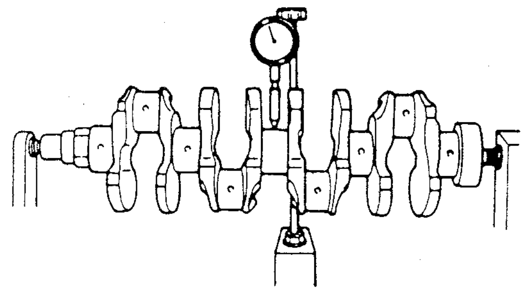
Crankshaft Inspection

S7RS0B1406037

Crankshaft Runout

Using a dial gauge, measure runout at center journal. Rotate crankshaft slowly. If runout exceeds its limit, replace crankshaft.

Crankshaft runout
Limit: 0.02 mm (0.0008 in.)

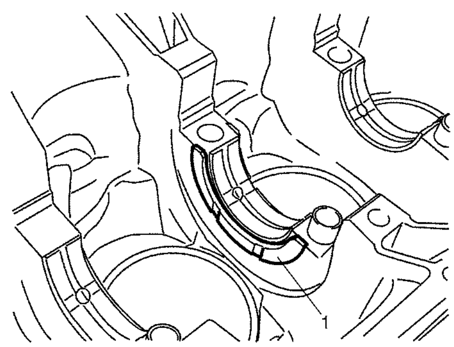


I2RH0B140135-01

Crankshaft Thrust Play

1) Measure this play with crankshaft set in cylinder block in the normal manner, that is with thrust bearing (1) and journal bearing caps installed.

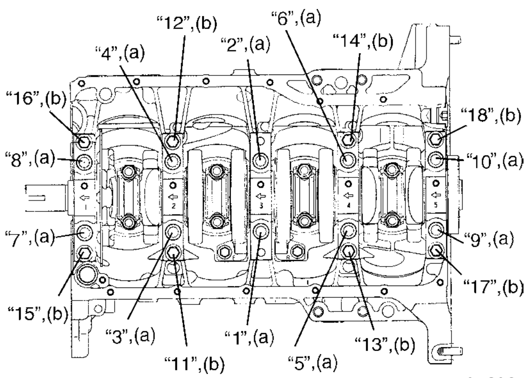
   Thickness of crankshaft thrust bearing
   Standard: 2.500 mm (0.0984 in.)
   Oversize (0.125 mm (0.0049 in.)): 2.563 mm (0.1009 in.)



I2RH0B140136-01

2) Tighten main bearing cap No.1 bolts (a) and main bearing cap No.2 bolts (b) gradually as follows.
   a) Tighten bolts (“1” through “10”) to 30 N·m (3.0 kgf-m, 22.0 lb-ft) according to numerical order in the figure.
   b) In the same manner as in Step a), tighten them to 50 N·m (5.0 kgf-m, 36.5 lb-ft).
   c) In the same manner as in Step a), retighten them to 60°.
   d) Tighten bolts (“11” through “18”) to 25 N·m (2.5 kgf-m, 18.0 lb-ft) according to numerical order in figure.

   Tighting torque
   Main bearing cap No.1 bolt (a): 30 N·m (3.0 kgf-m, 22.0 lb-ft), 50 N·m (5.0 kgf-m, 36.5 lb-ft) and then retighten by turning through 60°
   Main bearing cap No.2 bolt (b): 25 N·m (2.5 kgf-m, 18.0 lb-ft)



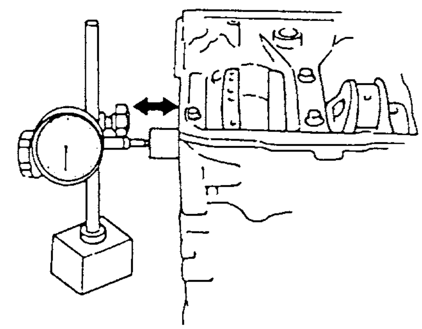
I6RS0C140027-01

3) Use a dial gauge to read displacement in axial (thrust) direction of crankshaft.
   If its limit is exceeded, replace thrust bearing with new standard one or oversize one to obtain standard thrust play.

   Crankshaft thrust play
   Standard: 0.11 – 0.31 mm (0.0043 – 0.0122 in.)
   Limit: 0.35 mm (0.0138 in.)

   NOTE

   After checking the thrust play, make sure that thread deformation of each bearing cap No.1 bolt referring to “Main Bearing Cap No.1 Bolt” in “Main Bearings Inspection”.

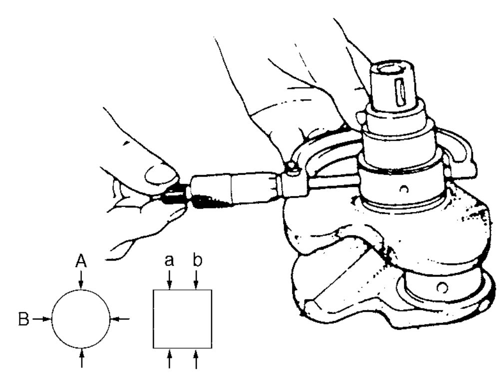

I2RH01140183-01

Out-of-Round and Taper (Uneven Wear) of Journals
An unevenly worn crankshaft journal shows up as a difference in diameter at a cross section or along its length (or both). This difference, if any, is determined by taking micrometer readings. If any one of journals is badly damaged or if amount of uneven wear in the sense exceeds its limit, regrind or replace crankshaft.

Crankshaft out-of-round and taper
Limit: 0.01 mm (0.0004 in.)

Out-of-round
A – B

Taper
a – b



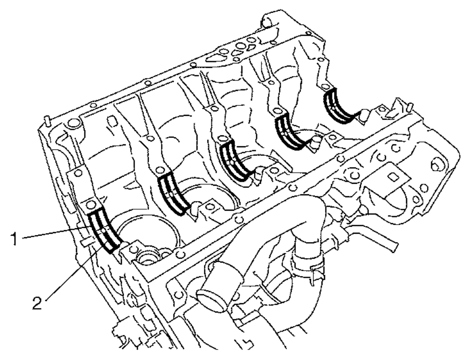
I2RH0B140138-01

Main Bearings Inspection

S7RS0B1406038

General Information

- Service main bearings are available in standard size and 0.25 mm (0.0098 in.) undersize, and each of them has 5 kinds of bearings differing in tolerance.
- Upper half of bearing (1) has oil groove (2) as shown in figure.
  Install this half with oil groove to cylinder block.
- Lower half of bearing does not have an oil groove.



I2RH0B140139-01

Visual Inspection

Check bearings for pitting, scratches, wear or damage. If any malcondition is found, replace both upper and lower halves. Never replace either half without replacing the other half.

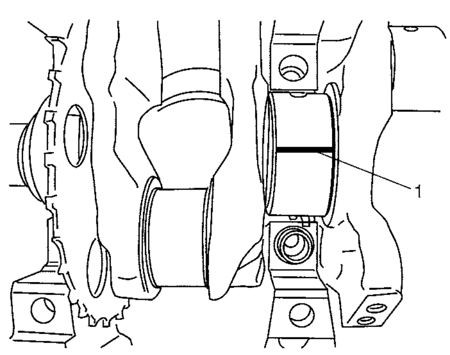
Main Bearing Clearance

NOTE

Do not rotate crankshaft while gauging plastic is installed.

Check clearance by using gauging plastic according to the following procedure.

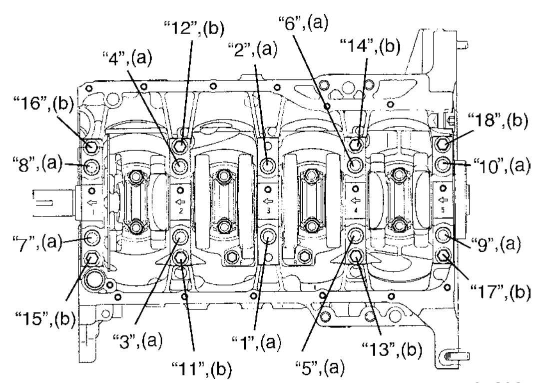
1) Remove bearing caps.
2) Clean bearings and main journals.
3) Place a piece of gauging plastic (1) the full width of bearing (parallel to crankshaft) on journal, avoiding oil hole.



I2RH0B140140-01

4) Tighten main bearing cap No.1 bolts (a) and main bearing cap No.2 bolts (b) gradually as follows.
   a) Tighten bolts (“1” through “10”) to 30 N·m (3.0 kgf-m, 22.0 lb-ft) according to numerical order in the figure.
   b) In the same manner as in Step a), tighten them to 50 N·m (5.0 kgf-m, 36.5 lb-ft).
   c) In the same manner as in Step a), retighten them to 60°.
   d) Tighten bolts (“11” through “18”) to 25 N·m (2.5 kgf-m, 18.0 lb-ft) according to numerical order in the figure.

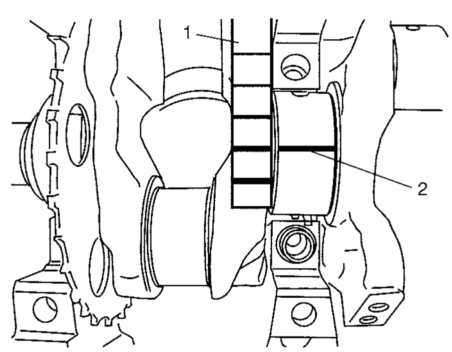
   Tightening torque
   Main bearing cap No.1 bolt (a): 30 Nm (3.0 kgf-m, 22.0 lb-ft), 50 Nm (5.0 kgf-m, 36.5 lb-ft) and then retighten by turning through 60°
   Main bearing cap No.2 bolt (b): 25 N·m (2.5 kgf-m, 18.0 lb-ft)



I6RS0C140027-01

5) Remove bearing caps and using scale (1) on gauging plastic envelop (2), measure gauging plastic width at its widest point. If clearance exceeds its limit, replace bearing. Always replace both upper and lower inserts as a unit.
   A new standard bearing may produce proper clearance. If not, it will be necessary to regrind crankshaft journal for use of 0.25 mm undersize bearing.
   After selecting new bearing, recheck clearance.

   <u>**Main bearing clearance**</u>
   Standard: 0.021 – 0.041 mm (0.0008 – 0.0016 in.)
   Limit: 0.054 mm (0.0021 in.)



I2RH0B140141-01

Selection of Main Bearings

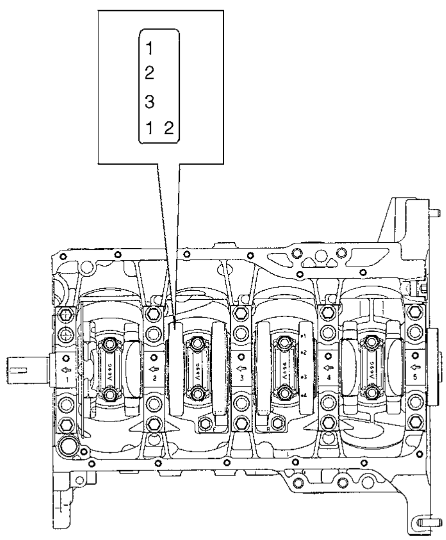
Standard bearing

If bearing is in malcondition, or bearing clearance is out of specification, select a new standard bearing according to the following procedure and install it.

1) First check journal diameter. As shown in the figure, crank web No.2 has stamped numbers.
   Three kinds of numbers (“1”, “2” and “3”) represent the following journal diameters.
   Stamped numbers on crank web No.2 represent journal diameters marked with an arrow in the figure respectively. For example, stamped number “1” indicates that corresponding journal diameter is 51.9940 – 52.0000 mm (2.0471 – 2.0472 in.).

   Crankshaft journal diameter

Stamped numbers	Journal diameter
1	**51.9940 – 52.0000 mm (2.0471 – 2.0472 in.)**
2	**51.9880 – 51.9939 mm (2.0468 – 2.0470 in.)**
3	**51.9820 – 51.9879 mm (2.0465 – 2.0467 in.)**

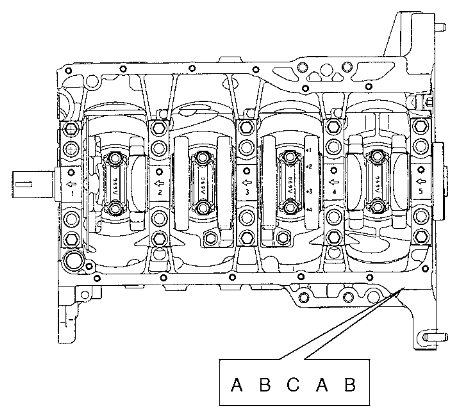


I2RH0B140142-01

2) Next, check bearing cap bore diameter without bearing. On mating surface of cylinder block, five alphabets are stamped as shown in figure.
   Three kinds of alphabets (“A”, “B” and “C”) or numbers (“1”, “2” and “3”) represent the following cap bore diameters.
   Stamped alphabets or numbers on cylinder block represent bearing cap bore diameter marked with an arrow in the figure respectively.
   For example, stamped “A” or “1” indicates that corresponding bearing cap bore diameter is 56.0000 – 56.0060 mm (2.2048 – 2.2049 in.).

   Crankshaft bearing cap bore

Stamped alphabet (number)	Bearing cap bore diameter (without bearing)
A or 1	**56.0000 – 56.0060 mm (2.2048 – 2.2049 in.)**
B or 2	**56.0061 – 56.0120 mm (2.2050 – 2.2051 in.)**
C or 3	**56.0121 – 56.0180 mm (2.2052 – 2.2054 in.)**

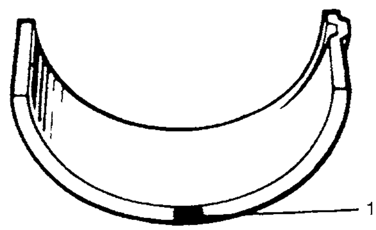


I2RH0B140143-01

3) There are 5 kinds of standard bearings differing in thickness. To distinguish them, they are painted in the following colors at the position as indicated in figure.
   Each color indicated the following thickness at the center of bearing.

Standard size of crankshaft main bearing thickness

Color painted	Bearing thickness
Purple	1.992 – 1.996 mm (0.07843 – 0.07858 in.)
Brown	1.995 – 1.999 mm (0.07855 – 0.07870 in.)
Green	1.998 – 2.002 mm (0.07867 – 0.07882 in.)
Black	2.001 – 2.005 mm (0.07878 – 0.07893 in.)
Colorless (no paint)	2.004 – 2.008 mm (0.07890 – 0.07906 in.)



I2RH01140191-01

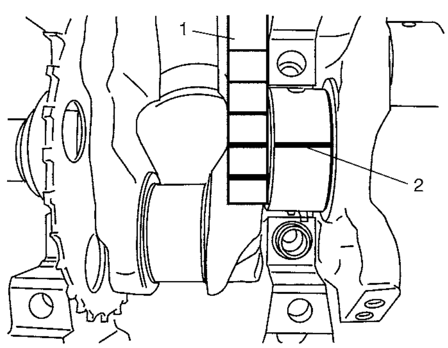
1. Paint

4) From number stamped on crank web No.2 and alphabets stamped on cylinder block, determine new standard bearing to be installed to journal, by referring to the table shown.
   For example, if number stamped on crank web No.2 is “1” and alphabet stamped on cylinder block is “B”, install a new standard bearing painted in “Brown” to its journal.

New standard size crankshaft main bearing specification

		Number stamped on crank web No.2 (Journal diameter)		
		1	2	3
Alphabet stamped on cylinder block (Cap bore dia.)	A or 1	Purple	Brown	Green
	B or 2	Brown	Green	Black
	C or 3	Green	Black	Colorless
		New standard bearing to be installed		

5) Using scale (1) on gauging plastic (2), check bearing clearance with newly selected standard bearing.
   If clearance still exceeds its limit, use next thicker bearing and recheck clearance.



I2RH0B140141-01

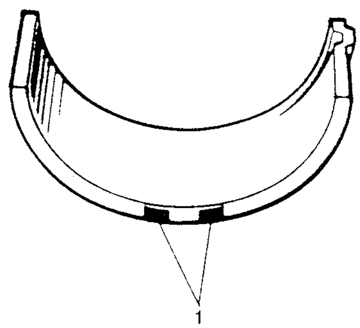
6) When replacing crankshaft or cylinder block due to any reason, select new standard bearings to be installed by referring to number stamped on new crankshaft or alphabets stamped on new cylinder block.

Undersize bearing (0.25 mm (0.0098 in.))

- 0.25 mm (0.0098 in.) undersize bearing is available, in five kinds varying in thickness.
  To distinguish them, each bearing is painted in the following colors at such position as indicated in the figure.
  Each color represents the following thickness at the center of bearing.

Undersize of crankshaft main bearing thickness

Color painted	Bearing thickness
Red and Purple	2.117 – 2.121 mm (0.08335 – 0.08350 in.)
Red and Brown	2.120 – 2.124 mm (0.08347 – 0.08362 in.)
Red and Green	2.123 – 2.127 mm (0.08359 – 0.08374 in.)
Red and Black	2.126 – 2.130 mm (0.08371 – 0.08385 in.)
Red only	2.129 – 2.133 mm (0.08382 – 0.08397 in.)



I2RH01140192-01

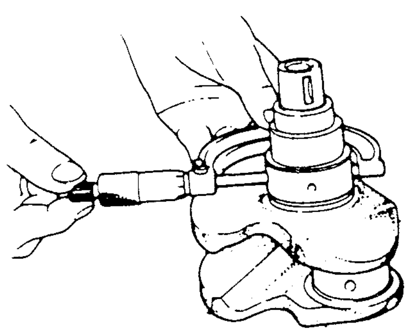
1. Paint

- If necessary, regrind crankshaft journal and select undersize bearing to use with it as follows.
  a. Regrind journal to the following finished diameter.

  Finished journal diameter
  51.7320 – 51.7500 mm (2.0367 – 2.0374 in.)

  b. Using micrometer, measure regrind journal diameter.
  Measurement should be taken in two directions perpendicular to each other in order to check for out-of-round.

  c. Using journal diameter measured above and alphabets stamped on cylinder block, select an undersize bearing by referring to the following table.
  Check bearing clearance with newly selected undersize bearing.



I2RH0B140144-01

New undersize crankshaft main bearing specification

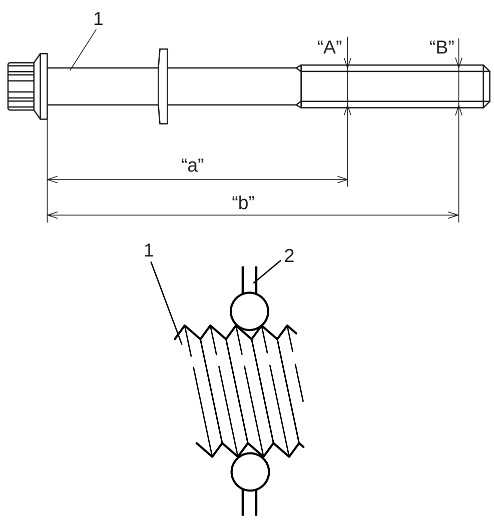
		Measured journal diameter		
		51.7320 – 51.7379 mm (2.0367 – 2.0369 in.)	51.7380 – 51.7439 mm (2.0370 – 2.0371 in.)	51.7440 – 51.7500 mm (2.0372 – 2.0373 in.)
Alphabets stamped on cylinder block	A (1)	Red and Green	Red and Brown	Red and Purple
	B (2)	Red and Black	Red and Green	Red and Brown
	C (3)	Red only	Red and Black	Red and Green
		Undersize bearing to be installed		

Main Bearing Cap No.1 Bolt

Measure each thread diameter main bearing cap No.1 bolts (1) at "A" on 60 mm (2.36 in.) from seat side of flange bolt and "B" on 90 mm (3.54 in.) from seat side of flange bolt by using a micrometer (2).
Calculate difference in diameters ("A" – "B").
If it exceeds limit, replace with new one.

Main bearing cap No.1 bolt diameter measurement points
"a": 60 mm (2.36 in.)
"b": 90 mm (3.54 in.)

Main bearing cap No.1 bolt diameter difference
Limit ("A" – "B"): 0.2 mm (0.008 in.)

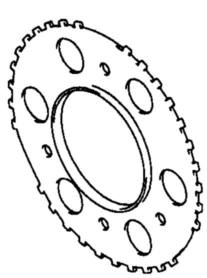


I2RH0B140145-01

Sensor Plate Inspection

S7RS0B1406039

Check sensor plate for crack damage.
If malcondition is found, replace it.

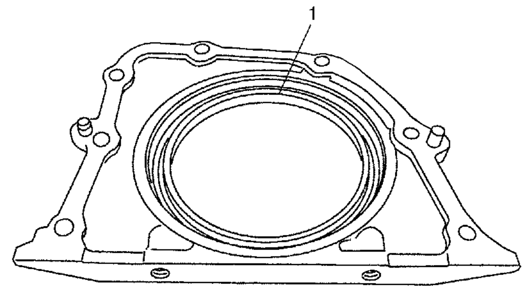


I2RH0B140151-01

Rear Oil Seal Inspection

S7RS0B1406040

Carefully inspect oil seal (1) for wear or damage. If its lip is worn or damaged, replace it.



I4RS0A140020-01

Flywheel Inspection

S7RS0B1406041

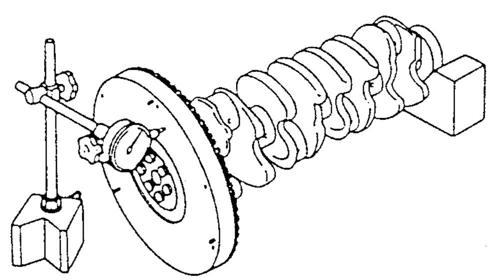
Visual Inspection

- If ring gear is damaged, cracked or worn, replace flywheel.
- If the surface contacting clutch disc is damaged, or excessively worn, replace flywheel.

Flywheel Face Runout

Check flywheel face runout with a dial gauge.
If runout exceeds its limit, replace flywheel.

Flywheel face runout
Limit: 0.2 mm (0.0079 in.)



I2RH01140198-01

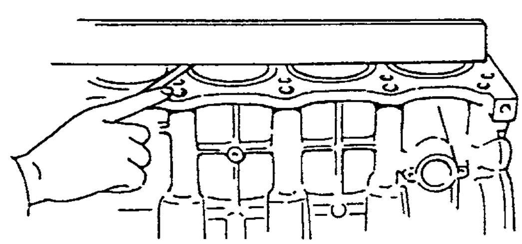
Cylinder Block Inspection

S7RS0B1406042

Distortion of Gasketed Surface

Using straightedge and thickness gauge, check gasketed surface for distortion and, if flatness exceeds its limit, correct It.

Cylinder block flatness
Limit: 0.03 mm (0.0012 in.)



I2RH01140199-01

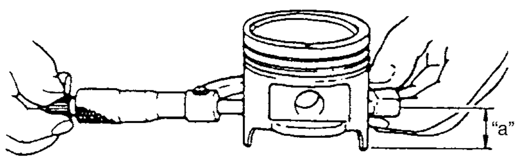
Honing or Reboring Cylinders

1) When any cylinder needs reboring, all other cylinders must also be rebored at the same time.
2) Select oversized piston according to amount of cylinder wear.

Oversize piston specification
Oversize 0.50: 78.453 – 78.468 mm (3.0887 – 3.0893 in.)

3) Using micrometer, measure piston diameter.

Measurement position for piston diameter
“a”: 7.0 mm (0.28 in.)



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4) Rebore and hone cylinder to the following dimension.

NOTE

Before reboring, install all main bearing caps in place and tighten to specification to avoid distortion of bearing bores.

Cylinder bore diameter to be rebored
Oversize 0.50: 78.500 – 78.514 mm (3.0906 – 3.0911 in.)

5) Measure piston clearance after honing.

Piston clearance
0.032 – 0.061 mm (0.0013 – 0.0024 in.)

Specifications

Tightening Torque Specifications

S7RS0B1407001

Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
Camshaft housing bolt	11	1.1	8.0	☞
Cylinder head cover bolt	Tighten 3 N·m (0.3 kgf-m, 2.5 lb-ft), 5 N·m (0.5 kgf-m, 4.0 lb-ft) and 8 N·m (0.8 kgf-m, 6.0 lb-ft) by the specified procedure			☞
Intake manifold bolt	23	2.3	17.0	☞
Intake manifold nut	23	2.3	17.0	☞
Intake manifold ground terminal bolt	11	1.1	8.0	☞
Engine left mounting bracket nut	55	5.5	40.0	☞
Engine right mounting nut	65	6.5	47.0	☞
Engine rear mounting bush bolt	55	5.5	40.0	☞
Starting motor terminal nut	11	1.1	8.0	☞
Generator terminal nut	6	0.6	4.5	☞
Intake manifold ground terminal bolt	11	1.1	18.0	☞
Timing chain cover bolt	25	2.5	18.0	☞
Timing chain cover nut	25	2.5	18.0	☞
Cap bolt	25	2.5	18.0	☞
Oil gallery pipe No.2 and No.3 bolt	11	1.1	8.0	☞
Crankshaft pulley bolt	150	15.0	108.5	☞
Oil control valve mounting nut	11	1.1	8.0	☞
Oil gallery pipe No.1 bolt	30	3.0	21.5	☞
Timing chain No.1 guide bolt	9	0.9	6.5	☞
Timing chain tensioner bolt	25	2.5	18.0	☞
Timing chain tensioner adjuster bolt	11	1.1	8.0	☞
Camshaft housing bolt	5 N·m (0.5 kgf-m, 4.0 lb-ft) and 11 N·m (1.1 kgf-m, 8.0 lb-ft) by the specified procedure			☞ / ☞
Intake cam timing sprocket bolt	60	6.0	43.5	☞
Venturi plug	3.5	0.35	3.0	☞
Cylinder head bolt for M8	25	2.5	18.0	☞
Cylinder head bolt for M10	20 N·m (2.0 kgf-m, 14.5 lb-ft), 40 N·m (4.0 kgf-m, 29.0 lb-ft) and then retighten by turning through to 60° twice			☞

Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
Connecting rod bearing cap bolt	15 N·m (1.5 kgf-m, 11.0 lb-ft) and then retighten by turning through 45° twice			☞ / ☞
Sensor plate bolt	11	1.1	8.0	☞
Piston cooling valve	11	1.1	8.0	☞
Main bearing cap No.1 bolt (a)	30 N·m (3.0 kgf-m, 22.0 lb-ft), 50 N·m (5.0 kgf-m, 36.5 lb-ft) and then retighten by turning through 60°			☞
Main bearing cap No.2 bolt (b)	25	2.5	18.0	☞
Rear oil seal housing bolt	11	1.1	8.0	☞
Flywheel or drive plate bolt	70	7.0	51.0	☞
Main bearing cap No.1 bolt	30 N·m (3.0 kgf-m, 22.0 lb-ft), 50 N·m (5.0 kgf-m, 36.5 lb-ft) and then retighten by turning through 60°			☞
Main bearing cap No.2 bolt	25	2.5	18.0	☞ / ☞
Main bearing cap No.1 bolt	30 Nm (3.0 kgf-m, 22.0 lb-ft), 50 Nm (5.0 kgf-m, 36.5 lb-ft) and then retighten by turning through 60°			☞

NOTE

The specified tightening torque is also described in the following.
“Air Cleaner Components”
“Throttle Body and Intake Manifold Components”
“Engine Mountings Components”
“Timing Chain Cover Components”
“Timing Chain and Chain Tensioner Components”
“Camshaft, Tappet and Shim Components”
“Valves and Cylinder Head Components”
“Pistons, Piston Rings, Connecting Rods and Cylinders Components”
“Main Bearings, Crankshaft and Cylinder Block Components”

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

Special Tools and Equipment

Recommended Service Material

S7RS0B1408001

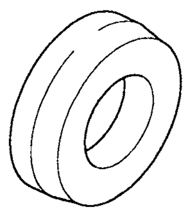
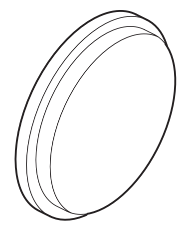
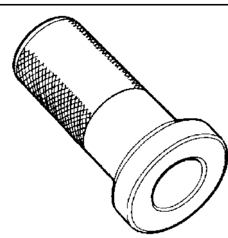
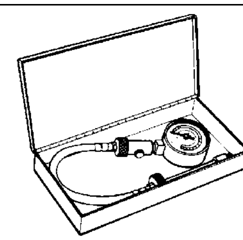
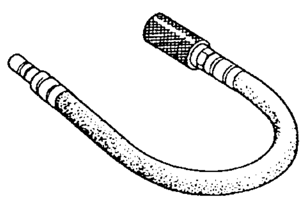
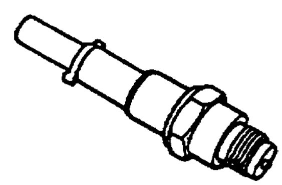
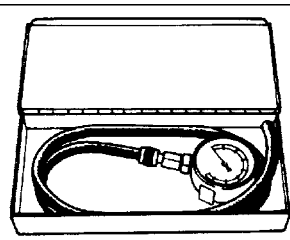
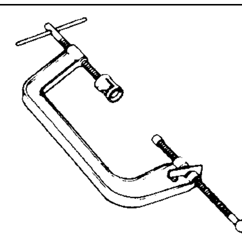
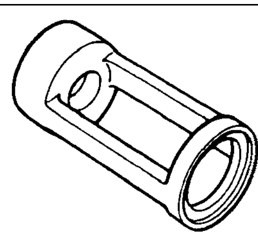
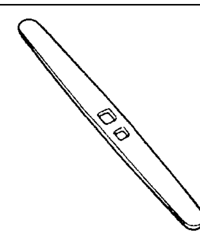
Material	SUZUKI recommended product or Specification		Note
Sealant	SUZUKI Bond No.1217G	P/No.: 99000–31260	☞
Water tight sealant	SUZUKI Bond No.1207B	P/No.: 99000–31140	☞
	SUZUKI Bond No.1207F	P/No.: 99000–31250	☞ / ☞ / ☞

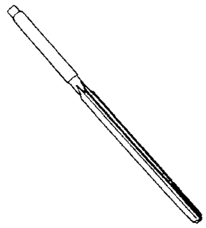
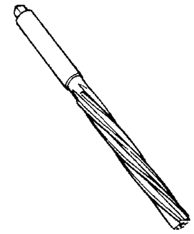
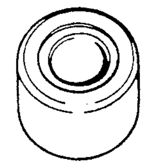
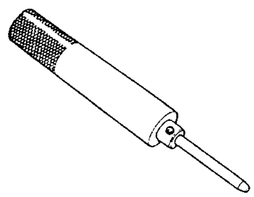
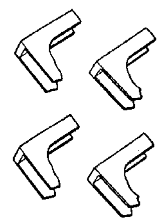
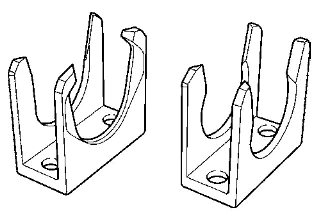
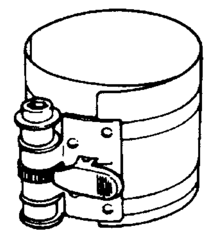
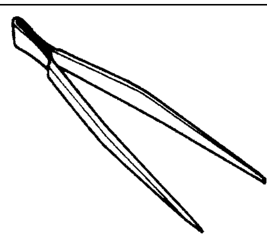
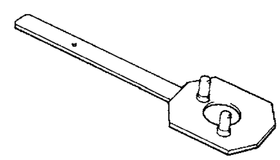
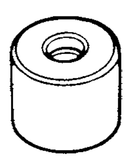
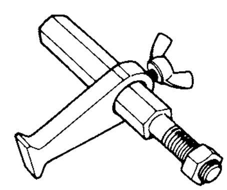
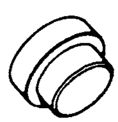
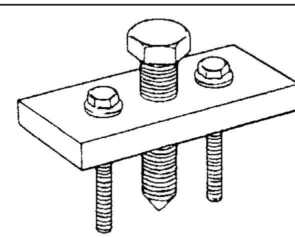
NOTE

Required service material is also described in the following.
“Timing Chain Cover Components”
“Timing Chain and Chain Tensioner Components”
“Camshaft, Tappet and Shim Components”
“Valves and Cylinder Head Components”
“Pistons, Piston Rings, Connecting Rods and Cylinders Components”
“Main Bearings, Crankshaft and Cylinder Block Components”

Special Tool

S7RS0B1408002

09911–97720 Oil seal installer ☞ 	09911–97821 Oil seal installer ☞ 
09913–75810 Bearing installer ☞ 	09915–64512 Compression gauge ☞ 
09915–64530 Compression gauge hose ☞ 	09915–67010 Compression gauge attachment (C) ☞ 
09915–67311 Vacuum gauge ☞ 	09916–14510 Valve lifter ☞ / ☞ 
09916–14521 Valve spring compressor attachment ☞ / ☞ 	09916–34542 Reamer handle ☞ / ☞ 

09916–34550 Reamer handle ☞ 	09916–37320 Valve guide outer reamer (10.5 mm) ☞ 
09916–44910 Valve guide installer & remover ☞ 	09916–56011 Valve guide installer attachment (protrusion: 11.5 mm) ☞ 
09916–58210 Valve guide installer handle ☞ / ☞ 	09916–67020 Tappet holder (Overseas) ☞ / ☞ 
09916–67021 Tappet holder ☞ / ☞ 	09916–77310 Piston ring compressor (50-125 mm) ☞ 
09916–84511 Forceps ☞ / ☞ 	09917–68221 Camshaft pulley holder ☞ / ☞ 
09917–98221 Valve guide stem attachment ☞ 	09924–17811 Flywheel holder ☞ / ☞ 
09926–58010 Bearing remover attachment ☞ 	09944–36011 Steering wheel remover ☞ 

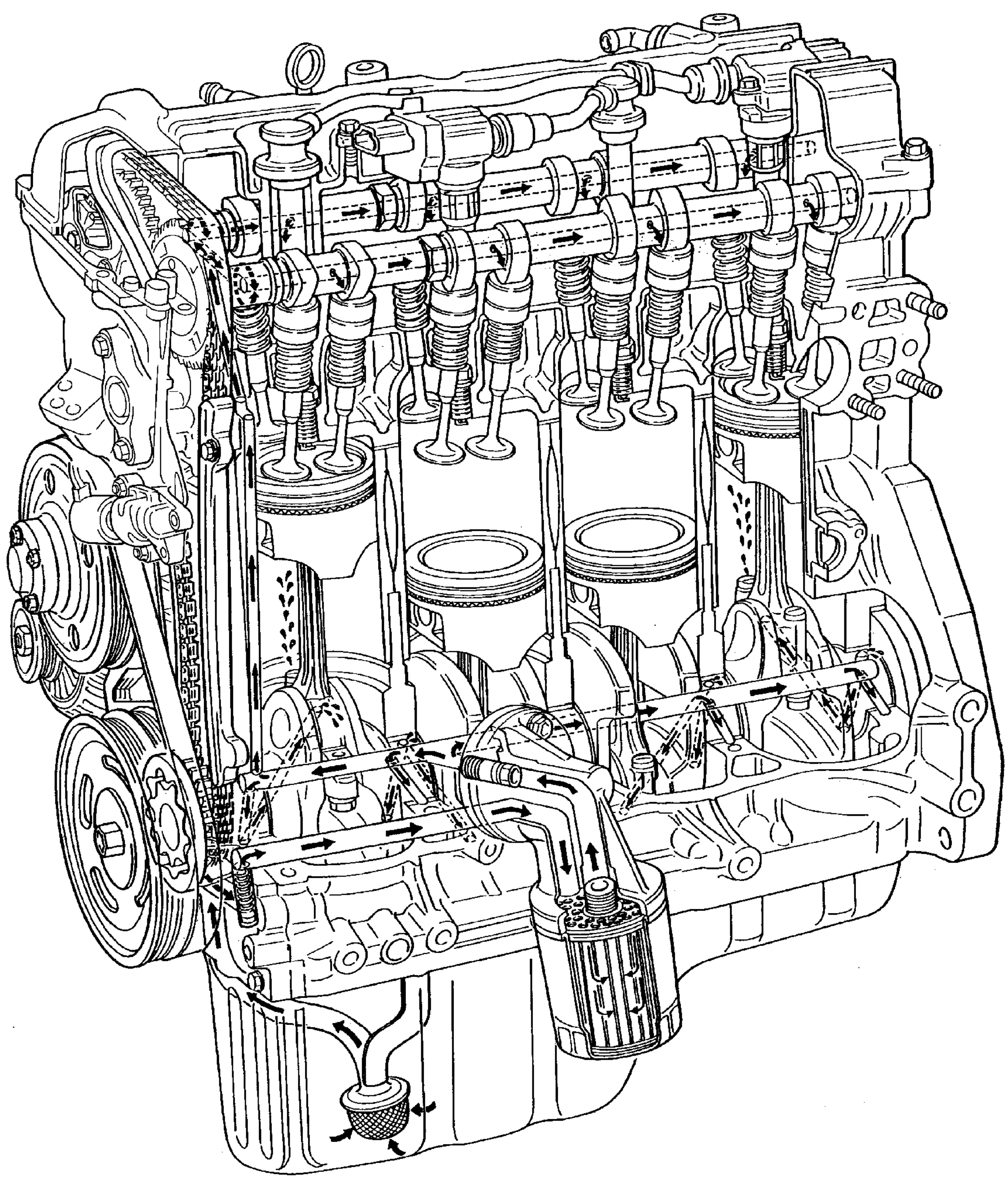
Engine Lubrication System

General Description

Engine Lubrication Description

S7RS0B1501001

The oil pump is of a trochoid type, and mounted on the crankshaft. Oil is drawn up through the oil pump strainer and passed through the pump to the oil filter.
The filtered oil flows into two paths in cylinder block.
The filtered oil is passed to the passage in heat exchanger and cylinder block to piston cooling valve of oil gushed to the lower side of piston.
In one path, oil reaches the crankshaft journal bearings. Oil from the crankshaft journal bearings is supplied to the connecting rod bearings by means of intersecting passages drilled in the crankshaft, and then injected from the big end of connecting rod to lubricate piston, rings and cylinder wall.
In the other path oil goes up to the cylinder head and lubricates valves and camshafts, etc., after passing through the internal oil way of camshafts.
An oil relief valve is provided on the oil pump. This valve starts relieving oil pressure when the pressure exceeds about 350 kPa (3.5 kg/cm^2, 49.8 psi).



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Diagnostic Information and Procedures

Oil Pressure Check

S7RS0B1504001

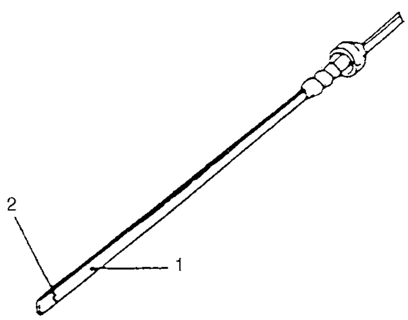
⚠ WARNING

To avoid danger of being burned, do not touch exhaust system when it is still hot.

NOTE

Prior to checking oil pressure, check the following.

- **Oil level in oil pan**
  If oil level is low, add oil up to Full level mark (hole) (1) on oil level gauge referring to "Engine Oil and Filter Change in Section 0B".



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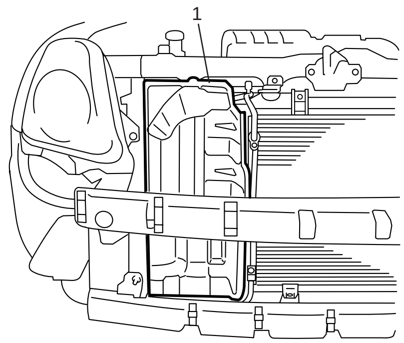
2.	Low level mark (hole)

- **Oil quality**
  If oil is discolored or deteriorated, change it. For particular oil to be used, refer to "Engine Oil and Filter Change in Section 0B".
- **Oil leaks**
  If leak is found, repair it.

1) Remove front bumper referring to "Front Bumper and Rear Bumper Components in Section 9K".
2) Remove engine front cover (1).



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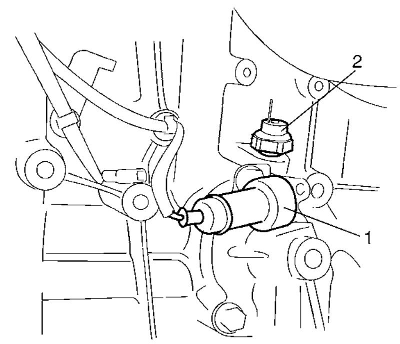
3) Disconnect oil pressure switch coupler (1).
4) Remove oil pressure switch (2) from cylinder block.



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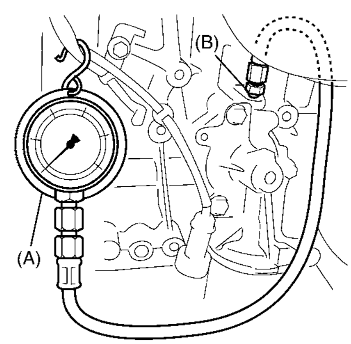
5) Install special tools (oil pressure gauge) to vacated threaded hole of oil pressure switch.

   Special tool
   (A): 09915–77310
   (B): 09915–78211



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6) Start engine and warm engine up to normal operating temperature.

NOTE

Be sure to shift transaxle gear shift lever in "Neutral" (shift select lever in "P" range for A/T vehicle), set parking brake and block drive wheels.

7) After warming up, raise engine speed to 4,000 r/min. and measure oil pressure.

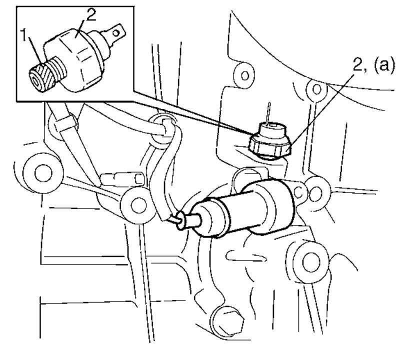
Oil pressure specification
More than 270 kPa (2.7 kg/cm^2, 39.8 psi) at 4,000 r/min. (rpm)

8) After checking oil pressure, stop engine and remove oil pressure gauge and attachment.
9) Before reinstalling oil pressure switch (2), be sure to wrap its screw threads with sealing tape (1) and tighten switch to specified torque.

NOTE

If sealing tape edge is bulged out from screw threads of switch, cut it off.

Tightening torque
Oil pressure switch (a): 13 N·m (1.3 kgf-m, 9.5 lb-ft)



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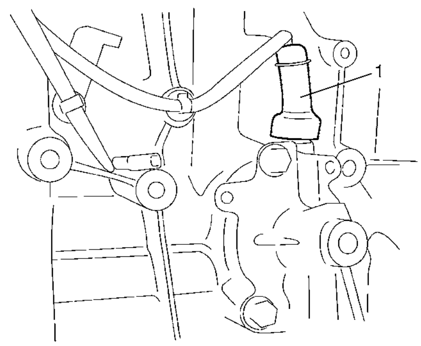
10) Start engine and check oil pressure switch for oil leakage. If oil leakage is found, repair it.
11) Connect oil pressure switch coupler (1).



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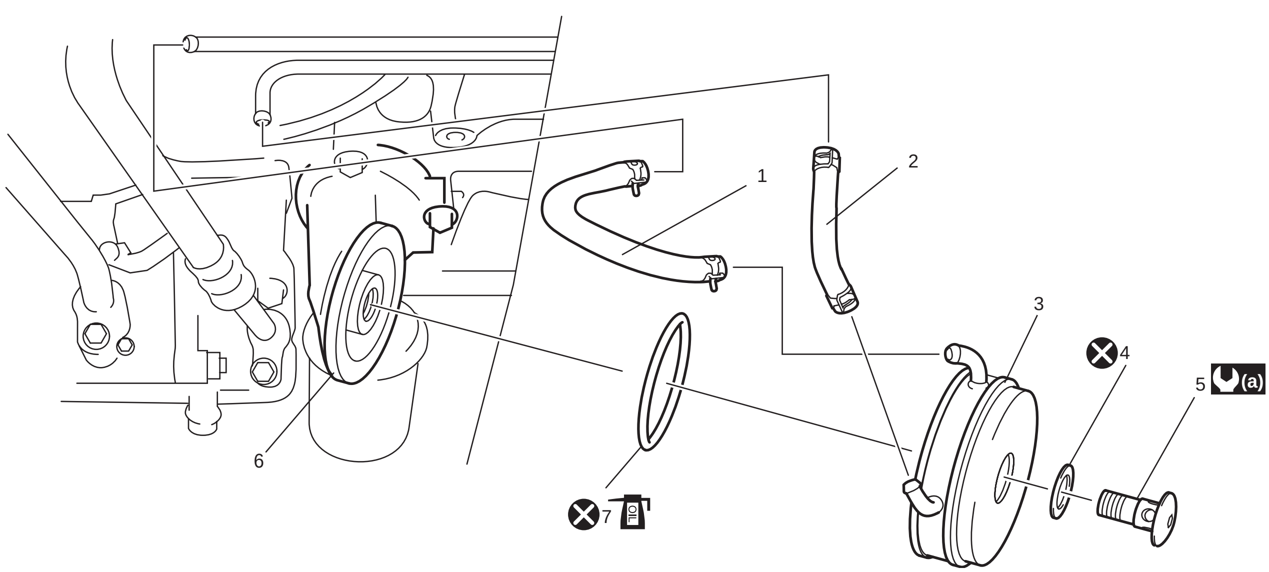
Repair Instructions

Heat Exchanger Components

S7RS0B1506001



I6RS0B151001-02

1. Heat exchanger inlet No. 1 hose	4. Gasket	7. O-ring : Apply engine oil.
2. Heat exchanger outlet No. 1 hose	5. Heat exchanger stand bolt	(a) : 22 N·m (2.2 kgf-m, 16.0 lb-ft)
3. Heat exchanger	6. Oil filter adapter case	: Do not reuse.

Heat Exchanger On-Vehicle Inspection

S7RS0B1506002

- Check heat exchanger for deformation wear or damage.
- Check heat exchanger for coolant leakage and oil leakage.

If any malcondition is found, replace O-ring, stand bolt gasket and/or heat exchanger.

Heat Exchanger Removal and Installation

S7RS0B1506003

Removal

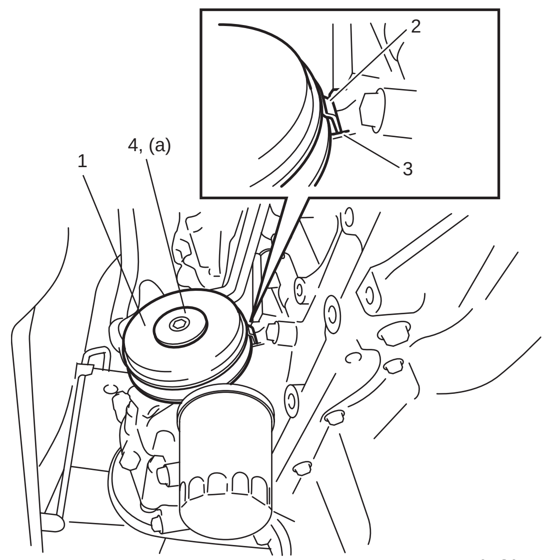
1) Drain engine oil by removing drain plug.
2) Drain coolant referring to “Cooling System Draining in Section 1F”.
3) Remove exhaust manifold referring to “Exhaust Manifold Removal and Installation in Section 1K”.
4) Remove heat exchanger inlet No. 1 hose and outlet No. 1 hose.
5) Remove heat exchanger, O-ring and gasket by removing heat exchanger stand bolt.

Installation

Reverse removal procedure for installation noting the followings.

- Use new stand bolt gasket.
- Apply engine oil to new O-ring and install it to heat exchanger.
- Install heat exchanger (1) while matching the projection of heat exchanger (2) in rib of the cylinder block (3) as shown in figure.
- Install heat exchanger stand bolt (4) to specified torque.

  Tightening torque
  Heat exchanger stand bolt (a): 22 N·m (2.2 kgf-m, 16.0 lb-ft)



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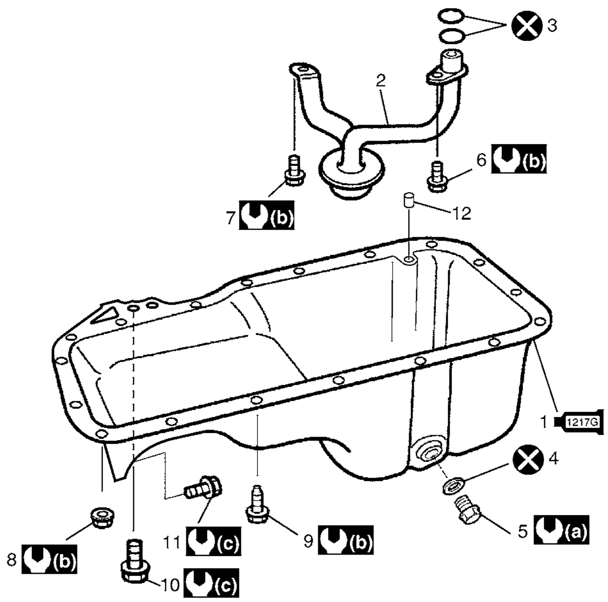
- Refill cooling system with coolant referring to “Cooling System Flush and Refill in Section 1F”.
- Refill engine with engine oil referring to “Engine Oil and Filter Change in Section 0B”.
- Upon completion of installation, check for engine coolant and oil leaks.

Oil Pan and Oil Pump Strainer Components

S7RS0B1506004



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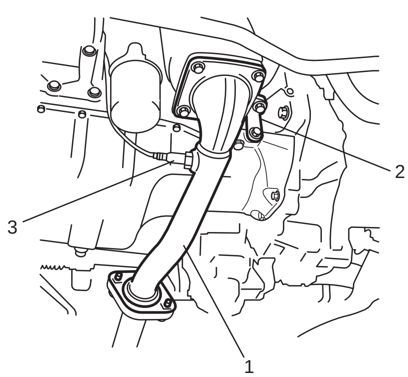
1217G 1.	Oil pan : Apply sealant 99000-31260 to mating surface.	6.	Strainer bolt	11.	Transaxle stiffener bolt
2.	Strainer	7.	Bracket bolt	(a) :	35 N·m (3.5 kgf-m, 25.5 lb-ft)
3.	O-ring	8.	Oil pan nut	(b) :	Tighten 11 N·m (1.1 kgf-m, 8.0 lb-ft) by the specified procedure.
4.	Gasket	9.	Oil pan bolt (M6)	(c) :	55 N·m (5.5 kgf-m, 40.0 lb-ft)
5.	Drain plug	10.	Oil pan bolt (M10)	:	Do not reuse.

Oil Pan and Oil Pump Strainer Removal and Installation

S7RS0B1506005

Removal

1) Remove oil level gauge.
2) Drain engine oil by removing drain plug.
3) Remove exhaust No.1 pipe (1), exhaust manifold stiffener (2) and heated oxygen sensor No.2 (connector color: green) (3) referring to “Exhaust System Components in Section 1K”.



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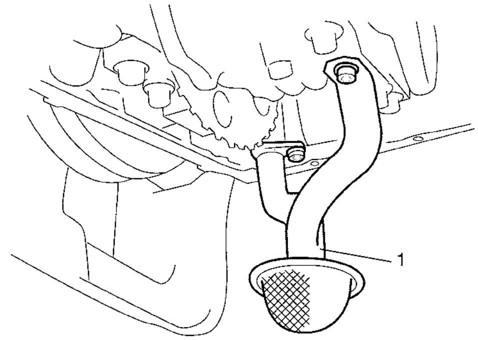
4) Remove clutch housing lower plate (1).

I4RS0A150004-01

5) Remove oil pan and then oil pump strainer (1) from cylinder block.

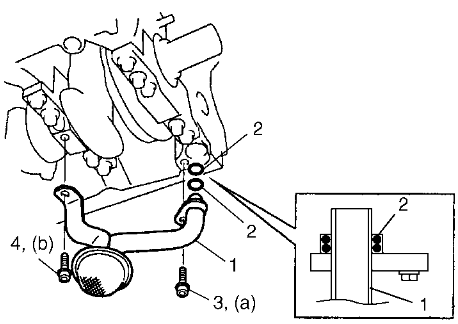


I2RH0B150010-01

Installation

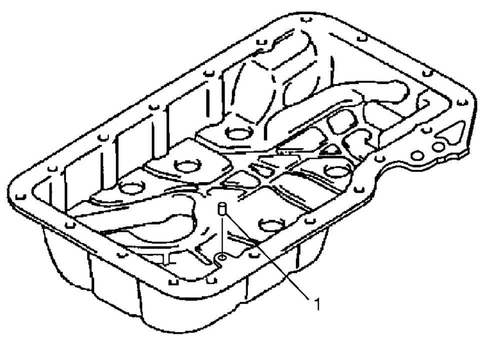
1) Install new O-rings (2) in the position as shown in figure and install oil pump strainer (1).
   Tighten strainer bolt (3) first and then bracket bolt (4) to specified torque.

   Tightening torque
   Oil pump strainer bolt (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)
   Oil pump strainer bracket bolt (b): 11 N·m (1.1 kgf-m, 8.0 lb-ft)



I2RH0B150012-01

2) Install dowel pin (1) to oil pan.

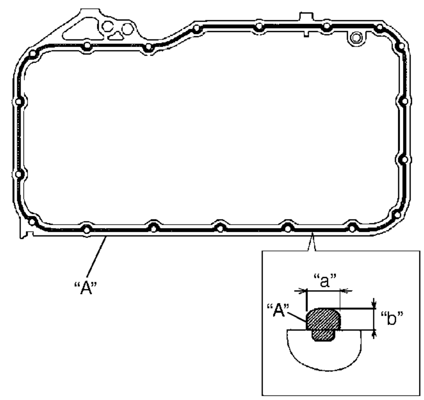


I4RS0A150005-01

3) Apply sealant continuously to oil pan mating surface as shown in figure.

   "A": Sealant 99000–31260 (SUZUKI Bond No.1217G)

   <u>Sealant amount for oil pan</u>
   Width "a": 3 mm (0.12 in.)
   Height "b": 2 mm (0.08 in.)

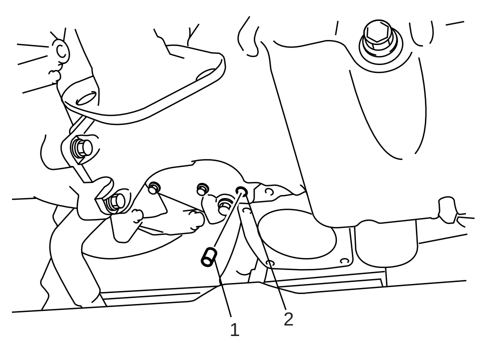


I4RS0A150006-01

4) Install oil pan to cylinder block temporarily.
5) Insert dowel pin (1) in hole (2) of oil pan in order to locate oil pan precisely.

NOTE

Dowel pin is available as a spare part (part number: 04211–13189).



I4RS0A150007-01

6) After fitting oil pan to cylinder block, run in securing bolts and start tightening at the center: move wrench outward, tightening one bolt at a time. Tighten bolts and nuts to specified torque.

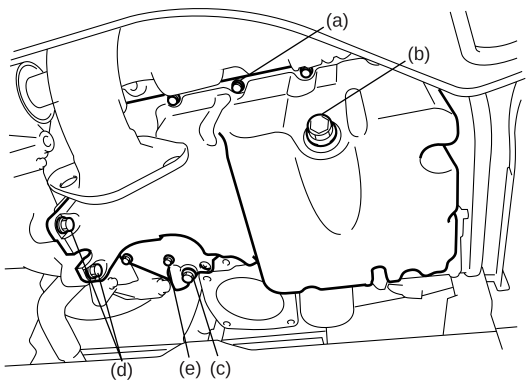
Tightening torque
Oil pan bolt (M6) (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)
Oil pan bolt (M10) (c): 55 N·m (5.5 kgf-m, 40.0 lb-ft)
Oil pan nut (e): 11 N·m (1.1 kgf-m, 8.0 lb-ft)

7) Install new gasket and drain plug to oil pan.
Tighten drain plug to specified torque.

Tightening torque
Oil pan drain plug (b): 35 N·m (3.5 kgf-m, 25.5 lb-ft)

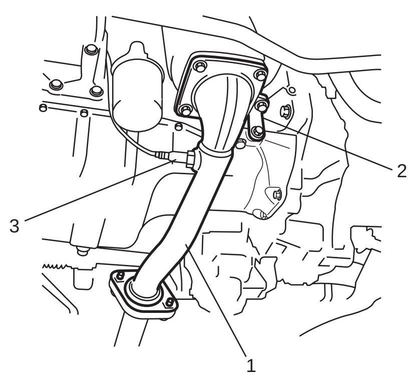
8) Tighten transaxle stiffener bolts to specified torque.

Tightening torque
Transaxle stiffener bolt (d): 55 N·m (5.5 kgf-m, 40.0 lb-ft)



I4RS0A150008-01

9) Install exhaust manifold stiffener (2) and exhaust No.1 pipe (1) and heated oxygen sensor No.2 (connector color: green) (3) referring to “Exhaust System Components in Section 1K”.



I4RS0A150003-01

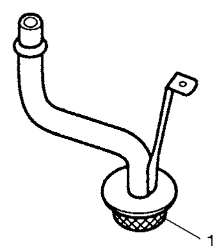
10) Install clutch housing lower plate (1).

I4RS0A150004-01

11) Install oil level gauge.
12) Refill engine with engine oil referring to “Engine Oil and Filter Change in Section 0B”.
13) Verify that there is no engine oil leakage and exhaust gas leakage at each connection.

Oil Pan and Oil Pump Strainer Cleaning
S7RS0B1506006

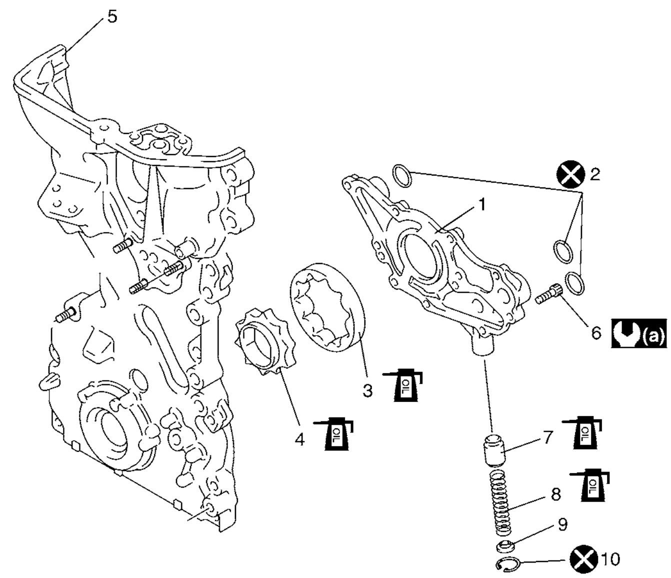
- Clean sealing surface between oil pan and cylinder block.
  Remove oil, old sealant, and dust from sealing surface.
- Clean oil pump strainer screen (1).



I2RH0B150016-01

Oil Pump Components

S7RS0B1506007



I4RS0A150010-01

1. Rotor plate	6. Rotor plate bolt	10. Circlip
2. O-ring	7. Relief valve	(a) : 11 N·m (1.1 kgf-mm 8.0 lb-ft)
3. Outer rotor	8. Spring	: Do not reuse.
4. Inner rotor	9. Retainer	: Apply thin coat of engine oil to sliding surface.
5. Timing chain cover	10. Circlip	

Oil Pump Removal and Installation

S7RS0B1506008

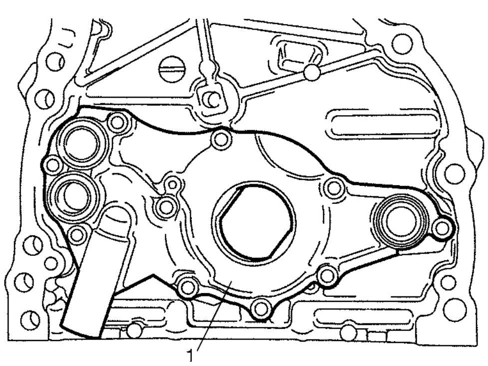
Oil pump is incorporated with timing chain cover. For removal and installation, refer to "Timing Chain Cover Removal and Installation in Section 1D".

Oil Pump Disassembly and Reassembly

S7RS0B1506009

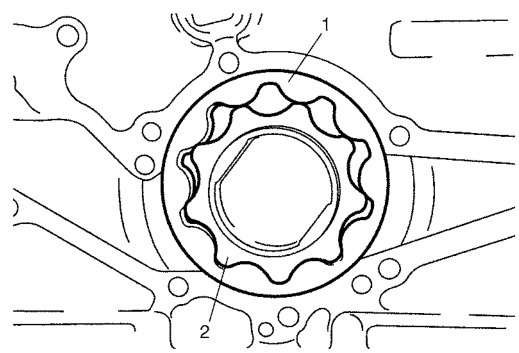
Disassembly

1) Remove rotor plate (1) by removing its mounting bolts.



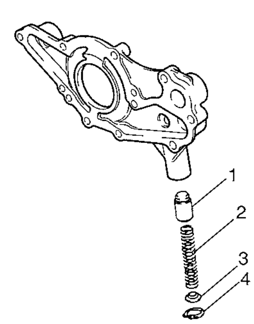
I2RH0B150018-01

2) Remove outer rotor (1) and inner rotor (2).



I2RH0B150019-01

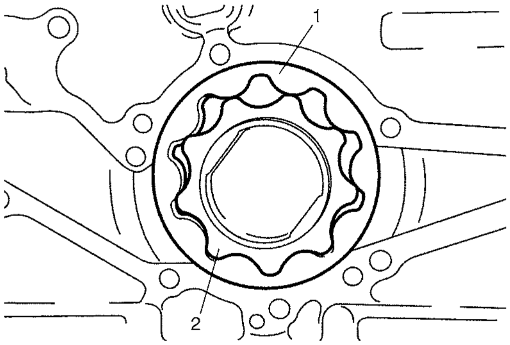
3) Remove relief valve (1), spring (2) and retainer (3) by removing circlip (4).



I2RH0B150020-01

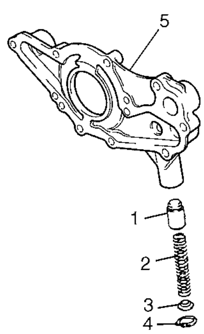
Reassembly

1) Wash, clean and then dry all disassembled parts.
2) Apply thin coat of engine oil to inner and outer rotors, oil seal lip portion, inside surfaces of oil pump case and plate.
3) Install outer (1) and inner rotors (2) to oil pump case.



I2RH0B150019-01

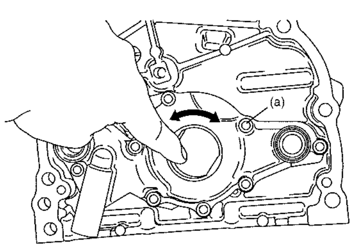
4) Apply engine oil to relief valve (1) and spring (2), and install them with retainer (3) and new circlip (4) to rotor plate (5).



I3RM0A150005-01

5) Install rotor plate and tighten all bolts to specified torque. After installing plate, check to be sure that rotors turn smoothly by hand (0.3 N·m (0.03 kgf-m, 0.25 lb-ft) torque or below).

   Tightening torque
   Oil pump rotor plate bolt (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)



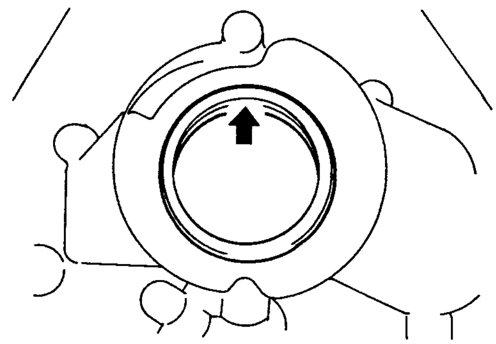
I2RH0B150022-01

Oil Pump Inspection

S7RS0B1506010

Oil Seal

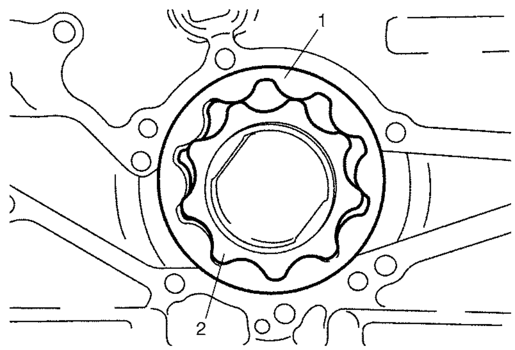
Check oil seal lip for fault or other damage. Replace as necessary.



I2RH0B150023-01

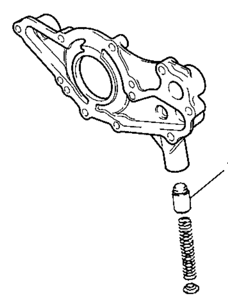
Oil Pump

- Check outer (1) and inner rotors (2), rotor plate, and oil pump case for excessive wear or damage.



I2RH0B150019-01

- Check relief valve (1) for excessive wear or damage and operates smoothly.



I2RH0B150025-01

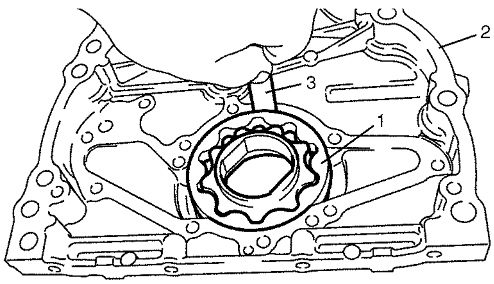
Radial clearance

Check radial clearance between outer rotor (1) and case (2) using thickness gauge (3).

If clearance exceeds its limit, replace outer rotor or case.

Radial clearance between outer rotor and case for oil pump

Limit: 0.310 mm (0.0122 in.)



I2RH0B150026-01

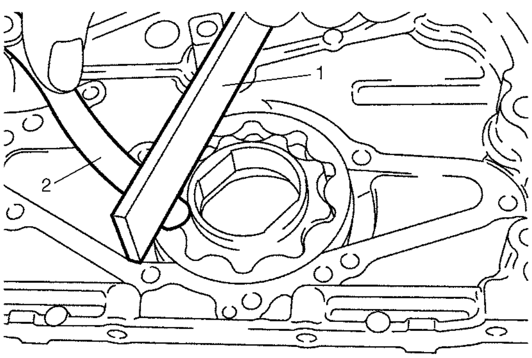
Side clearance

Using straightedge (1) and thickness gauge (2), measure side clearance.

If side clearance exceeds its limit, replace oil pump assembly.

Side clearance for oil pump inner rotor

Limit: 0.15 mm (0.0059 in.)



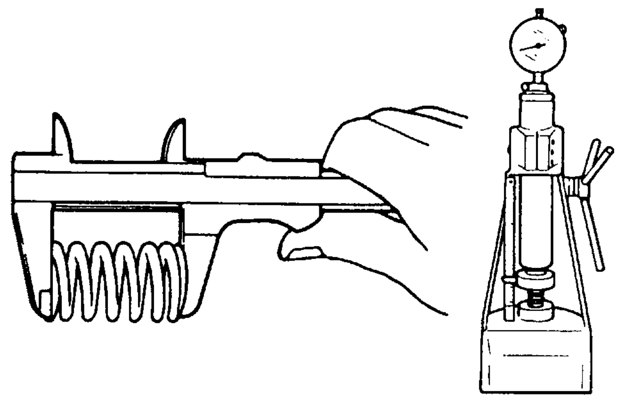
I2RH0B150027-01

Relief valve spring free length and load

Check relief valve spring free length and load as shown in the figure. If the measured valve spring length is lower than the specification, replace relief valve spring.

Relief valve spring free length and load

	Standard	Limit
Free length	52.4 mm (2.06 in.)	—
Load at spring length 38.5 mm (1.52 in.)	79 N (7.9 kgf, 17.5 lb)	69 N (6.9 kgf, 15.0 lb)



I2RH01150023-01

Specifications

Tightening Torque Specifications

S7RS0B1507001

Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
Oil pressure switch	13	1.3	9.5	☞
Heat exchanger stand bolt	22	2.2	16.0	☞
Oil pump strainer bolt	11	1.1	8.0	☞
Oil pump strainer bracket bolt	11	1.1	8.0	☞
Oil pan bolt (M6)	11	1.1	8.0	☞
Oil pan bolt (M10)	55	5.5	40.0	☞
Oil pan nut	11	1.1	8.0	☞
Oil pan drain plug	35	3.5	25.5	☞
Transaxle stiffener bolt	55	5.5	40.0	☞
Oil pump rotor plate bolt	11	1.1	8.0	☞

NOTE

The specified tightening torque is also described in the following.
“Heat Exchanger Components”
“Oil Pan and Oil Pump Strainer Components”
“Oil Pump Components”

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

Special Tools and Equipment

Recommended Service Material

S7RS0B1508001

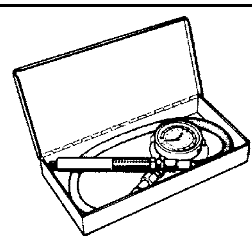
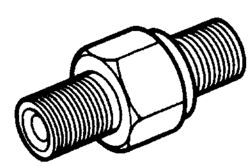
Material	SUZUKI recommended product or Specification		Note
Sealant	SUZUKI Bond No.1217G	P/No.: 99000–31260	☞

NOTE

Required service material is also described in the following.
“Heat Exchanger Components”
“Oil Pan and Oil Pump Strainer Components”
“Oil Pump Components”

Special Tool

S7RS0B1508002

09915–77310 Oil pressure gauge (0-10kg/cm2) ☞ 	09915–78211 Oil pressure gauge attachment ☞ 

Engine Cooling System

General Description

Cooling System Description

S7RS0B1601001

The cooling system consists of the radiator cap, radiator, coolant reservoir, hoses, water pump, cooling fan and thermostat. The radiator is of tube-and-fin type.

Coolant Description

S7RS0B1601002

⚠ WARNING

- **Do not remove radiator cap to check engine coolant level; check coolant visually at the see-through coolant reservoir. Coolant should be added only to reservoir as necessary.**
- **As long as there is pressure in the cooling system, the temperature can be considerably higher than the boiling temperature of the solution in the radiator without causing the solution to boil. Removal of the radiator cap while engine is hot and pressure is high will cause the solution to boil instantaneously and possibly with explosive force, spewing the solution over engine, fenders and person removing cap. If the solution contains flammable anti-freeze such as alcohol (not recommended for use at any time), there is also the possibility of causing a serious fire.**
- **Check to make sure that engine coolant temperature is cold before removing any part of cooling system.**
- **Also be sure to disconnect negative cable from battery terminal before removing any part.**

The coolant recovery system is standard. The coolant in the radiator expands with heat, and the coolant is overflowed to the reservoir.
When the system cools down, the coolant is drawn back into the radiator.
The cooling system has been filled with a quality coolant that is a 50/50 mixture of water and ethylene glycol antifreeze.
This 50/50 mixture coolant solution provides freezing protection to –36 °C (–33 °F).

- Maintain cooling system freeze protection at –36 °C (–33 °F) to ensure protection against corrosion and loss of coolant from boiling. This should be done even if freezing temperatures are not expected.
- Add ethylene glycol base coolant when coolant has to be added because of coolant loss or to provide added protection against freezing at temperature lower than –36 °C (–33 °F).

NOTE

- **Alcohol or methanol base coolant or plain water alone should not be used in cooling system at any time as damage to cooling system could occur.**
- **Coolant must be mixed with deminerated water or distilled water.**

Anti-freeze proportioning table

		For M/T model	For A/T model
Freezing temperature	°C	–36	–36
	°F	–33	–33
Anti-freeze / Anti-corrosion coolant concentration	%	50	50
Ratio of compound to cooling water	ltr.	3.10/3.10	3.05/3.05
	US pt.	6.55/6.55	6.44/6.44
	Imp pt.	5.46/5.46	5.37/5.37

<u>**Coolant capacity**</u>
For M/T model:
- **Engine, radiator and heater: 5.5 liters (11.62/9.68 US/Imp pt.)**
- **Reservoir: 0.7 liters (1.48/1.23 US/Imp pt.)**
- **Total: 6.2 liters (13.10/10.91 US/Imp pt.)**

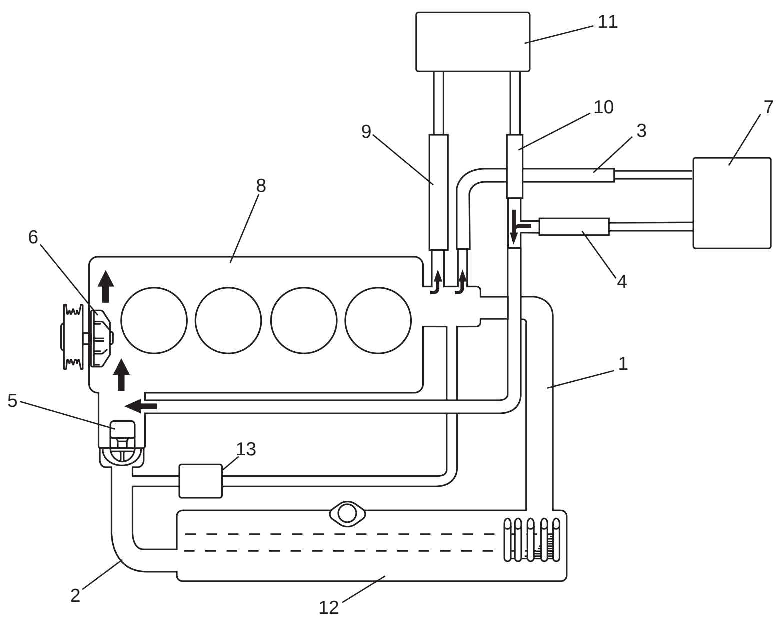
For A/T model:
- **Engine, radiator and heater: 5.4 liters (11.41/9.50 US/Imp pt.)**
- **Reservoir: 0.7 liters (1.48/1.23 US/Imp pt.)**
- **Total: 6.1 liters (12.89/10.74 US/Imp pt.)**

Schematic and Routing Diagram

Coolant Circulation

S7RS0B1602001

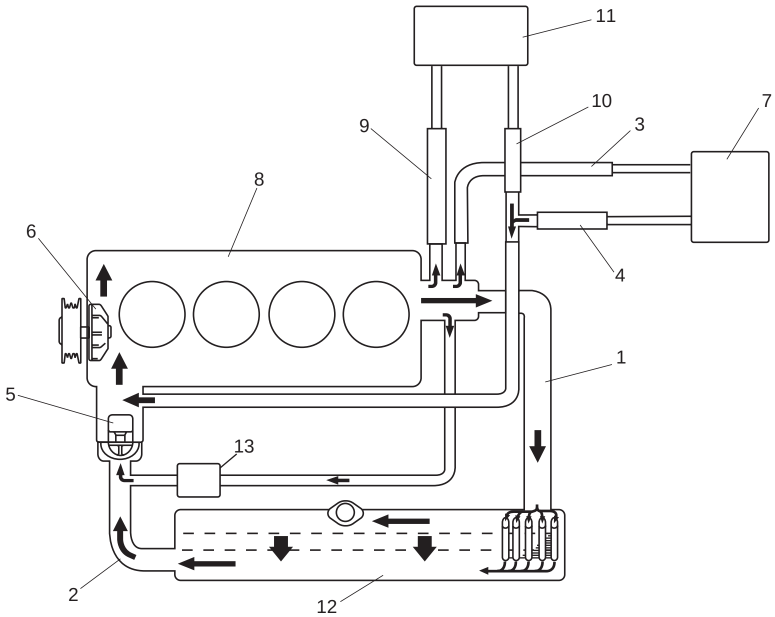
While the engine is warmed up (thermostat closed), coolant circulates as follows.



I6RS0C160001-01

1. Radiator inlet hose	6. Water pump	11. Heater core
2. Radiator outlet hose	7. Throttle body	12. Radiator
3. Throttle body inlet hose	8. Engine	13. Heat exchanger
4. Throttle body outlet hose	9. Heater core inlet hose	
5. Thermostat	10. Heater core outlet hose	

When coolant is warmed up to normal temperature and the thermostat opens, coolant passes through the radiator core to be cooled as follows.



I6RS0C160002-01

1. Radiator inlet hose	6. Water pump	11. Heater core
2. Radiator outlet hose	7. Throttle body	12. Radiator
3. Throttle body inlet hose	8. Engine	13. Heat exchanger
4. Throttle body outlet hose	9. Heater core inlet hose	
5. Thermostat	10. Heater core outlet hose	

Diagnostic Information and Procedures

Engine Cooling Symptom Diagnosis

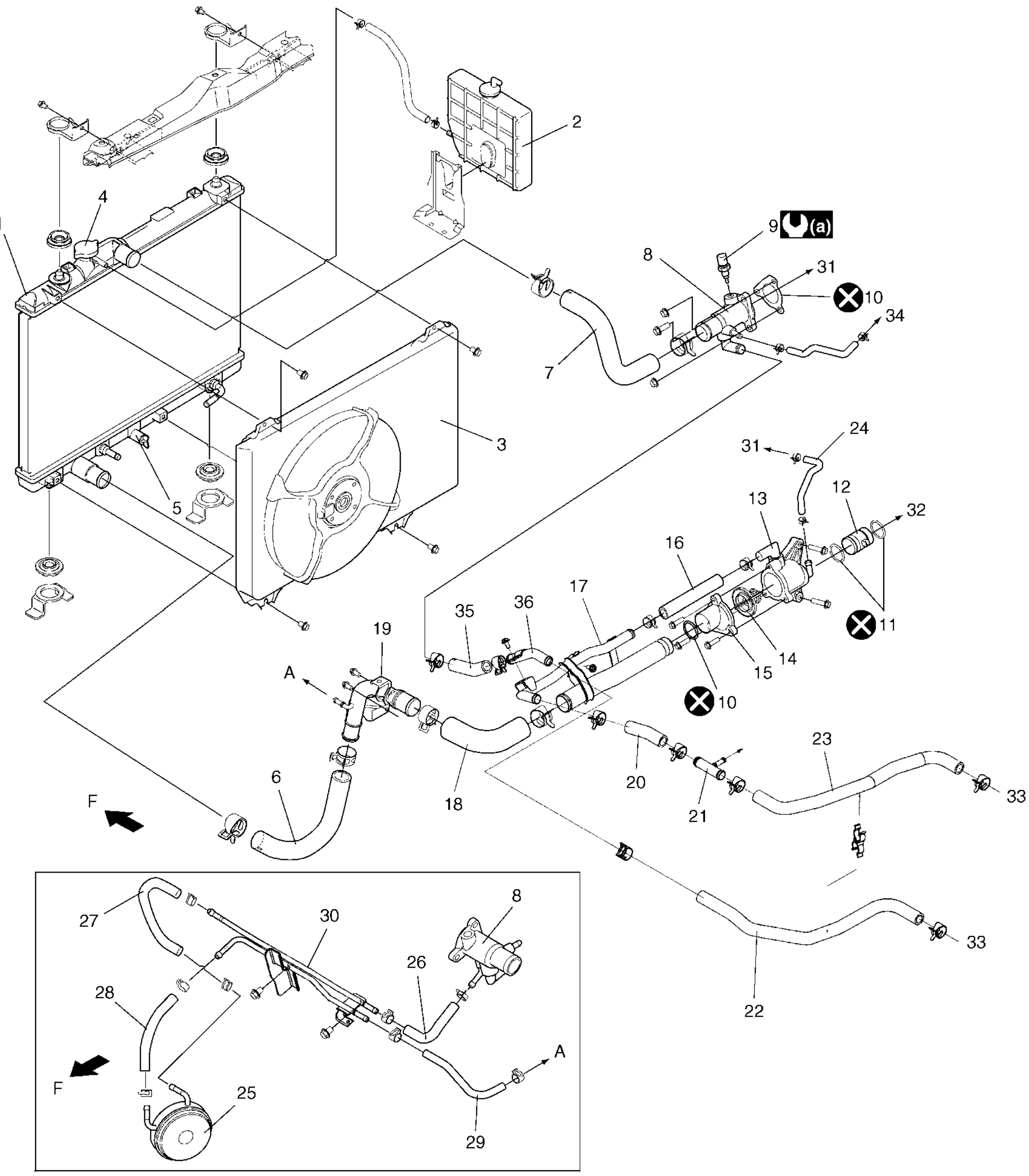
S7RS0B1604001

Condition	Possible cause	Correction / Reference Item
Engine overheats (Radiator fan operates)	Loose or broken water pump belt	*Adjust or replace.*
	Not enough coolant	*Check coolant level and add as necessary.*
	Faulty thermostat	*Replace.*
	Faulty water pump	*Replace.*
	Dirty or bent radiator fins	*Clean or remedy.*
	Coolant leakage on cooling system	*Repair.*
	Clogged radiator	*Check and replace radiator as necessary.*
	Faulty radiator cap	*Replace.*
	Improper ignition timing	*Adjust.*
	Dragging brakes	*Adjust brake.*
	Slipping clutch	*Adjust or replace.*
	Poor charge battery	*Check and replace as necessary.*
	Poor generation generator	*Check and repair.*
	ECT sensor faulty	*Check and replace as necessary.*
	Radiator cooling fan relay No.2 and/or No.3 faulty	*Check and replace as necessary.*
	Radiator fan motor faulty	*Check and replace as necessary.*
	ECM faulty	*Check and replace as necessary.*
	Wiring or grounding faulty	*Repair as necessary.*
	Equipped with too much electric load part(s)	*Dismount.*
Engine overheats (Radiator fan does not operate)	Fuse blown	*Check 30 A fuse of relay/fuse box and check for short circuit to ground.*
	Radiator cooling fan relay No.1 faulty	*Check and replace as necessary.*
	ECT sensor faulty	*Check and replace as necessary.*
	Radiator cooling fan motor faulty	*Check and replace as necessary.*
	Wiring or grounding faulty	*Repair as necessary.*
	ECM faulty	*Check and replace as necessary.*

Repair Instructions

Cooling System Components

S7RS0B1606001



I7RS0B160004-01

F:	Vehicle forward	10.	Water outlet cap gasket	20.	Heater outlet No.2 hose	30.	Heat exchanger water pipe
1.	Radiator	11.	O-ring	21.	Heater union	31.	To cylinder head
2.	Reservoir	12.	Thermostat case water outlet pipe	22.	Heater inlet No.1 hose	32.	To water pump
3.	Engine cooling fan assembly	13.	Thermostat case	23.	Heater outlet No.1 hose	33.	To heater core
4.	Radiator cap	14.	Thermostat	24.	Water bypass No.2 hose	34.	To throttle body
5.	Drain plug	15.	Thermostat cap	25.	Heat exchanger	35.	Heater inlet No.2 hose
6.	Radiator outlet hose	16.	Water bypass No.1 hose	26.	Heat exchanger inlet No.1 hose	36.	Heater inlet pipe
7.	Radiator inlet hose	17.	Water inlet No.1 pipe	27.	Heat exchanger inlet No.2 hose	(a) :	15 N·m (1.5 kgf-m, 11.0 lb-ft)
8.	Water outlet cap	18.	Water inlet hose	28.	Heat exchanger outlet No.1 hose	:	Do not reuse.
9.	ECT sensor	19.	Water inlet No.2 pipe	29.	Heat exchanger outlet No.2 hose		

Coolant Level Check

S7RS0B1606002

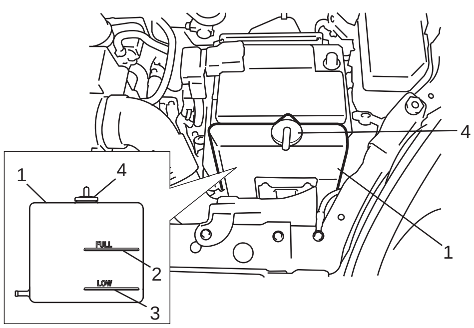
⚠ WARNING

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 radiator cap is taken off too soon.

To check level, lift hood and look at "see-through" coolant reservoir.
It is not necessary to remove radiator cap to check coolant level.
When engine is cool, check coolant level in reservoir (1).
A normal coolant level should be between FULL mark (2) and LOW mark (3) on reservoir (1).
If coolant level is below LOW mark (3), remove reservoir cap (4) and add proper coolant to reservoir to bring coolant level up to FULL mark (2).

NOTE

If proper quality antifreeze is used, there is no need to add extra inhibitors or additives that claim to improve system. They may be harmful to proper operation of system, and are unnecessary expense.



I4RS0B160002-01

Engine Cooling System Inspection and Cleaning

S7RS0B1606003

⚠ WARNING

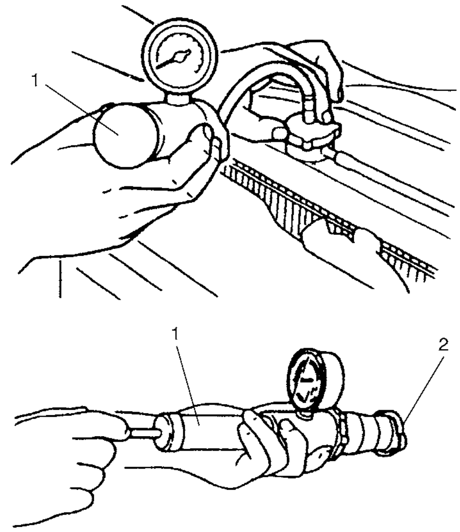
To help avoid danger of being burned, do not remove radiator cap while engine and radiator are still hot. Scalding fluid and steam can be blown out under pressure if cap is taken off too soon.

1) Check cooling system for leakage or damage.
2) Wash radiator cap and filler neck with clean water by removing radiator cap when engine is cold.
3) Check coolant for proper level and freeze protection.
4) Using a pressure tester (1), check system and radiator cap (2) for proper pressure holding capacity. If replacement of cap is required, use a proper cap for this vehicle.

NOTE

After installing radiator cap to radiator, make sure that the ear of cap lines is parallel to radiator.

<u>Cooling system and radiator cap holding pressure (for inspection)</u>
110 kPa (1.1 kg/cm^2, 15.6 psi)



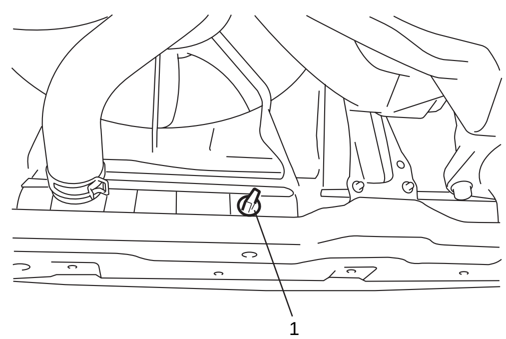
I5RH01160001-01

5) Tighten hose clamps and inspect all hoses. Replace hoses whenever cracked, swollen or otherwise deteriorated.
6) Clean frontal area of radiator core.

Cooling System Draining

S7RS0B1606004

1) Remove radiator cap.
2) Drain coolant from radiator drain plug (1).
3) After draining coolant, be sure to tighten drain plug (1) securely.



I4RS0A160003-01

Cooling System Flush and Refill

S7RS0B1606005

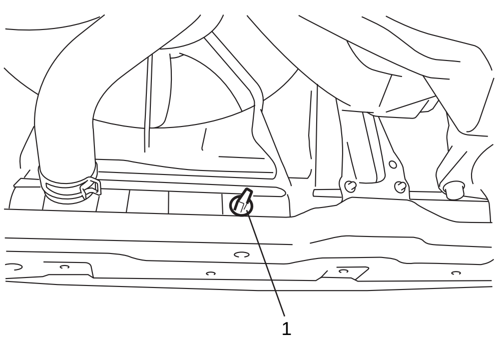
⚠ WARNING

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.

NOTE

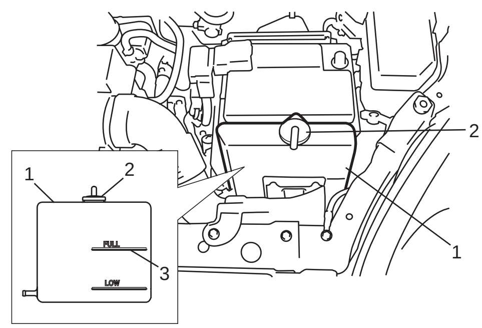
For detail of coolant specification, refer to “Coolant Description”.

1) Remove radiator cap when engine is cool as follows.
   a) Turn cap counterclockwise slowly until it reaches a “stop” (Do not press down while turning it).
   b) Wait until pressure is relieved (indicated by a hissing sound) then press down on cap and continue to turn it counterclockwise.
2) With radiator cap removed, run engine until upper radiator hose is hot (this shows that thermostat is open and coolant is flowing through system).
3) Stop engine and drain coolant from radiator drain plug (1).
4) Close radiator drain plug. Add water until system is filled and run engine until upper radiator hose is hot again.
5) Repeat Steps 3) and 4) several times until drained liquid is nearly colorless.
6) Close radiator drain plug (1) tightly.



I4RS0A160003-01

7) Remove reservoir (1) and remove cap (2) from reservoir (1).
8) Pour out any fluid, scrub and clean inside of reservoir with soap and water.
   Flush it well with clean water and drain, Reinstall reservoir.
9) Fill reservoir with coolant up to “Full” level mark (3).
10) Install reservoir cap (2) on reservoir.
11) Fill radiator with coolant up to bottom of radiator filler neck and install radiator cap, making sure that the ear of cap lines is parallel to radiator.
12) Run engine at idle speed.
13) Run engine until radiator fan motor is operated.
14) Stop engine and wait until engine comes cooled down to help avoid danger of being burned.
15) Add coolant to radiator up to bottom of radiator filler neck, and install radiator cap, making sure that the ear of cap lines is parallel to radiator.
16) Repeat Step 12) through 15).
17) Confirm that reservoir coolant level is “Full” level mark (3). If coolant is insufficient, repeat Step 9) and 10).



I7RS0B160005-01

Cooling Water Pipes or Hoses Removal and Installation

S7RS0B1606006

Removal

1) Drain coolant referring to “Cooling System Draining”.
2) To remove these pipes or hoses, loosen clamp on each hose and pull hose end off.

Installation

Install removed parts in reverse order of removal procedure, noting the following.

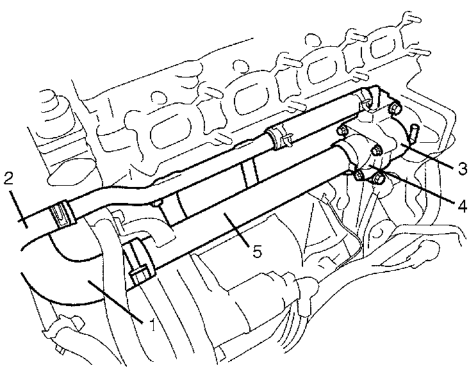
- Tighten each clamp securely referring to “Cooling System Components”.
- Refill cooling system referring to Step 7) to 22) of “Cooling System Flush and Refill”.

Thermostat Removal and Installation

S7RS0B1606007

Removal

1) Drain coolant referring to "Cooling System Draining".
2) Remove intake manifold referring to "Intake Manifold Removal and Installation in Section 1D".
3) Remove generator referring to "Generator Dismounting and Remounting in Section 1J".
4) Disconnect water hose (1) and heater hose (2) from each pipe.
5) Remove thermostat case (3) with thermostat cap (4) and water inlet pipe (5).
6) Remove water inlet pipe with thermostat cap from thermostat case.
7) Remove thermostat from thermostat case (3).



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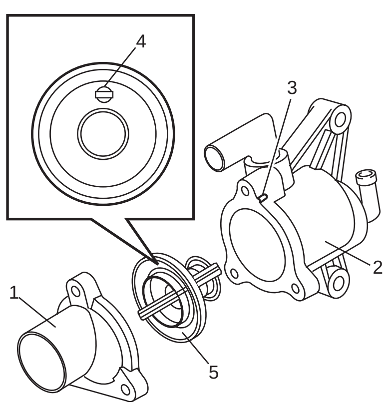
Installation

Reverse removal procedure for installation noting the following points.

- Install thermostat cap (1) to thermostat case (2) by aligning match mark (3) of thermostat case with air bleed valve (4) of the thermostat (5).



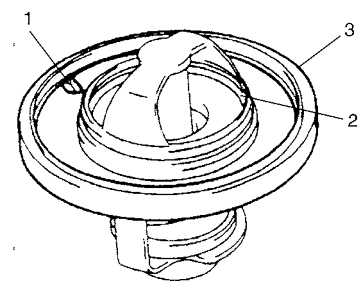
I7RS0B160006-01

- Use new O-rings when installing.
- Adjust water pump belt tension referring to "Water Pump / Generator Drive Belt Tension Inspection and Adjustment in Section 1J".
- Adjust A/C compressor belt tension referring to "Compressor Drive Belt Inspection and Adjustment in Section 7B" or "Compressor Drive Belt Inspection and Adjustment in Section 7B".
- Refill cooling system referring to Step 7) to 22) of "Cooling System Flush and Refill".
- Verify that there is no coolant leakage at each connection.

Thermostat Inspection

S7RS0B1606008

- Make sure that air bleed valve (1) of thermostat is clean.
- Check to make sure that valve seat (2) is free from foreign matters which would prevent valve from seating tight.
- Check thermostat seal (3) for breakage, deterioration or any other damage.



I3RM0A160008-01

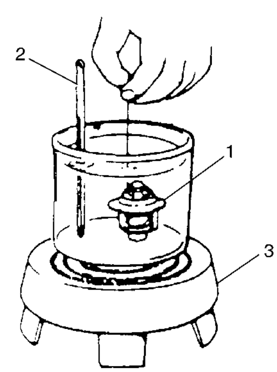
- Check thermostatic movement of wax pellet as follows:
  a. Immerse thermostat (1) in water, and heat water gradually.
  b. Check that valve starts to open at specific temperature.

  <u>Temperature at which valve begins to open</u>
  80 – 84 °C (176 – 183 °F)

  <u>Temperature at which valve become fully open</u>
  95 – 97 °C (203 °F)

  <u>Valve lift</u>
  More than 8 mm at 95 °C (203 °F)

If valve starts to open at a temperature substantially below or above specific temperature, thermostat unit should be replaced with a new one. Such a unit, if reused, will bring about overcooling or overheating tendency.



I2RH01160012-01

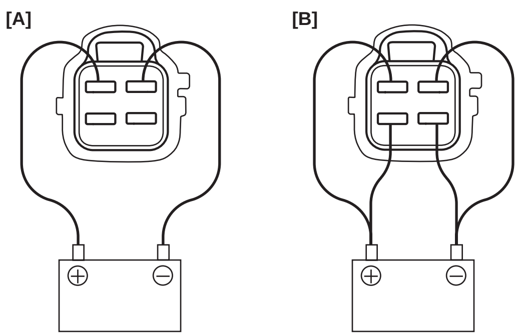
2. Thermometer	3. Heater

Radiator Cooling Fan Motor On-Vehicle Inspection

S7RS0B1606009

1) Check low speed operation of radiator cooling fan as follows.
   a) Connect battery to fan motor coupler as shown in figure.
   b) Check that radiator cooling fan rotates smoothly. If any abnormality is found, replace fan motor.
2) Check high speed operation of radiator cooling fan as follows.
   a) Connect battery to fan motor coupler as shown in figure.
   b) Check that radiator cooling fan rotates smoothly and its rotational speed is faster than low speed operation.
   If any abnormality is found, replace fan motor.

   Reference: Fan motor specified current at 12 V
   Low speed operation: 14.0 A maximum
   High speed operation: 18.0 A maximum



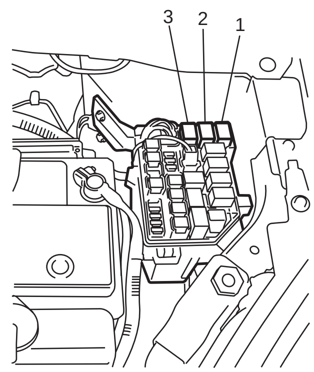
I7RS0B160007-01

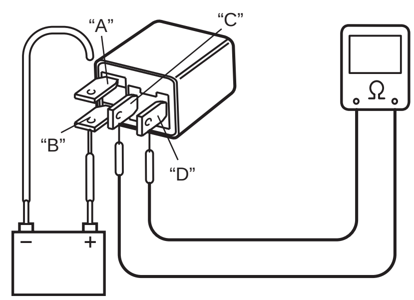
[A]:	Low speed operation
[B]:	High speed operation

Radiator Cooling Fan Relay Inspection

S7RS0B1606010

1) Disconnect negative (–) cable at battery.
2) Remove radiator cooling fan relay No.1 (1), No.2 (2) and/or No.3 (3) from relay box.
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.
5) Connect battery negative (–) terminal “A” of relay.
6) Check continuity between terminal “C” and “D”. If there is no continuity when relay is connected to the battery, replace relay.





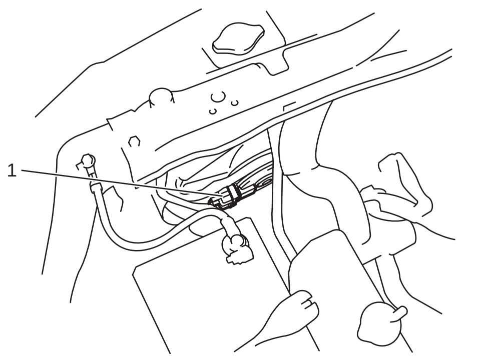
I4RS0B160004-01

Radiator Cooling Fan Removal and Installation

S7RS0B1606011

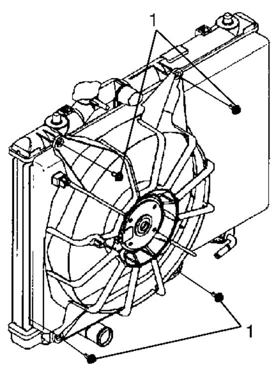
Removal

1) Disconnect negative (–) cable at battery.
2) Disconnect connector (1) of cooling fan motor.



I7RS0A160004-01

3) Drain coolant.
4) Remove front bumper, front bumper upper absorber and upper member referring to “Front Bumper and Rear Bumper Components in Section 9K”.
5) Remove radiator inlet hose and reservoir hose.
6) Remove cooling fan mounting bolts (1).



I4RS0A160009-01

7) Slide condenser with radiator, and then remove radiator cooling fan.

> ⚠ **CAUTION**
>
> **Be sure not to damage condenser outlet pipe.**

Installation

Reverse removal procedure for installation noting the following.

- Refill cooling system referring to Step 7) to 22) of “Cooling System Flush and Refill”.
- After installation, verify there is no coolant leakage at each connection.

Radiator On-Vehicle Inspection and Cleaning

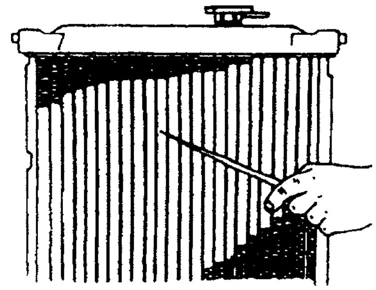
S7RS0B1606012

Inspection

Check radiator for leakage or damage. Straighten bent fins, if any.

Cleaning

Clean frontal area of radiator cores.



I2RH01160014-01

Radiator Removal and Installation

S7RS0B1606013

Removal

1) Disconnect negative cable at battery.
2) Drain A/T fluid.
3) Drain coolant.
4) Remove cooling fan assembly referring to “Radiator Cooling Fan Removal and Installation”.
5) Remove A/T fluid cooler inlet and outlet hoses.
6) Remove radiator outlet hose from radiator.
7) Remove radiator from vehicle.

Installation

Reverse removal procedures, noting the following.

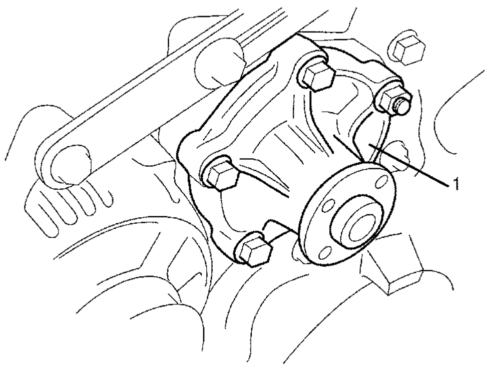
- Refill cooling system referring to Step 7) to 22) of “Cooling System Flush and Refill”.
- After installation, verify there is no coolant leakage each connection.
- Refill A/T fluid referring to “A/T Fluid Change in Section 5A”.

Water Pump Removal and Installation

S7RS0B1606014

Removal

1) Disconnect negative cable at battery.
2) Drain coolant.
3) Remove water pump / generator drive belt referring to “Water Pump / Generator Drive Belt Removal and Installation in Section 1J”.
4) Remove water pump assembly (1).



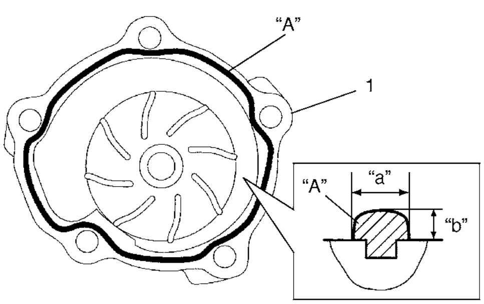
I2RH0B160016-01

Installation

1) Apply sealant to mating surface of water pump (1) as shown in the figure.

“A”: Water tight sealant 99000–31250 (SUZUKI Bond No.1207F)

<u>Sealant quantity (to mating surface of water pump)</u>
Width “a”: 3 mm (0.12 in.)
Height “b”: 2 mm (0.08 in.)



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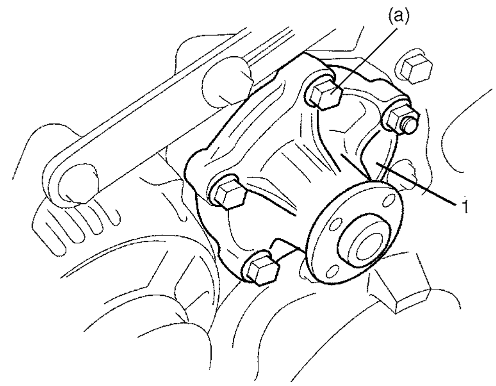
2) Install water pump assembly (1) to cylinder block and tighten bolts and nut to specified torque.

Tightening torque
Water pump bolt and nut (a): 25 N·m (2.5 kgf-m, 18.0 lb-ft)



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3) Install water pump pulley.
4) Install water pump / generator drive belt referring to “Water Pump / Generator Drive Belt Tension Inspection and Adjustment in Section 1J”.
5) Install A/C compressor belt (if equipped) referring to “Compressor Drive Belt Inspection and Adjustment in Section 7B” or “Compressor Drive Belt Inspection and Adjustment in Section 7B”.
6) Refill cooling system referring to Step 7) to 22) of “Cooling System Flush and Refill”.
7) Connect negative cable at battery.
8) Check each part for leakage.

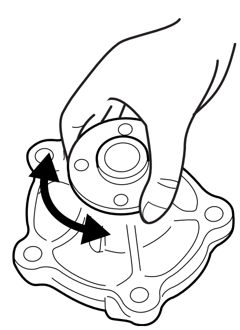
Water Pump Inspection

S7RS0B1606015

⚠ CAUTION

Do not disassemble water pump.
If any repair is required on pump, replace it as assembly.

Rotate water pump by hand to check for smooth operation. If pump does not rotate smoothly or makes abnormal noise, replace it.



I2RH0B160019-01

Specifications

Tightening Torque Specifications

S7RS0B1607001

Fastening part	Tightening torque			Note
	N⋅m	kgf-m	lb-ft	
Water pump bolt and nut	25	2.5	18.0	☞

NOTE

The specified tightening torque is also described in the following.
“Cooling System Components”

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

Special Tools and Equipment

Recommended Service Material

S7RS0B1608001

Material	SUZUKI recommended product or Specification		Note
Water tight sealant	SUZUKI Bond No.1207F	P/No.: 99000–31250	☞

Fuel System

Precautions

Precautions on Fuel System Service

S7RS0B1700001

WARNING

Before attempting service of any type on fuel system, the following should be always observed in order to reduce the risk of fire and personal injury.

- **Disconnect negative cable at battery.**
- **Do not smoke, and place no smoking signs near work area.**
- **Be sure to have CO_2 fire extinguisher handy.**
- **Be sure to perform work in a well-ventilated area and away from any open flames (such as gas hot heater).**
- **Wear safety glasses.**
- **To relieve fuel vapor pressure in fuel tank, remove fuel filler cap from fuel filler neck and then reinstall it.**
- **As fuel feed line is still under high fuel pressure even after stopping engine, loosening or disconnecting fuel feed line directly may cause dangerous spout of fuel. Before loosening or disconnecting fuel feed line, make sure to relieve fuel pressure referring to “Fuel Pressure Relief Procedure”.**
- **A small amount of fuel may be released when the fuel line is disconnected. In order to reduce the risk of personal injury, cover a shop cloth to the fitting to be disconnected. Be sure to put that cloth in an approved container after disconnecting.**
- **Never run engine with fuel pump relay disconnected when engine and exhaust system are hot.**
- **Note that fuel hose connection varies with each type of pipe. Be sure to connect and clamp each hose correctly referring to “Fuel Hose Disconnecting and Reconnecting”.
After connecting, make sure that it has no twist or kink.**
- **When installing injector or fuel feed pipe, lubricate its O-ring with gasoline.**

General Description

Fuel System Description

S7RS0B1701001

CAUTION

This engine requires the unleaded fuel only. The leaded and/or low lead fuel can result in engine damage and reduce the effectiveness of the emission control system.

The main components of the fuel system are fuel tank, fuel pump assembly (with fuel filter, fuel level gauge, fuel pressure regulator, fuel feed line and fuel vapor line.
For the details of fuel flow, refer to “Fuel Delivery System Diagram”.

Fuel Delivery System Description

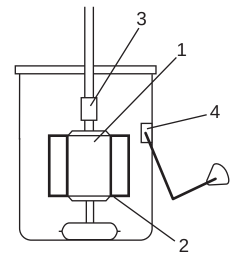
S7RS0B1701002

The fuel delivery system consists of the fuel tank, fuel pump assembly (with built-in fuel filter and fuel pressure regulator), delivery pipe, injectors and fuel feed line.
The fuel in the fuel tank is pumped up by the fuel pump, sent into delivery pipe and injected by the injectors.
As the fuel pump assembly is equipped with built-in fuel filter and fuel pressure regulator, the fuel is filtered and its pressure is regulated before being sent to the feed pipe.
The excess fuel at fuel pressure regulation process is returned back into the fuel tank.
Also, fuel vapor generated in fuel tank is led through the fuel vapor line into the EVAP canister.
For system diagram, refer to “Fuel Delivery System Diagram”.

Fuel Pump Description

S7RS0B1701003

The fuel pump (1) is an in-tank type electric pump. Incorporated in the pump assembly are;
a fuel filter (2) and a fuel pressure regulator (3) are included and a fuel level gauge (4) is attached. Addition of the fuel pressure regulator to the fuel pump makes it possible to maintain the fuel pressure at constant level and ECM controls compensation for variation in the intake manifold pressure.

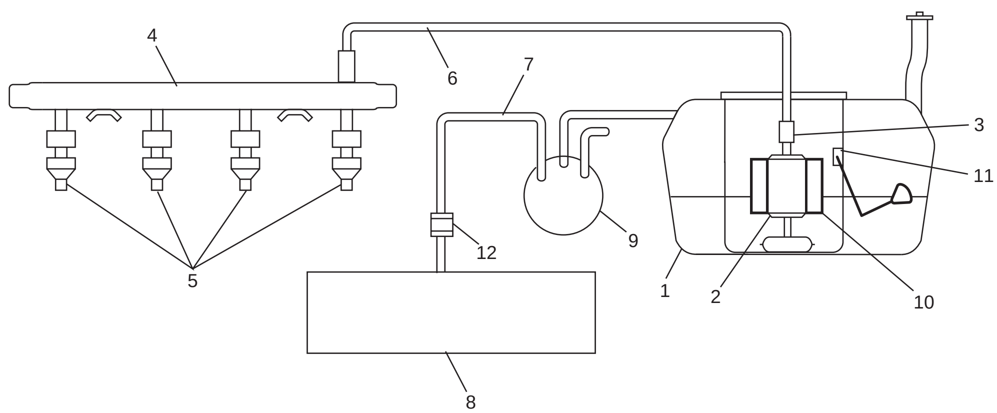


I6RS0C170001-01

Schematic and Routing Diagram

Fuel Delivery System Diagram

S7RS0B1702001



I6RS0C170002-01

1. Fuel tank	5. Fuel injector	9. EVAP canister
2. Fuel pump	6. Fuel feed line	10. Fuel filter
3. Fuel pressure regulator	7. Fuel vapor line	11. Main fuel level sensor
4. Delivery pipe	8. Intake manifold	12. EVAP canister purge valve

Diagnostic Information and Procedures

Fuel Pressure Inspection

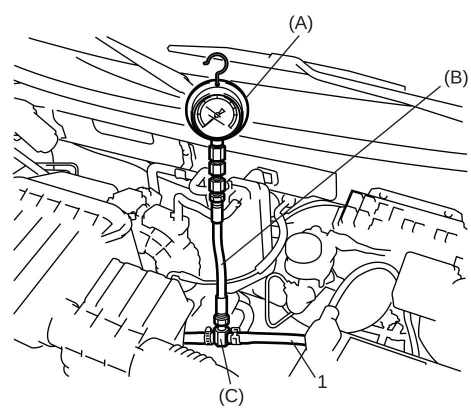
S7RS0B1704001

⚠ WARNING

Before starting the following procedure, be sure to observe “Precautions on Fuel System Service” in order to reduce the risk or fire and personal injury.

1) Relieve fuel pressure in fuel feed line referring to “Fuel Pressure Relief Procedure”.
2) Disconnect fuel feed hose from fuel delivery pipe.
3) Connect special tools and hose between fuel feed hose (1) and fuel delivery pipe as shown in figure, and clamp hoses securely in order to ensure that no leaks occur during checking.

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



I3RM0A170004-01

4) Check that battery voltage is 11 V or more.
5) Measure fuel pressure at each condition.
If measured pressure is out of specification, refer to "Fuel Pressure Check in Section 1A" and check each possibly defective part. Replace if found defective.
   a) Turn ignition switch ON to operate fuel pump and after 2 seconds turn it OFF. Repeat this 3 or 4 times and then check fuel pressure.

   <u>Fuel pressure specification</u>
   With fuel pump operating and engine stopped: 270 – 310 kPa (2.7 – 3.1 kg/cm^2, 38.4 – 44.0 psi)

   b) Start engine and warm it up to normal operating temperature, and measure fuel pressure at idling.

   <u>Fuel pressure specification</u>
   At specified idle speed: 270 – 310 kPa (2.7 – 3.1 kg/cm^2, 38.4 – 44.0 psi)

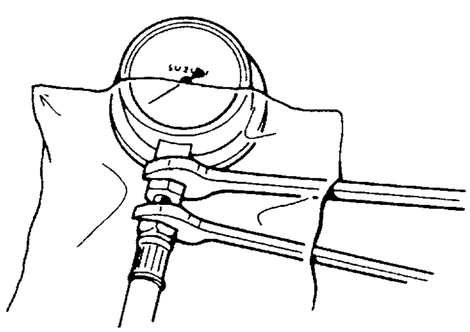
   c) Stop engine, and measure fuel pressure at one minute after stopping.

   <u>Fuel pressure specification</u>
   With 1 min. after engine (fuel pump) stop (Pressure reduces as time passes): Over 300 kPa (3.0 kg/cm^2, 42.7 psi)

6) After checking fuel pressure, remove fuel pressure gauge.

⚠ WARNING

As fuel feed line is still under high fuel pressure, make sure to release fuel pressure according to the following procedures.
- **Place fuel container under joint.**
- **Cover joint with rag and loosen joint nut slowly in order to release fuel pressure gradually.**



I2RH01170032-01

7) Remove special tools from fuel delivery pipe and fuel feed hose.
8) Connect fuel feed hose to fuel delivery pipe and clamp it securely.
9) With engine OFF and ignition switch ON, check for fuel leaks.

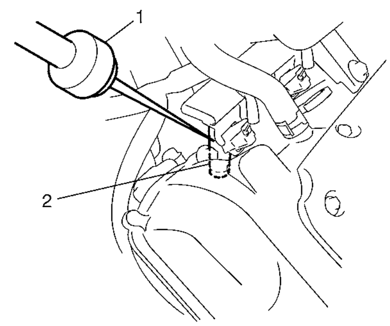
Fuel Cut Operation Inspection

S7RS0B1704002

NOTE

Before inspection, make sure that gear shift lever is in neutral position (shift select lever is "P" range for A/T vehicle), A/C is OFF and parking brake lever is pulled all the way up.

1) Warm engine up to normal operating temperature.
2) While listening to sound of injector (2) by using sound scope (1) or such, increase engine speed to higher than 3,000 r/min.



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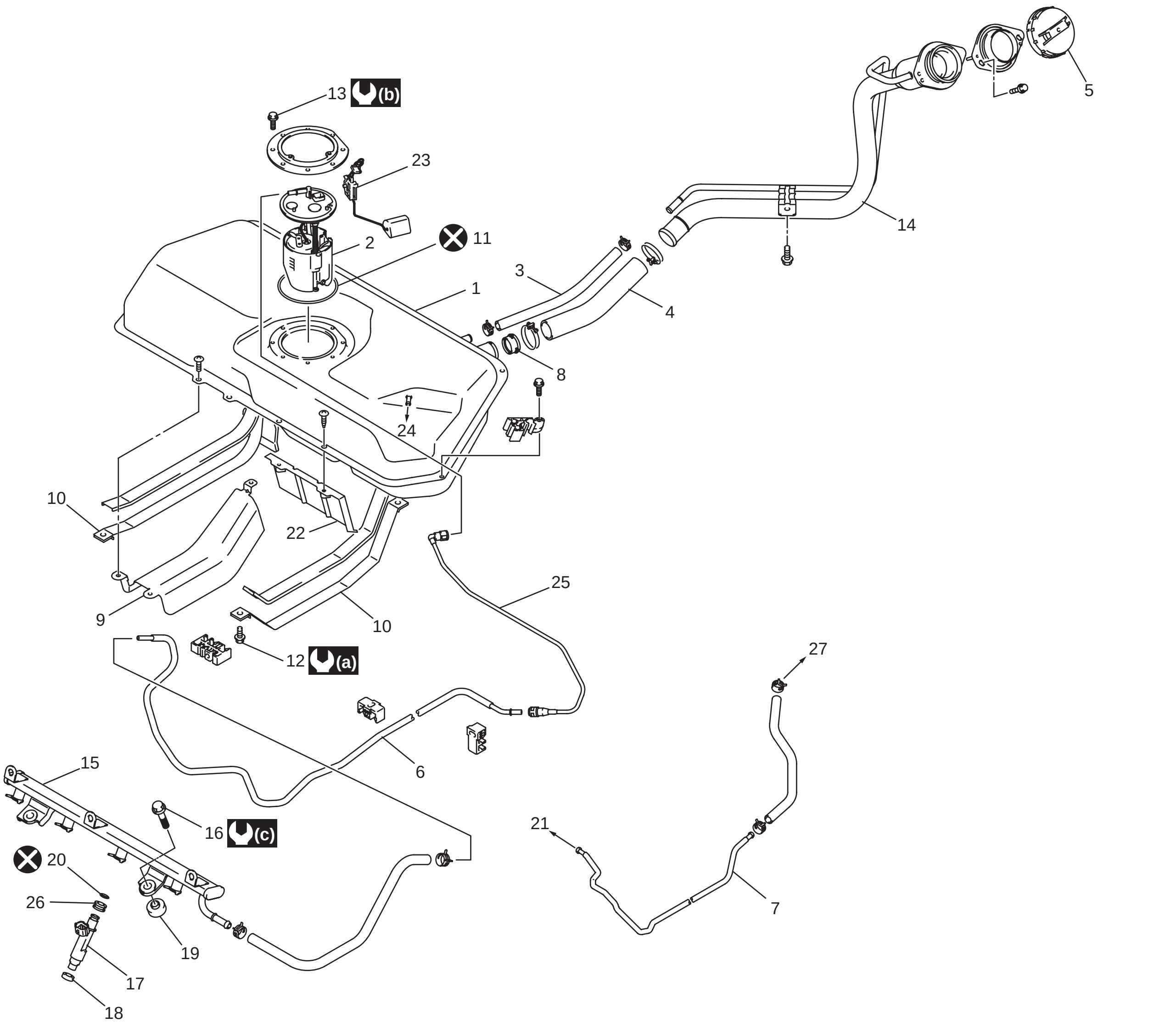
3) Check to make sure that injector operation sound is stop when throttle valve is closed instantly and it is heard again when engine speed is reduced to approx. 2,000 r/min or less.

Repair Instructions

Fuel System Components

S7RS0B1706001



I6RS0C170003-01

1. Fuel tank	12. Fuel tank bolt	23. Main fuel level sensor
2. Fuel pump assembly	13. Fuel pump assembly bolt	24. To fuel vapor line
3. Breather hose	14. Fuel filler neck	25. Fuel feed hose
4. Fuel tank filler hose	15. Fuel delivery pipe	26. Grommet
5. Fuel filler cap	16. Fuel delivery pipe bolt	27. To fuel tank
6. Fuel feed line	17. Fuel injector	⊗ : Do not reuse.
7. Fuel vapor line	18. Injector cushion	(a) : 45 N·m (4.5 kgf-m, 33.0 lb-ft)
8. Fuel tank inlet valve	19. Fuel delivery pipe insulator	(b) : 11 N·m (1.1 kgf-m, 8.0 lb-ft)
9. Fuel tank protector	20. O-ring	(c) : 25 N·m (2.5 kgf-m, 18.0 lb-ft)
10. Fuel tank belt	21. To canister	
11. Fuel pump gasket	22. Fuel tank cover	

Fuel Hose Disconnecting and Reconnecting

S7RS0B1706002

⚠ WARNING

Before starting the following procedure, be sure to observe “Precautions on Fuel System Service” in order to reduce the risk or fire and personal injury.

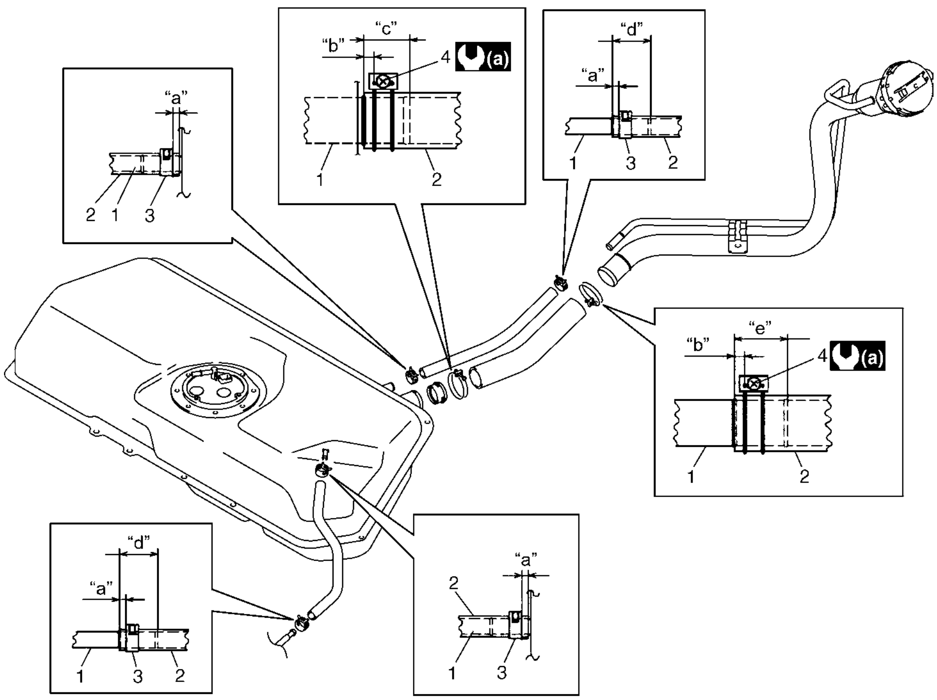
Be sure to connect and clamp each hose correctly as shown in figure.

For Connection Other Than Quick Joint

Clamp around fuel tank

NOTE

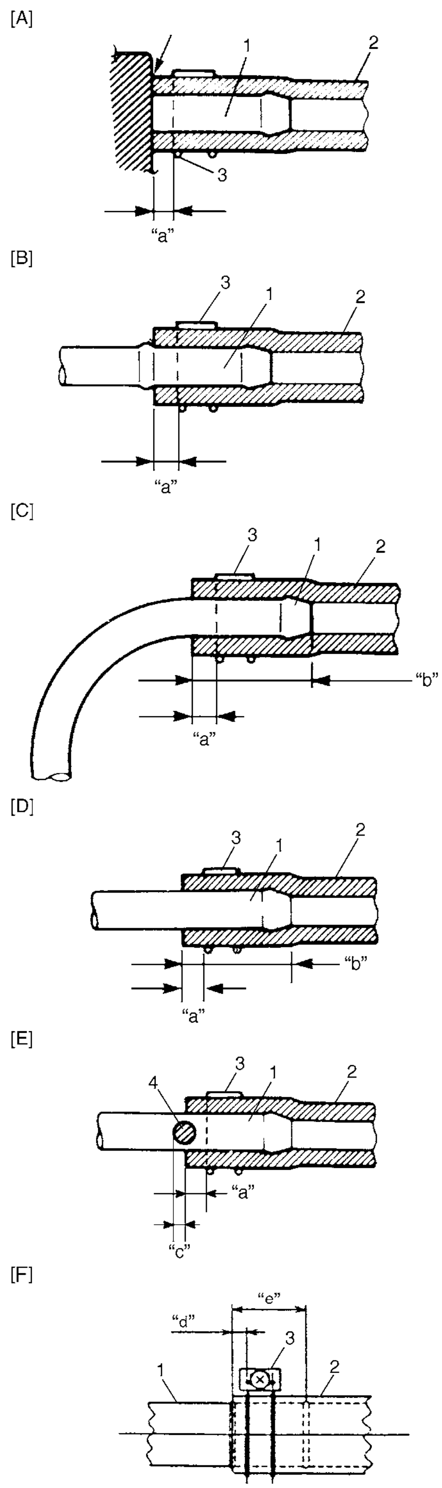
Be sure to install hose to spool of pipe surely.



I6RS0C170004-01

1. Pipe	“a” 3 – 7 mm (0.12 – 0.28 in.)	“e” 38 mm (1.50 in.)
2. Hose	“b” 5 – 12 mm (0.20 – 0.48 in.)	(a) : 2 N·m (0.2 kgf-m, 1.5 lb-ft)
3. Clamp	“c” 33 mm (1.30 in.)	
4. Fuel filler hose clamp screw	“d” 30 mm (1.18 in.)	

Clamp other than around fuel tank



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[A]:	With short pipe, fit hose as far as it reaches pipe joint as shown.
[B]:	With the following type pipe, fit hose as far as its peripheral projection as shown.
[C]:	With bent pipe, fit hose as its bent part as shown or till depth "b".
[D]:	With straight pipe, fit hose till depth "b".
[E]:	With red marked pipe, fit hose end reaches red mark on pipe.
[F]:	For fuel tank filler hose, insert it to spool or welding-bead.
"a":	Clamp securely at a position 3 – 7 mm (0.12 – 0.27 in.) from hose end.
"b":	20 – 30 mm (0.79 – 1.18 in.)
"c":	0 – 5 mm (0 – 0.19 in.)
"d":	5 – 12 mm (0.2 – 0.47 in.)
"e":	40 mm (1.57 in.)
1.	Pipe
2.	Hose
3.	Clamp
4.	Red mark

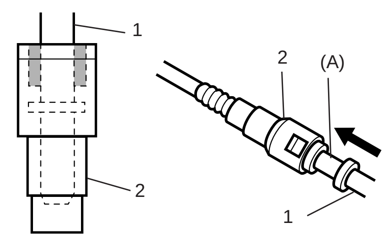
For Quick Joint

Disconnecting

1) Remove mud, dust and/or foreign material between pipe (1) and quick joint (2) by blowing compressed air.
2) Unlock joint lock by inserting special tool between pipe and quick joint.

   Special tool
   (A): 09919–47020

3) Disconnect quick joint from pipe.



I4RS0A170019-01

Reconnecting

Insert quick joint to fuel pipe until they lock securely (a click is heard), and confirm that quick joint is not disconnected by hand.

Fuel Pressure Relief Procedure

S7RS0B1706003

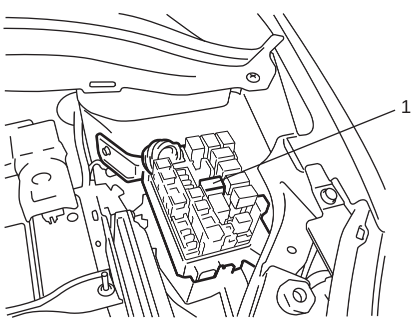
⚠ CAUTION

This work must not be done when engine is hot. If done so, it may cause adverse effect to catalyst.

NOTE

If ECM detects DTC(s) after servicing, clear DTC(s) referring to “DTC Clearance in Section 1A”.

1) Make sure that engine is cold.
2) Shift transaxle gear shift lever in “Neutral” (shift select lever in “P” range for A/T model), set parking brake and block drive wheels.
3) Remove relay / fuse box cover.
4) Disconnect fuel pump relay (1) from relay / fuse box (2).
5) Remove fuel filter cap in order to release fuel vapor pressure in fuel tank, and then reinstall it.
6) Start engine and run it until engine stops for lack of fuel. Repeat cranking engine 2 – 3 times for about 3 seconds each time in order to dissipate fuel pressure in lines. Fuel connections are now safe for servicing.
7) After servicing, connect fuel pump relay (1) to relay / fuse box and install relay / fuse box cover.



I4RS0A170004-01

Fuel Leakage Check Procedure

S7RS0B1706004

After performing any service on fuel system, check to make sure that there are no fuel leakages as follows.

1) Turn ON ignition switch for 3 seconds (to operate fuel pump) and then turn it OFF.
   Repeat this (ON and OFF) 3 or 4 times and apply fuel pressure to fuel line until fuel pressure is felt by hand placed on fuel feed hose.
2) In this state, check to see that there are no fuel leakages from any part of fuel system.

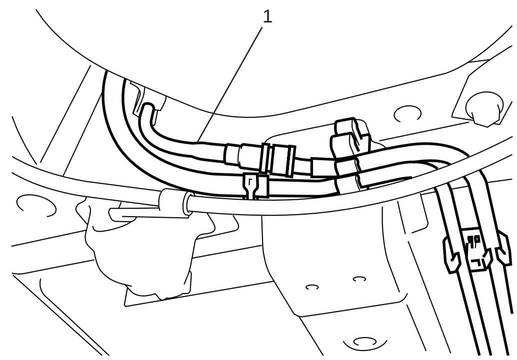
Fuel Lines On-Vehicle Inspection

S7RS0B1706005

⚠ CAUTION

Due to the fact that fuel feed line (1) is under high pressure, use special care when servicing it.

Visually inspect fuel lines for evidence of fuel leakage, hose crack and deterioration or damage.
Make sure all clamps are secure.
Replace parts as needed.



I4RS0A170005-01

Fuel Pipe Removal and Installation

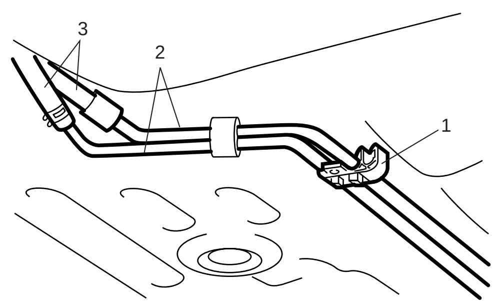
S7RS0B1706006

⚠ WARNING

Before starting the following procedure, be sure to observe “Precautions on Fuel System Service” in order to reduce the risk or fire and personal injury.

Removal

1) Relieve fuel pressure in fuel feed line according to “Fuel Pressure Relief Procedure”.
2) Disconnect negative cable at battery.
3) Disconnect fuel pipe joint and fuel hose (3) from fuel pipe (2) at the front and rear of each fuel pipe referring to “Fuel Hose Disconnecting and Reconnecting”.
4) Mark the location of clamps (1) on fuel pipes (2), so that the clamps can be reinstalled to where they were.
5) Remove pipes (2) with clamp (1) from vehicle.
6) Remove clamp (1) from pipes (2).



I4RS0A170020-01

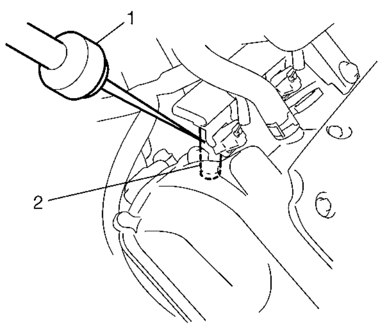
Installation

1) Install clamps to marked location on pipes. If clamp is deformed, its claw is bent or broken, replace it with new one.
2) Install pipes with pipe clamps to vehicle.
3) Connect fuel hoses and pipes to each pipe referring to “Fuel Hose Disconnecting and Reconnecting”.
4) Connect negative cable at battery.
5) With engine OFF, turn ignition switch to ON position and check for fuel leaks.

Fuel Injector On-Vehicle Inspection

S7RS0B1706007

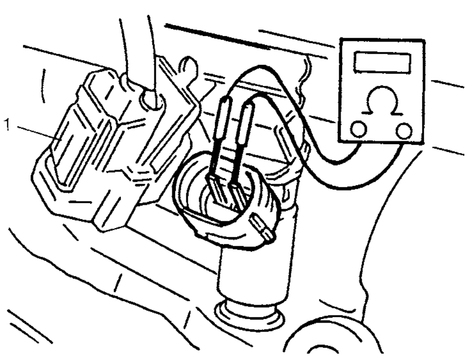
1) Using sound scope (1) or such, check operating sound of injector (2) when engine is running or cranking.
   Cycle of operating sound should vary according to engine speed.
   If no sound or an unusual sound is heard, check injector circuit (wire or coupler) or injector.



I2RH0B170007-01

2) Disconnect connector (1) from injector, connect ohmmeter between terminals of injector and check resistance.
   If resistance is out of specification, replace.

   Resistance of fuel injector
   11.3 – 13.8 Ω at 20 °C, 68 °F



I2RH0B170008-01

3) Connect connector to injector securely.

Fuel Injector Removal and Installation

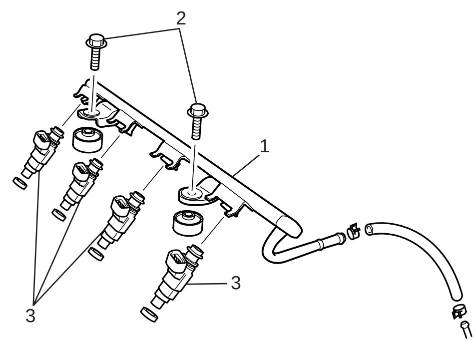
S7RS0B1706008

WARNING

Before starting the following procedure, be sure to observe “Precautions on Fuel System Service” in order to reduce the risk or fire and personal injury.

Removal

1) Relieve fuel pressure according to “Fuel Pressure Relief Procedure”.
2) Disconnect negative cable at battery.
3) Disconnect MAF sensor connector, and detach EVAP canister purge valve.
4) Remove air cleaner assembly with air intake pipe.
5) Disconnect fuel injector couplers.
6) Disconnect fuel feed hose from fuel delivery pipe (1).
7) Remove fuel delivery pipe bolts (2).
8) Remove fuel injector(s) (3).



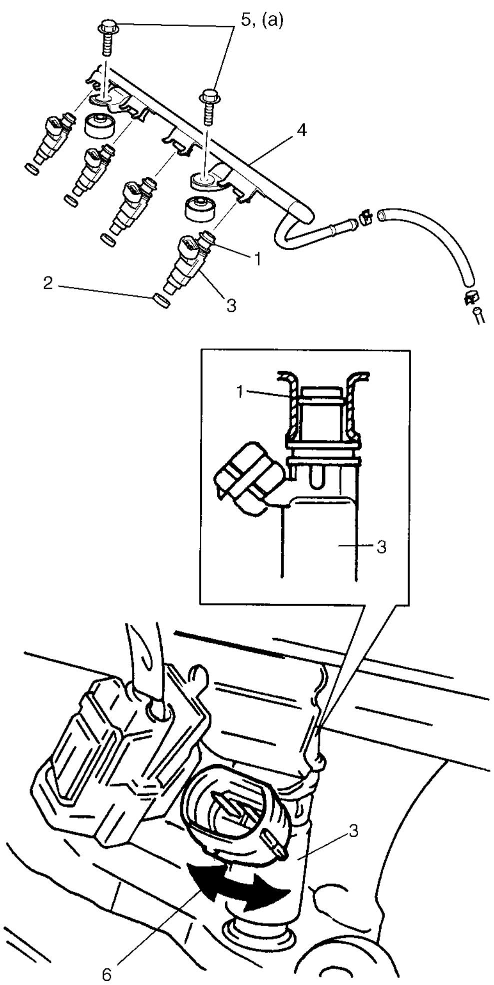
I3RM0A170010-01

Installation

Reverse removal procedure for installation noting the following.

- Replace injector O-ring (1) with new one using care not to damage it.
- Check if cushion (2) is scored or damaged. If it is, replace with new one.
- Apply thin coat of fuel to O-rings (1) and then install injectors (3) into delivery pipe (4) and cylinder head. Make sure that injectors rotate smoothly (6). If not, probable cause is incorrect installation of O-ring. Replace O-ring with new one.
- Tighten delivery pipe bolts (5) to specified torque and make sure that injectors rotate smoothly.

  Tightening torque
  Fuel delivery pipe bolt (a): 25 N·m (2.5 kgf-m, 18.0 lb-ft)



I3RM0A170011-01

- After installation, with engine OFF and ignition switch ON, check for fuel leaks around fuel line connection.

Fuel Injector Inspection

S7RS0B1706009

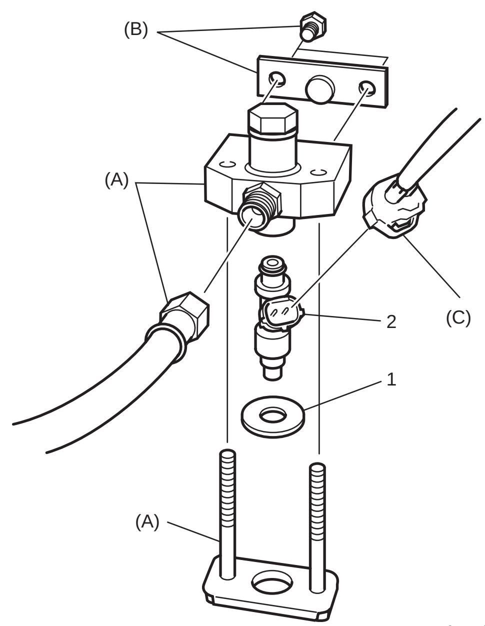
WARNING

Before starting the following procedure, be sure to observe “Precautions on Fuel System Service” in order to reduce the risk or fire and personal injury.

1) Relieve fuel pressure according to “Fuel Pressure Relief Procedure” if equipped.
2) Disconnect fuel feed hose from delivery pipe.
3) Set special tools as follows.

   Special tool
   (A): 09912–58421
   (B): 09930–88530
   (C): 09912–57610

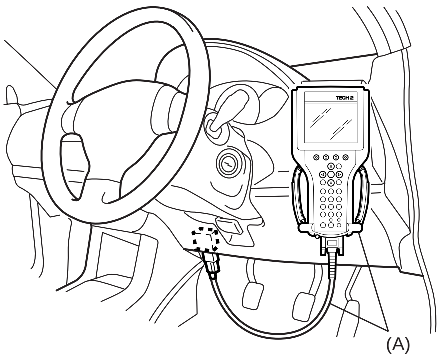
   a) Fit washer (1) (inside diameter 13.5 – 14.5 mm (0.532 – 0.570 in.)) to injector (2), and then install injector to special tool (A).
   b) Connect special tool (B) to injector.
   c) Install special tool (C) to special tool (A).
   d) Connect fuel feed hose to special tool (A).



I6RW0B170014-01

4) Install suitable vinyl tube onto injector nozzle to prevent fuel from splashing out when injecting.
5) Put graduated cylinder under injector.
6) Operate fuel pump and apply fuel pressure to injector as follows:
   a) When using scan tool:
      i) Connect scan tool to DLC with ignition switch OFF.
      ii) Turn ignition switch ON, clear DTC and select "MISC TEST" mode on scan tool.
      iii) Turn fuel pump ON by using scan tool.

      Special tool
      (A): SUZUKI scan tool



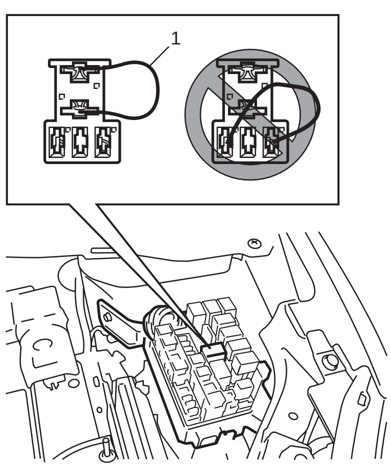
I4RS0A170021-01

   b) When not using scan tool:
      i) Remove fuel pump relay from connector.
      ii) Connect two terminals of relay connector using service wire (1) as shown in figure.

⚠ CAUTION

Check to make sure that connection is made between correct terminals. Wrong connection can cause damage to ECM, wire harness, etc.

      iii) Turn ignition switch ON.



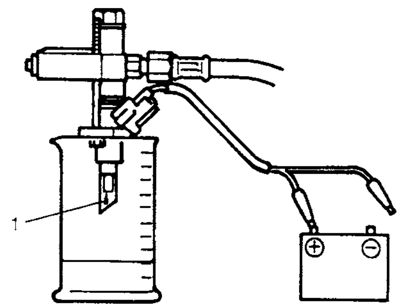
I4RS0A170006-02

7) Apply battery voltage to injector (1) for 15 seconds and measure injected fuel volume with graduated cylinder. Test each injector two or three times. If not within specification, replace injector.

   Injected fuel volume
   43 – 47 cc/15 sec. (1.45/1.51 – 1.58/1.65 US/Imp oz/15 sec.)

8) Check fuel leakage from injector nozzle. Do not operate injector for this check (but fuel pump should be at work). If fuel leaks (1) more than the following specifications, replace.

   Fuel leakage
   Less than 1 drop/min.



I2RH0B170013-01

Fuel Filler Cap Inspection

S7RS0B1706010

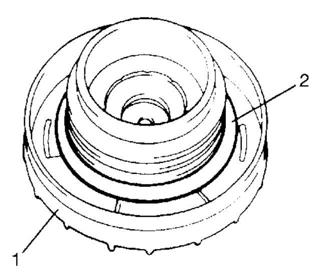
⚠ WARNING

Before starting the following procedure, be sure to observe "Precautions on Fuel System Service" in order to reduce the risk or fire and personal injury.

Remove cap (1), and check gasket for even filler neck imprint, and deterioration or any damage. If gasket (2) is in malcondition, replace cap.

NOTE

If cap requires replacement, only a cap with the same features should be used. Failure to use correct cap can result in fire and personal injury.



I2RH01170008-01

Fuel Tank Inlet Valve Removal and Installation

S7RS0B1706011

⚠ WARNING

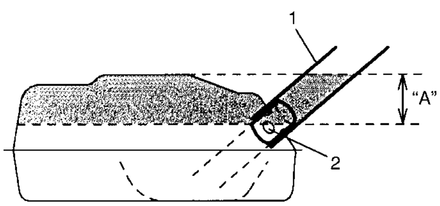
Before starting the following procedure, be sure to observe "Precautions on Fuel System Service" in order to reduce the risk or fire and personal injury.

Removal

1) Remove fuel filler cap.
2) Insert hose of a hand operated pump into fuel filler hose (1) and drain fuel in space "A" as shown in figure.

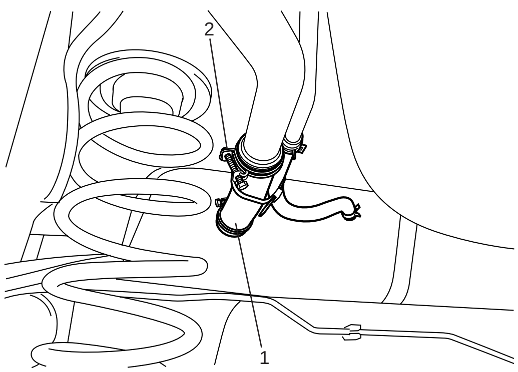
⚠ CAUTION

Do not force pump hose into fuel tank, or pump hose may damage to fuel tank inlet valve (2).



IYSQ01170010-01

3) Hoist vehicle, and remove clamp (2) and fuel filler hose (1) from fuel tank.

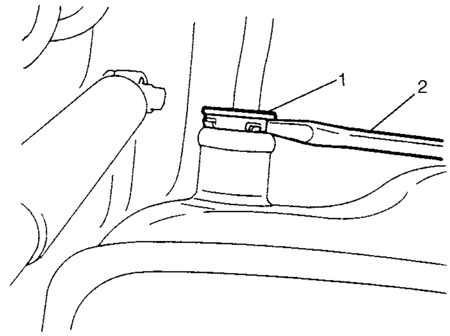


I4RS0A170007-01

4) Remove fuel tank inlet valve (1) using flat head rod (2) or the like.

⚠ CAUTION

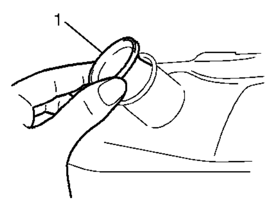
Be careful not to damage fuel tank inlet valve (1) with flat head rod (2) or the like.



I6RS0C170007-01

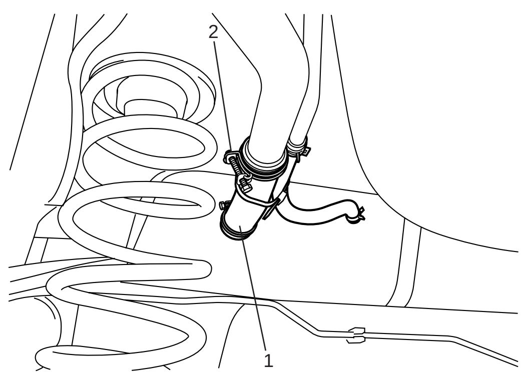
Installation

1) Install fuel tank inlet valve (1) to fuel tank.



I2RH0B170018-01

2) Install fuel filler hose (1) to fuel tank and secure it with clamp (2).
   For proper installation, refer to "Fuel Hose Disconnecting and Reconnecting".



I4RS0A170007-01

3) Lower vehicle and install fuel filler cap.

Fuel Tank Inlet Valve Inspection

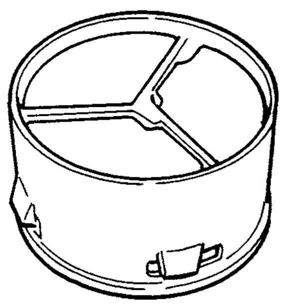
S7RS0B1706012

⚠ WARNING

Before starting the following procedure, be sure to observe "Precautions on Fuel System Service" in order to reduce the risk or fire and personal injury.

Check fuel tank inlet valve for the following.
If any damage or malfunction is found, replace.

- Damage
- Smooth opening and closing



I2RH0B170019-01

Fuel Tank Removal and Installation

S7RS0B1706013

⚠ WARNING

Before starting the following procedure, be sure to observe "Precautions on Fuel System Service" in order to reduce the risk or fire and personal injury.

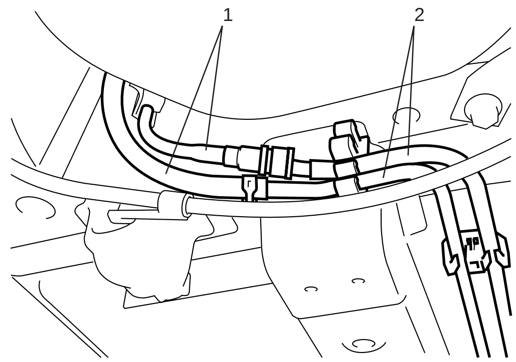
Removal

1) Relieve fuel pressure in fuel feed line according to "Fuel Pressure Relief Procedure".
2) Disconnect negative cable at battery.
3) Hoist vehicle.
4) Remove exhaust center pipe.
5) Disconnect fuel filler hose and breather hose from filler neck referring to "Fuel Tank Inlet Valve Removal and Installation".
6) Due to absence of fuel tank drain plug, drain fuel tank by pumping fuel out through fuel tank filler. Use hand operated pump device to drain fuel tank.

⚠ CAUTION

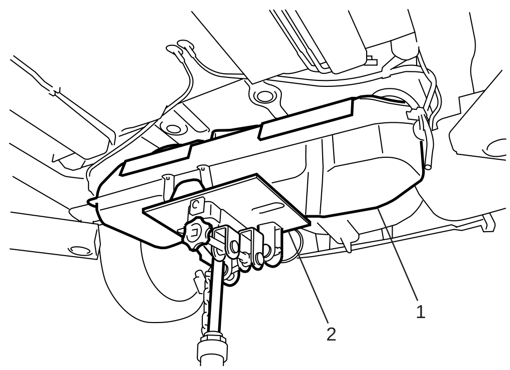
- **Do not force pump hose into fuel tank, or pump hose may damage fuel tank inlet valve.**
- **Never store fuel in an open container due to possibility of fire or explosion.**

7) Disconnect fuel pipe joint and fuel hoses (1) from fuel pipes (2) referring to "Fuel Hose Disconnecting and Reconnecting".



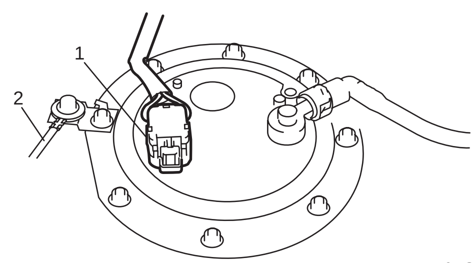
I4RS0A170008-01

8) Support fuel tank (1) with jack (2) and remove its mounting bolts.



I4RS0A170009-01

9) Lower fuel tank a little as to disconnect wire harness at connector (1) and ground wire (2), then remove fuel tank.



I6RS0C170005-02

Installation

⚠ **CAUTION**

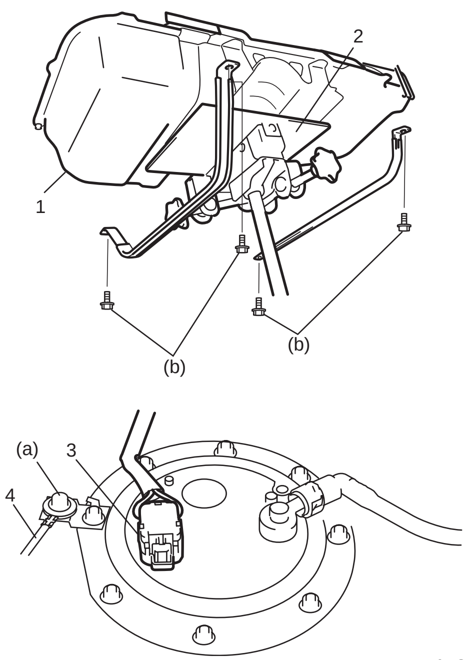
- **When connecting joint, clean outside surfaces of pipe where joint is to be inserted, push joint into pipe till joint lock clicks and check to ensure that pipes are connected securely, or fuel leak may occur.**
- **Never let the fuel hoses touch the ABS sensor harness (if equipped).**

1) If parts have been removed from fuel tank, install them before installing fuel tank to vehicle.
2) Raise fuel tank (1) with jack (2) and connect fuel pump connector (3), ground wire (4) and clamp wire harness.

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

3) Install fuel tank to vehicle.

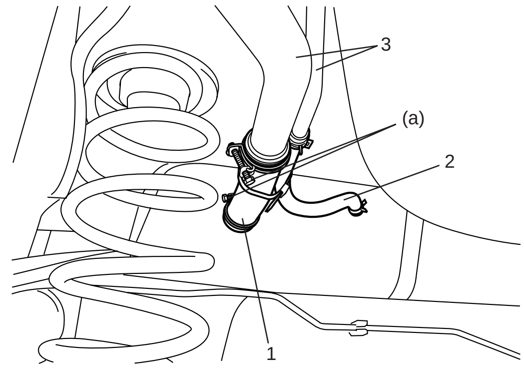
   Tightening torque
   Fuel tank bolt (b): 45 N·m (4.5 kgf-m, 33.0 lb-ft)



I6RS0C170006-02

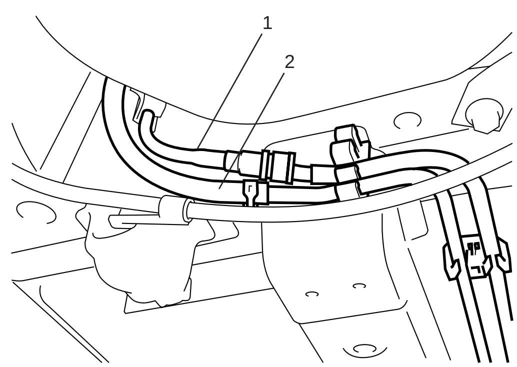
4) Connect fuel filler hose (1) and breather hose (2) to filler neck (3) as shown in figure, and clamp them securely.

   Tightening torque
   Fuel filler hose clamp (a): 2 N·m (0.2 kgf-m, 1.5 lb-ft)



I4RS0A170012-01

5) Connect fuel feed hose (1) and vapor hose (2) to each pipe as shown in figure, and clamp them securely.



I4RS0A170013-01

6) Install exhaust center pipe referring to “Exhaust Pipe and Muffler Removal and Installation in Section 1K”.
7) Connect negative cable at battery.
8) With engine OFF, turn ignition switch to ON position and check for fuel leaks.

Fuel Tank Inspection

S7RS0B1706014

After removing fuel tank, check hoses and pipes connected to fuel tank for leaks, loose connections, deterioration or damage. Also check fuel pump assembly gaskets for leaks, visually inspect fuel tank for leaks and damage.
Replace any damaged or malconditioned parts.

Fuel Tank Purging Procedure

S7RS0B1706015

⚠ WARNING

- **Before starting the following procedure, be sure to observe "Precautions on Fuel System Service" in order to reduce the risk or fire and personal injury.**
- **This purging procedure will not remove all fuel vapor.**
  Do not attempt any repair on tank using heat of flame as an explosion resulting in personal injury could occur.

⚠ CAUTION

Never remain water in fuel tank after washing, or fuel tank inside will get corrosion.

The following procedure are used for purging fuel tank.

1) After removing fuel tank, remove all hoses, pipes and fuel pump assembly from fuel tank.
2) Drain all remaining fuel from tank.
3) Place fuel tank to flushing area.
4) Fill tank with warm water or tap water, and agitate vigorously and drain. Repeat this washing until inside of tank is clean. Replace tank if its inside is rusty.
5) Completely flush out remaining water after washing.

Fuel Pump On-Vehicle Inspection

S7RS0B1706016

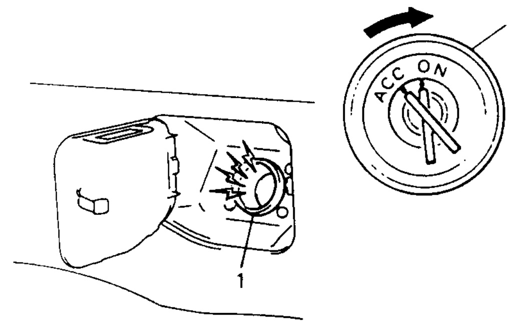
⚠ WARNING

Before starting the following procedure, be sure to observe "Precautions on Fuel System Service" in order to reduce the risk or fire and personal injury.

NOTE

The fuel pressure regulator is incorporated with the fuel pump assembly so individual inspection of it is impossible.

1) Remove filler cap and turn ON ignition switch (2). Then fuel pump operating sound should be heard from fuel filler (1) for about 2 seconds and stop. Be sure to reinstall fuel filler cap after checking.
   If the check result is not satisfactory, go to "Fuel Pump and Its Circuit Check in Section 1A".



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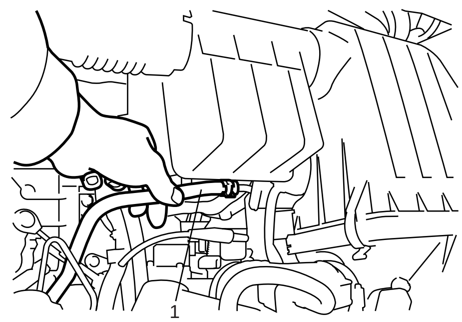
2) Turn OFF ignition switch and leave over 10 minutes as it is.
3) Fuel pressure should be felt at fuel feed hose (1) for about 2 seconds after ignition switch ON.
   If fuel pressure is not felt, go to "Fuel Pressure Check in Section 1A".



I3RM0A170019-01

Fuel Pump Assembly Removal and Installation

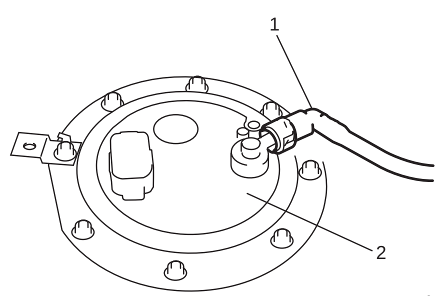
S7RS0B1706017

⚠ WARNING

Before starting the following procedure, be sure to observe "Precautions on Fuel System Service" in order to reduce the risk or fire and personal injury.

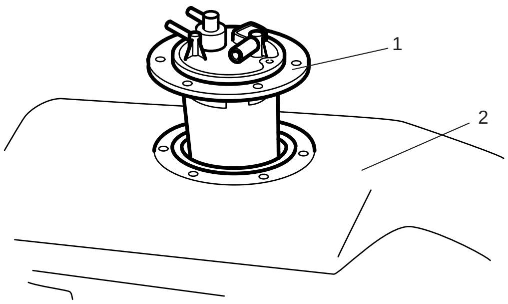
Removal

1) Remove fuel tank from vehicle. Refer to "Fuel Tank Removal and Installation".
2) Disconnect fuel feed pipe (1) from fuel pump assembly (2) referring to "Fuel Hose Disconnecting and Reconnecting".



I6RS0C170008-02

3) Remove fuel pump assembly (1) from fuel tank (2).



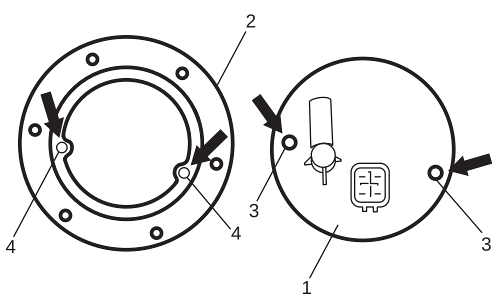
I3RM0A170021-01

Installation

⚠ **CAUTION**

When connecting joint, clean outside surface of pipe where joint is to be inserted, push joint into pipe till joint lock clicks and check to ensure that pipes are connected securely, or fuel leak may occur.

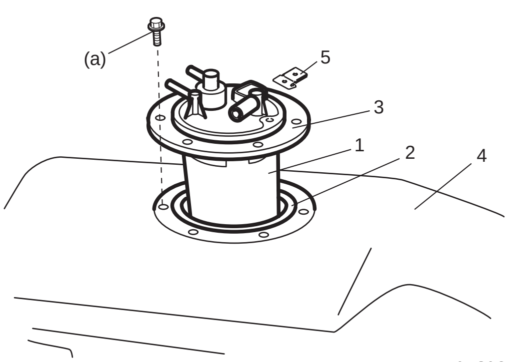
1) Clean mating surfaces of fuel pump assembly (1) and fuel tank.
2) Put plate (2) on fuel pump assembly (1) by matching the protrusion of fuel pump assembly (3) to plate hole (4) as shown.



I4RS0A170015-01

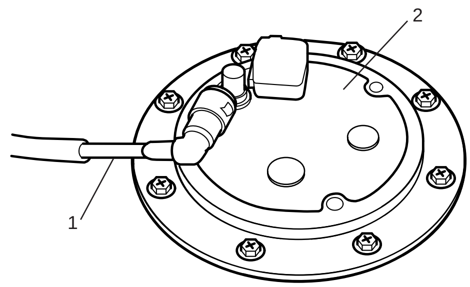
3) Install new gasket (2) and fuel pump assembly (1) earth bracket (5) with plate (3) to fuel tank (4).

Tightening torque
Fuel pump assembly bolt (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)



I6RS0C170009-01

4) Connect fuel feed line (1) (pipe joint) to fuel pump assembly (2).



I4RS0A170014-01

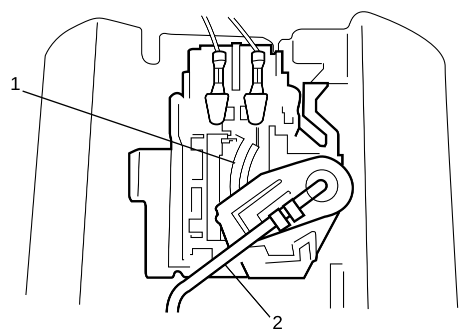
5) Install fuel tank to vehicle. Refer to “Fuel Tank Removal and Installation”.

Main Fuel Level Sensor Removal and Installation

S7RS0B1706018

⚠ **CAUTION**

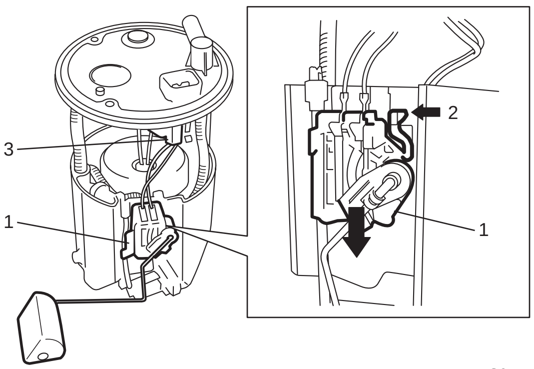
- **Do not touch resister plate (1) and deform arm (2). It may cause main fuel level sensor to fail.**
- **Be very careful not to cause damage to fuel tube installed section (sealed section in bore). If it be damaged, replace it with new one, or fuel will leak from the part.**



I4RS0A170016-01

Removal

1) Remove fuel pump assembly from fuel tank referring to “Fuel Pump Assembly Removal and Installation”.
2) Disconnect main fuel level sensor connector (3).
3) With pressing snap-fit part (2), remove main fuel level sensor (1) by sliding it in the arrow direction as shown in figure.



I5RS0D170006-03

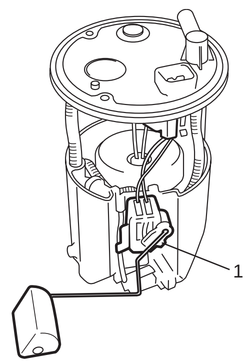
Installation

Reverse removal procedure for installation.

Fuel Pump Inspection

S7RS0B1706019

- Check fuel pump assembly for damage.
- Check fuel suction filter for evidence of dirt and contamination. If present, replace or clean and check for presence of dirt in fuel tank.
- For electrical circuit, refer to “Fuel Pressure Check in Section 1A”.
- For inspection of main fuel level sensor (1), refer to “Fuel Level Sensor Inspection in Section 9C”.



I5RS0D170008-01

Specifications

Tightening Torque Specifications

S7RS0B1707001

Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
Fuel delivery pipe bolt	25	2.5	18.0	☞
Ground wire bolt	11	1.1	8.0	☞
Fuel tank bolt	45	4.5	33.0	☞
Fuel filler hose clamp	2	0.2	1.5	☞
Fuel pump assembly bolt	11	1.1	8.0	☞

NOTE

The specified tightening torque is also described in the following.
“Fuel System Components”
“Fuel Hose Disconnecting and Reconnecting”

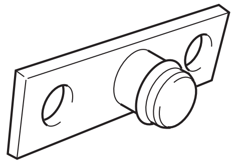
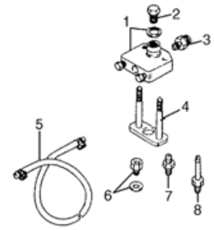
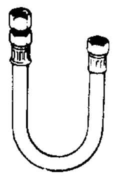
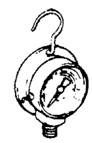
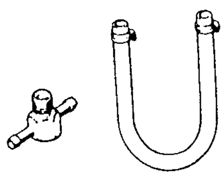
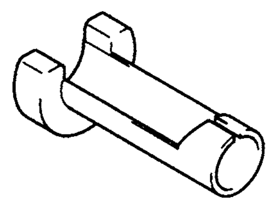
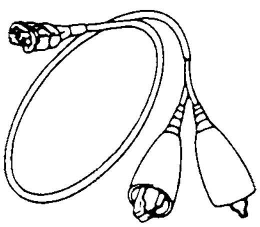
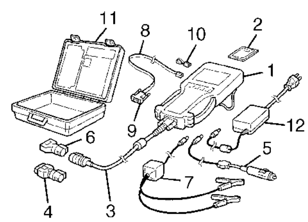
Reference:

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

Special Tools and Equipment

Special Tool

S7RS0B1708001

09912–57610 Injector checking tool plate ☞ 	09912–58421 Checking tool set This kit includes the following items. 1. Tool body and washer, 2. Body plug, 3. Body attachment-1, 4. Holder, 5. Return hose and clamp, 6. Body attachment-2 and washer, 7. Hose attachment-1, 8. Hose attachment-2☞ 
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 ☞ 	09919–47020 Quick joint remover ☞ 
09930–88530 Injector test lead ☞ 	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 loop back adapter, 7. Battery power cable, 8. RS232 cable, 9. RS232 adapter, 10. RS232 loop back connector, 11. Storage case, 12.☞ 

Ignition System

General Description

Ignition System Construction

S7RS0B1801001

The ignition system is an electronic (distributorless) ignition system. It consists of the parts as described below.

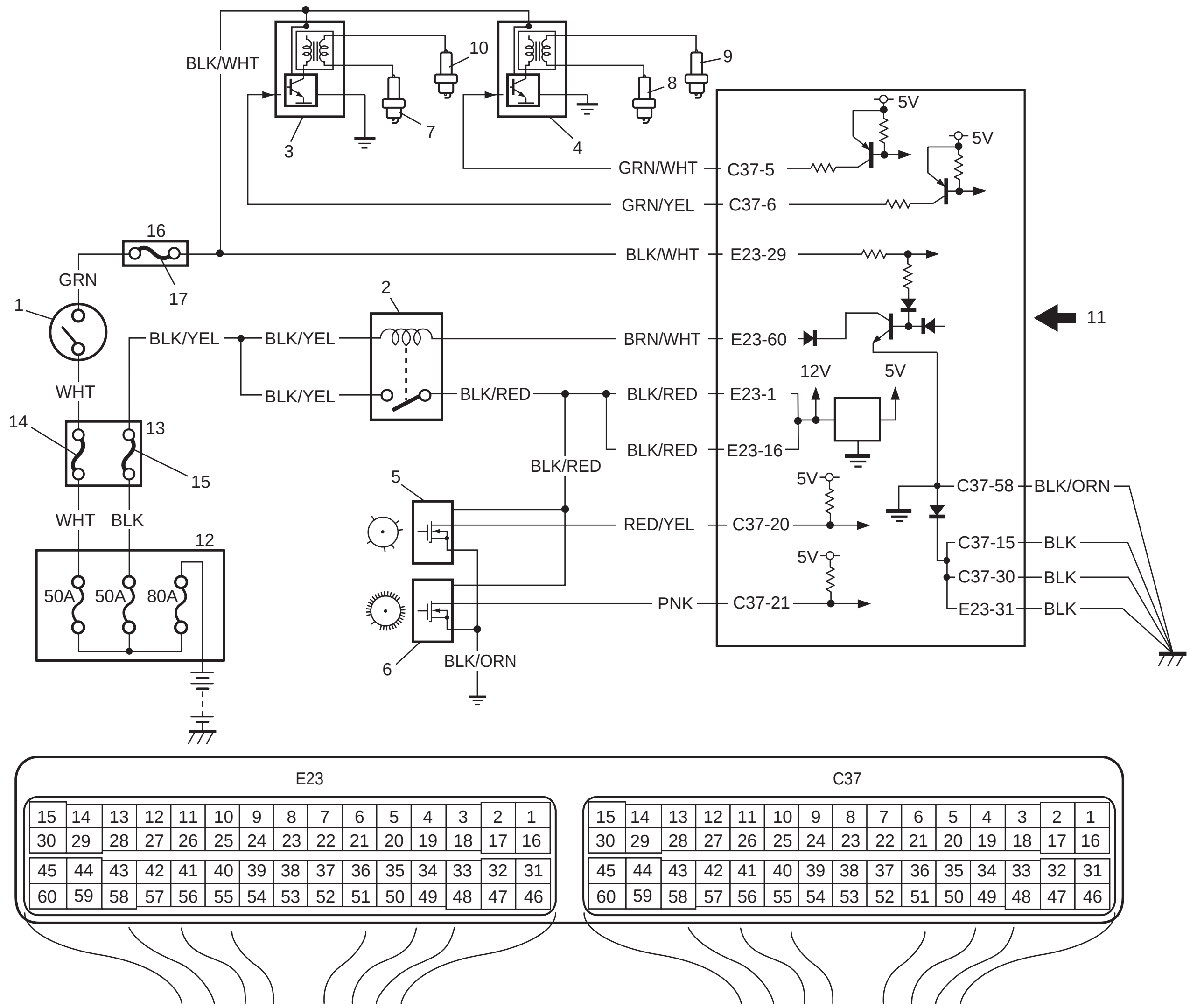
- **ECM**
  It detects the engine and vehicle conditions through the signals from the sensors, determines the most suitable ignition timing and time for electricity to flow to the primary coil and sends a signal to the ignitor (power unit) in the ignition coil assembly.
- **Ignition coil assembly (including an ignitor)**
  The ignition coil assembly has a built-in ignitor which turns ON and OFF the current flow to the primary coil according to the signal from ECM. When the current flow to the primary coil is turned OFF, a high voltage is induced in the secondary coil.
- **High-tension cords and spark plugs**
- **CMP sensor (Camshaft position sensor) and CKP sensor (Crankshaft position sensor)**
  Using signals from these sensors, ECM identifies the specific cylinder whose piston is in the compression stroke, detects the crank angle and adjusts initial ignition timing automatically.
- **TP sensor, ECT sensor, MAP sensor, MAF sensor, IAT sensor, knock sensor and other sensors / switches**

Although this ignition system does not have a distributor, it has two ignition coil assemblies (one is for No.1 and No.4 spark plugs and the other is for No.2 and No.3 spark plugs). When an ignition signal is sent from ECM to the ignitor in the ignition coil assembly for No.1 and No.4 spark plugs, a high voltage is induced in the secondary coil and that passes through the high-tension cords and causes No.1 and No.4 spark plugs to spark simultaneously. Likewise, when an ignition signal is sent to the ignitor in the other ignition coil assembly, No.2 and No.3 spark plugs spark simultaneously.

Schematic and Routing Diagram

Ignition System Wiring Circuit Diagram

S7RS0B1802001



I4RS0B180001-01

1.	Ignition switch	7.	No.1 spark plug	13.	Individual circuit fuse box No.1
2.	Main relay	8.	No.2 spark plug	14.	"IG ACC" fuse
3.	Ignition coil assembly for No.1 and No.4 spark plugs	9.	No.3 spark plug	15.	"FI" fuse
4.	Ignition coil assembly for No.2 and No.3 spark plugs	10.	No.4 spark plug	16.	Junction block assembly
5.	CMP sensor	11.	Sensed information (MAP sensor, ECT sensor, MAF and IAT sensor, TP sensor, Knock sensor, VSS, Electric load signal, Engine start signal)	17.	"IG COIL" fuse
6.	CKP sensor	12.	Battery fuse box		

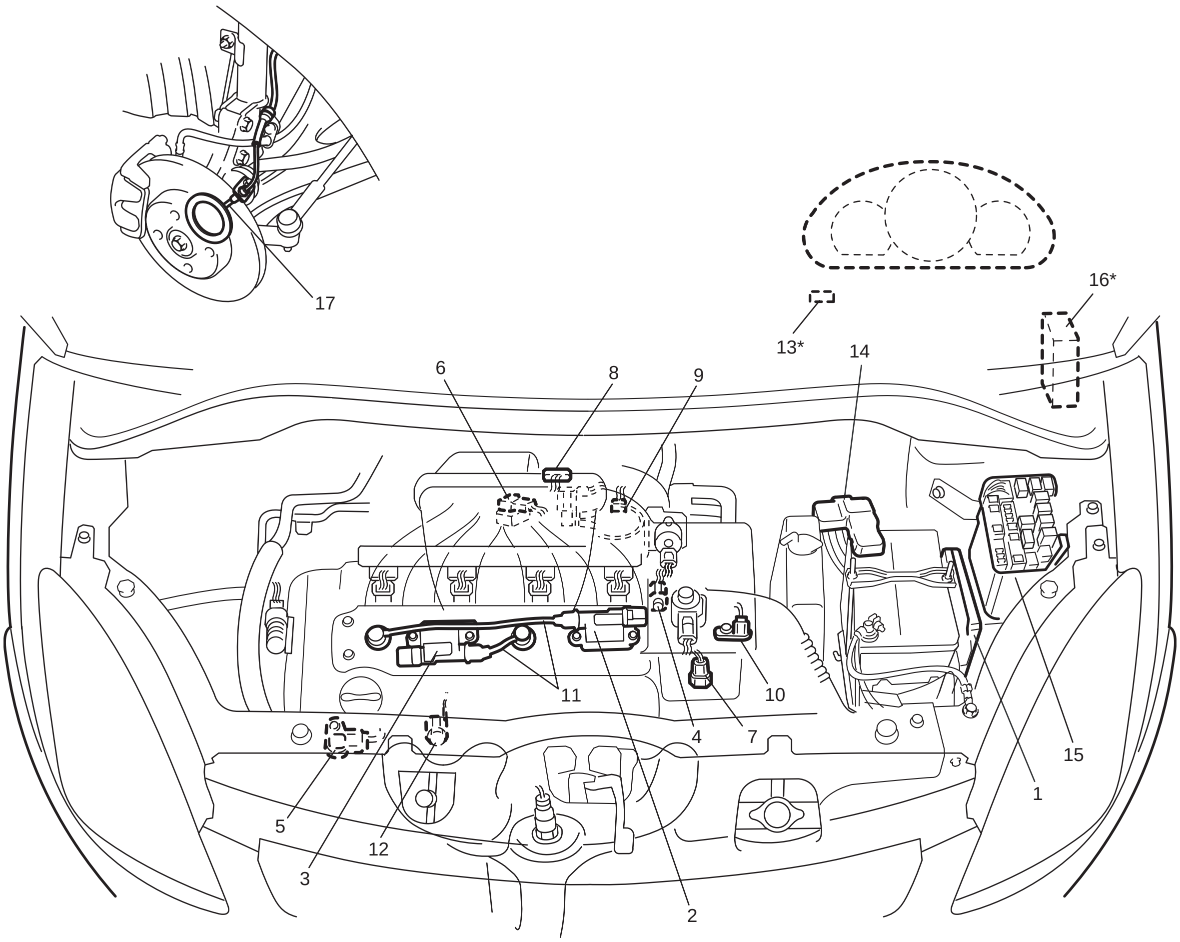
Component Location

Ignition System Components Location

S7RS0B1803001

NOTE

The figure shows left-hand steering vehicle. For right-hand steering vehicle, parts with (*) are installed at the opposite side.



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1. ECM	7. ECT sensor	13. Data link connector
2. Ignition coil assembly for No.1 and No.4 spark plugs	8. MAF and IAT sensor	14. Battery fuse box
3. Ignition coil assembly for No.2 and No.3 spark plugs	9. Electric throttle body	15. Relay box
4. CMP sensor	10. Wheel speed sensor (VSS)	16. Junction block assembly
5. CKP sensor	11. High-tension cords	
6. MAP sensor	12. Knock sensor	

Diagnostic Information and Procedures

Ignition System Symptom Diagnosis

S7RS0B1804001

Condition	Possible cause	Correction / Reference Item
Engine cranks, but will not start or hard to start (No spark)	Blown fuse for ignition coil	*Replace.*
	Loose connection or disconnection of lead wire or high-tension cord(s)	*Connect securely.*
	Faulty high-tension cord(s)	*Replace.*
	Faulty spark plug(s)	*Replace.*
	Faulty ignition coil	*Replace ignition coil assembly.*
	Faulty CKP sensor or CKP sensor plate	*Clean, tighten or replace.*
	Faulty CMP sensor or sensor rotor tooth of camshaft	*Clean, tighten or replace.*
	Faulty ECM	*Replace.*
Poor fuel economy or engine performance	Incorrect ignition timing	*Check related sensors and CKP sensor plate.*
	Faulty spark plug(s) or high-tension cord(s)	*Adjust, clean or replace.*
	Faulty ignition coil assembly	*Replace.*
	Faulty CKP sensor or CKP sensor plate	*Clean, tighten or replace.*
	Faulty CMP sensor or sensor rotor tooth of camshaft	*Clean, tighten or replace.*
	Faulty knock sensor	*Replace.*
	Faulty ECM	*Replace.*

Reference Waveform of Ignition System

S7RS0B1804002

Refer to “Reference waveform No.5”, “Reference waveform No.6” and “Reference waveform No.7” under “Inspection of ECM and Its Circuits in Section 1A” for waveform of Ignition trigger signal.

Ignition System Check

S7RS0B1804003

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 in Section 1A”.
2	**Ignition spark test** 1) Check all spark plugs for condition and type referring to “Spark Plug Inspection”. 2) If OK, perform ignition spark test referring to “Ignition Spark Test”. *Is spark emitted from all spark plugs?*	Go to Step 13.	Go to Step 3.
3	**DTC check** 1) Perform DTC check referring to “DTC Check in Section 1A”. *Is DTC stored in ECM?*	Go to applicable DTC diag. flow.	Go to Step 4.
4	**Electrical connection check** 1) Check ignition coil assemblies and high-tension cords for electrical connection. *Are they connected securely?*	Go to Step 5.	Connect securely.
5	**High-tension cords check** 1) Check high-tension cord for resistance referring to “High-Tension Cord Inspection”. *Is check result satisfactory?*	Go to Step 6.	Replace high-tension cord(s).

Step	Action	Yes	No
6	**Ignition coil assembly power supply and ground circuit check** 1) Check ignition coil assembly power supply and ground circuits for open and short. *Are circuits in good condition?*	Go to Step 7.	Repair or replace.
7	**Ignition coil assembly check** 1) Check ignition coil for resistance referring to “Ignition Coil Assembly (Including ignitor) Inspection”. *Is check result satisfactory?*	Go to Step 8.	Replace ignition coil assembly.
8	**CKP sensor check** 1) Check CKP sensor referring to “CKP Sensor Inspection in Section 1C”. *Is check result satisfactory?*	Go to Step 9.	Tighten CKP sensor bolt, replace CKP sensor or CKP sensor plate.
9	**CMP sensor check** 1) Check CMP sensor referring to “Camshaft Position (CMP) Sensor Inspection in Section 1C”. *Is check result satisfactory?*	Go to Step 10.	Tighten CMP sensor bolt, replace CMP sensor or intake camshaft.
10	**Ignition trigger signal circuit check** 1) Check ignition trigger signal wire for open, short and poor connection. *Is circuit in good condition?*	Go to Step 11.	Repair or replace.
11	**A known-good ignition coil assembly substitution** 1) Substitute a known-good ignition coil assembly and then repeat Step 2. *Is check result of Step 2 satisfactory?*	Go to Step 12.	Substitute a known-good ECM and then repeat Step 2.
12	**Knock sensor check** 1) Confirm that knock sensor circuit is in good condition referring to “DTC P0327 / P0328: Knock Sensor 1 Circuit Low / High in Section 1A”. 2) Check oscilloscope waveform of knock sensor signal referring to “Reference waveform No.25” and “Reference waveform No.26” under “Inspection of ECM and Its Circuits in Section 1A”. *Is check result satisfactory?*	Go to Step 13.	Substitute a known-good knock sensor and recheck.
13	**Ignition timing check** 1) Check initial ignition timing and ignition timing advance referring to “Ignition Timing Inspection”. *Is check result satisfactory?*	System is in good condition.	Check CMP sensor, CMP sensor rotor tooth of camshaft, CKP sensor, CKP sensor plate and/or input signals related to this system.

Ignition Spark Test

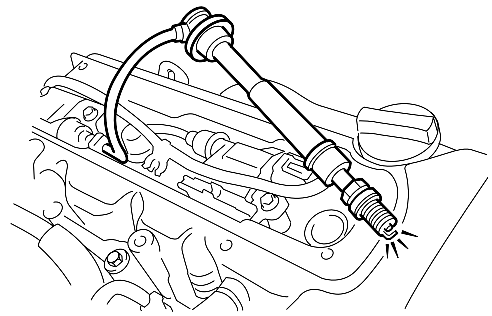
S7RS0B1804004

1) Remove air cleaner assembly with air intake pipe.
2) Disconnect all injector couplers from injectors.

WARNING

Without disconnection of injector couplers, combustible gas may come out from spark plug holes during this test and may get ignited in engine room.

3) Remove spark plug and check it for condition and type referring to "Spark Plug Inspection".
4) If OK, connect ignition coil coupler to ignition coil assembly and connect spark plug to ignition coil assembly or high-tension cord. Ground spark plug.
5) Crank engine and check if each spark plug sparks.



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6) If no spark is emitted, inspect the related parts as described in "Ignition System Symptom Diagnosis".

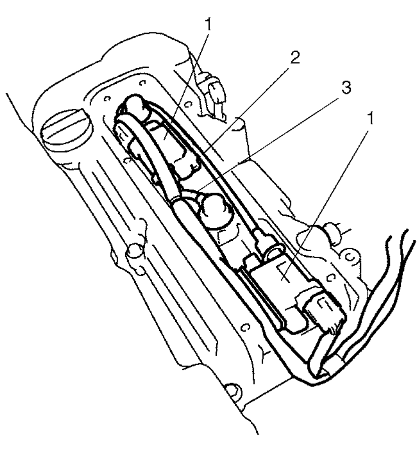
Repair Instructions

High-Tension Cord Removal and Installation

S7RS0B1806001

Removal

1) Remove air cleaner assembly with air intake pipe and cylinder head upper cover.
2) Disconnect No.1 cylinder (2) and No.3 cylinder (3) high-tension cords from ignition coil assemblies (1) while gripping each cap.



I4RS0A180003-01

3) Pull out high-tension cords from spark plugs while gripping each cap.

CAUTION

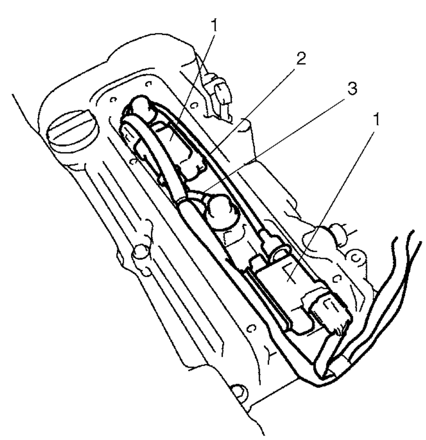
- **Removal of high-tension cords together with clamps will be recommended so as not to damage their inside wire (resistive conductor).**
- **For the same reason, pull out each connection by gripping cap portion.**

Installation

1) Install No.1 cylinder (2) and No.3 cylinder (3) high-tension cords to spark plugs and ignition coil assemblies (1) while gripping each cap.

CAUTION

- **Never attempt to use metal conductor high-tension cords as replacing parts.**
- **Insert each cap portion fully when installing high-tension cords.**



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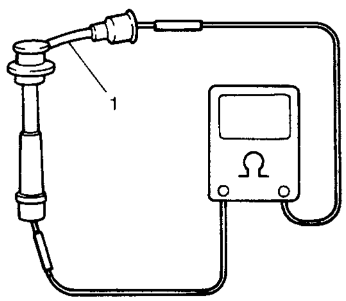
High-Tension Cord Inspection

S7RS0B1806002

Measure resistance of high-tension cord (1) by using ohmmeter.
If resistance exceeds specification, replace high-tension cord(s).

High-tension cord resistance
No.1 cylinder high-tension cord resistance: 1.4 – 4.0 kΩ
No.3 cylinder high-tension cord resistance: 0.6 – 2.0 kΩ



I2RH0B180005-01

Spark Plug Removal and Installation

S7RS0B1806003

Removal

1) Remove air cleaner assembly with air intake pipe and cylinder head upper cover.
2) Pull out high-tension cords by gripping their caps and then remove ignition coil assemblies referring to "Ignition Coil Assembly (Including ignitor) Removal and Installation".
3) Remove spark plugs.

Installation

1) Install spark plugs and tighten them to specified torque.

   Tightening torque
   Spark plug: 25 N·m (2.5 kgf-m, 18.0 lb-ft)

2) Install ignition coil assemblies referring to "Ignition Coil Assembly (Including ignitor) Removal and Installation".
3) Install high-tension cords securely by gripping their caps.
4) Install cylinder head upper cover and air cleaner assembly with air intake pipe.

Spark Plug Inspection

S7RS0B1806004

⚠ CAUTION

- **When servicing the iridium / platinum spark plugs (slender center electrode type plugs), do not touch the center electrode to avoid damage to it. The electrode is not strong enough against mechanical force as it is slender and its material is not mechanically tough.**
- **Do not clean or adjust gap for the iridium / platinum spark plugs.**

Inspect spark plug for:

- Electrode wear
- Carbon deposits
- Insulator damage

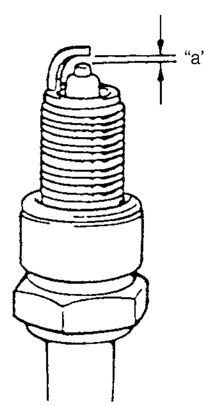
If any abnormality is found for nickel spark plugs, adjust air gap, clean with spark plug cleaner or replace them with specified new plugs.
For iridium / platinum spark plugs, replace them with new plugs.

Spark plug air gap "a"
: 1.0 – 1.1 mm (0.040 – 0.043 in.)

Spark plug type
NGK: IFR6J11 (Iridium)

NOTE

NGK IFR6J11 is highly recommended for better engine starting performance under –25 °C (–13 °F).



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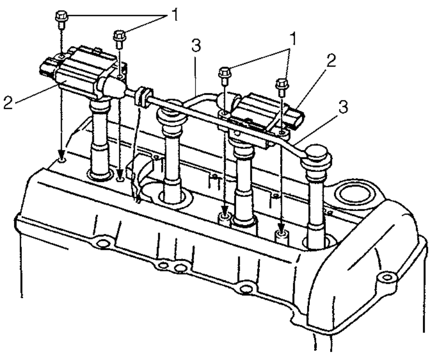
Ignition Coil Assembly (Including ignitor) Removal and Installation

S7RS0B1806005

Removal

1) Disconnect negative (–) cable at battery.
2) Remove air cleaner assembly with air intake pipe and cylinder head upper cover.
3) Disconnect ignition coil coupler.
4) Disconnect high-tension cord (3) from ignition coil assembly (2).
5) Remove ignition coil bolts (1) and then pull out ignition coil assembly.



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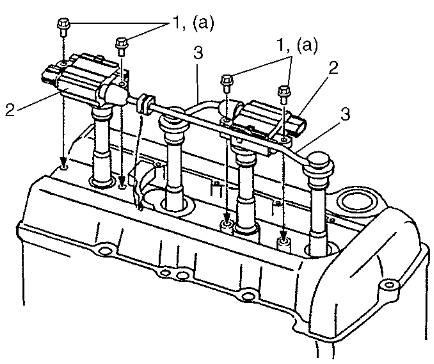
Installation

1) Install ignition coil assembly (2).
2) Tighten ignition coil bolts (1) to specified torque, and then connect ignition coil coupler.

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

3) Install high-tension cord (3) to ignition coil assembly while gripping its cap.



I3RM0A180004-01

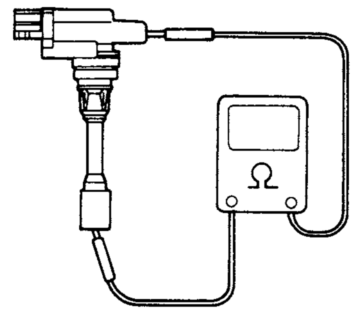
4) Install cylinder head upper cover and air cleaner assembly with air intake pipe.
5) Connect negative (–) cable to battery.

Ignition Coil Assembly (Including ignitor) Inspection

S7RS0B1806006

Measure secondary coil for resistance.
If resistance is out of specification, replace ignition coil assembly.

<u>Secondary coil resistance</u>
7.5 – 10.3 kΩ at 20 °C, 68 °F



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Ignition Timing Inspection

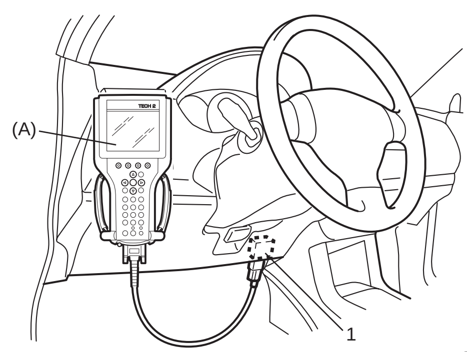
S7RS0B1806007

NOTE

- **Ignition timing is not adjustable. If ignition timing is out of specification, check system related parts.**
- **Before starting engine, place transmission gear shift lever in “Neutral” (shift selector lever to “P” range for A/T model), and set parking brake.**

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

   Special tool
   (A): SUZUKI scan tool



I4RS0B180003-01

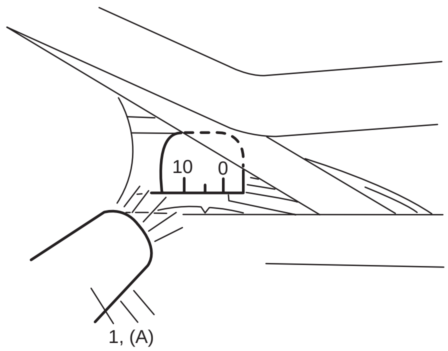
2) Start engine and warm it up to normal operating temperature.
3) Make sure that all of electrical loads except ignition are switched off.
4) Check to be sure that idle speed is within specification referring to “Idle Speed and IAC Throttle Valve Opening Inspection in Section 1A”
5) Fix ignition timing by using “Fixed Spark” of “Misc Test” mode on scan tool.

6) Set timing light (1) to high-tension cord for No.1 cylinder and check that ignition timing is within specification.

<u>Initial ignition timing</u>
Fixed with SUZUKI scan tool: 5 ± 3° BTDC (at specified idle speed)

<u>Ignition order</u>
1 – 3 – 4 – 2

Special tool
(A): 09930–76420



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7) If ignition timing is out of specification, check the followings.
   - CKP sensor
   - CKP sensor plate
   - CMP sensor
   - CMP sensor rotor tooth of camshaft
   - VSS
   - Timing chain cover installation
8) After checking initial ignition timing, release ignition timing fixation by using scan tool.
9) With engine idling (throttle opening at closed position and vehicle stopped), check that ignition timing is about 3° – 13° BTDC. (Constant variation within a few degrees from 3° – 13° BTDC indicates no abnormality but proves operation of electronic timing control system.) Also, check that increasing engine speed advances ignition timing.
   If the check results are not satisfactory, check CKP sensor and ECM.

Specifications

Tightening Torque Specifications

S7RS0B1807001

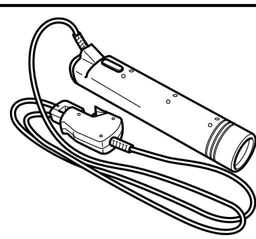
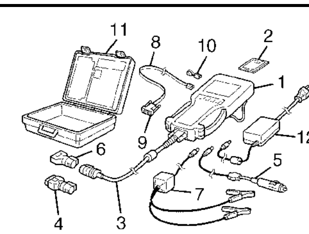
Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
Spark plug	25	2.5	18.0	☞
Ignition coil bolt	10	1.0	7.5	☞

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

S7RS0B1808001

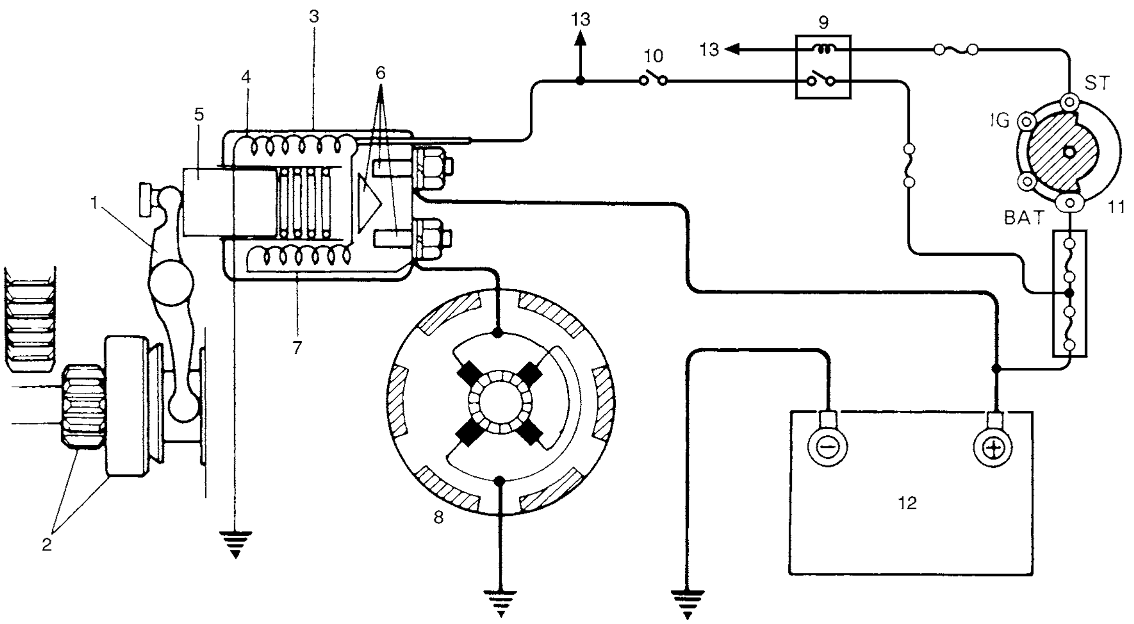
09930–76420 Timing-light (dry cell type) ☞ 	SUZUKI scan tool — This kit includes following items. 1. Tech 2, 2. PCMCIA card, 3. DLC cable, 4. SAE 16/19 adapter, 5. Cigarette cable, 6. DLC loop back adapter, 7. Battery power cable, 8. RS232 cable, 9. RS232 adapter, 10. RS232 loop back connector, 11. Storage case, 12. ☞ 

Starting System

Schematic and Routing Diagram

Cranking System Circuit Diagram

S7RS0B1902001



I4RS0A190001-01

1. Pinion drive lever	6. Magnetic switch contacts	11. Ignition & Starter switch
2. Pinion & Over-running clutch	7. Pull-in coil	12. Battery
3. Magnetic switch	8. Starting motor	13. To ECM
4. Hold-in coil	9. Starting motor control relay	
5. Plunger	10. A/T: Transmission range switch (shift lever switch)	

Diagnostic Information and Procedures

Cranking System Symptom Diagnosis

S7RS0B1904001

Possible symptoms due to starting system trouble would be as follows:

- Starting motor does not run (or runs slowly)
- Starting motor runs but fails to crank engine
- Abnormal noise is heard

Proper diagnosis must be made to determine exactly where the cause of each trouble lies in battery, wiring harness, (including starting motor switch), starting motor or engine.

Do not remove motor just because starting motor does not run. Check the following items and narrow down scope of possible causes.

1) Condition of trouble
2) Tightness of battery terminals (including ground cable connection on engine side) and starting motor terminals
3) Discharge of battery
4) Mounting of starting motor

Condition	Possible cause	Correction / Reference Item
Motor not running (No operating sound of magnetic switch)	Shift lever switch is not in P or N, or not adjusted (A/T)	*Shift in P or N, or adjust switch. (A/T)*
	Battery run down	*Recharge battery.*
	Battery voltage too low due to battery deterioration	*Replace battery.*
	Poor contact in battery terminal connection	*Retighten or replace.*
	Loose grounding cable connection	*Retighten.*
	Fuse set loose or blown off	*Tighten or replace.*
	Poor contacting action of ignition switch and magnetic switch	*Replace.*
	Lead wire coupler loose in place	*Retighten.*
	Open-circuit between ignition switch and magnetic switch	*Repair.*
	Open-circuit in pull-in coil	*Replace magnetic switch.*
	Brushes are seating poorly or worn down	*Repair or replace.*
	Poor sliding of plunger and/or pinion	*Repair.*
	Faulty starting motor control relay	*"Main Relay, Fuel Pump Relay and Starting Motor Control Relay Inspection in Section 1C".*
	Faulty ECM and its circuit	*"Inspection of ECM and Its Circuits in Section 1A".*
Motor not running (Operating sound of magnetic switch heard)	Battery run down	*Recharge battery.*
	Battery voltage too low due to battery deterioration	*Replace battery.*
	Loose battery cable connections	*Retighten.*
	Burnt main contact point, or poor contacting action of magnetic switch	*Replace magnetic switch.*
	Brushes are seating poorly or worn down	*Repair or replace.*
	Weakened brush spring	*Replace.*
	Burnt commutator	*Replace armature.*
	Layer short-circuit of armature	*Replace.*
	Crankshaft rotation obstructed	*Repair.*
Starting motor running but too slow (small torque) (If battery and wiring are satisfactory, inspect starting motor)	Insufficient contact of magnetic switch main contacts	*Replace magnetic switch.*
	Layer short-circuit of armature	*Replace.*
	Disconnected, burnt or worn commutator	*Repair commutator or replace armature.*
	Worn brushes	*Replace brush.*
	Weakened brush springs	*Replace spring.*
	Burnt or abnormally worn end bush	*Replace bush.*
Starting motor running, but not cranking engine	Worn pinion tip	*Replace over-running clutch.*
	Poor sliding of over-running clutch	*Repair.*
	Over-running clutch slipping	*Replace over-running clutch.*
	Worn teeth of ring gear	*Replace flywheel (M/T) or drive plate (A/T).*
Noise	Abnormally worn bush	*Replace bush.*
	Worn pinion or worn teeth of ring gear	*Replace over-running clutch, flywheel (M/T) or drive plate (A/T).*
	Poor sliding of pinion (failure in return movement)	*Repair or replace.*
	Worn internal or planetary gear teeth	*Replace.*
	Lack of oil in each part	*Lubricate.*
Starting motor does not stop running	Fused contact points of magnetic switch	*Replace magnetic switch.*
	Short-circuit between turns of magnetic switch coil (layer short-circuit)	*Replace magnetic switch.*
	Failure of returning action in ignition switch	*Replace.*

Cranking System Test

S7RS0B1904002

⚠ **CAUTION**

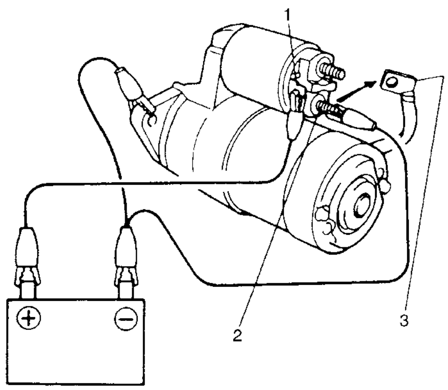
Each test must be performed within 3 – 5 seconds to avoid coil from burning.

Pull-In Test

Connect battery to the magnetic switch as shown.
Check that plunger and pinion move outward.
If plunger and pinion don't move, replace the magnetic switch.

NOTE

Before testing, disconnect lead wire from terminal "M" (2).

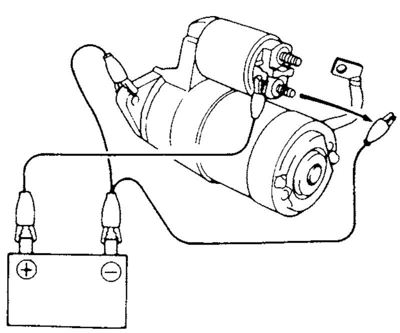


I2RH01190002-01

1.	Terminal "S"
3.	Lead wire (switch to motor)

Hold-In Test

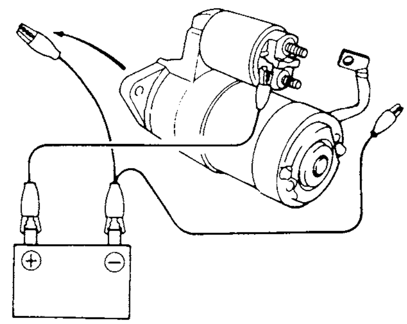
While connected as the figure with plunger out, disconnect negative lead from terminal "M".
Check that plunger and pinion remain out.
If plunger and pinion return inward, replace the magnetic switch.



I2RH01190003-01

Plunger and Pinion Return Test

Disconnect negative lead from starting motor body.
Check that plunger and pinion return inward.
If plunger and pinion don't return, replace the magnetic switch.

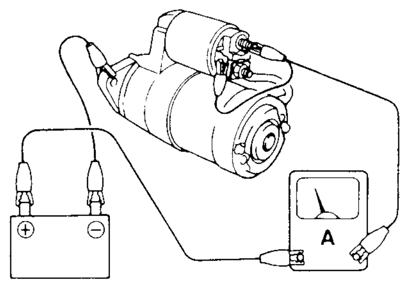


I2RH01190004-01

No-Load Performance Test

Connect battery and ammeter to starter as shown.
Check that starter rotates smoothly and steadily with pinion moving out. Check that ammeter indicates specified current.

<u>**Specified current (No-load performance test)**</u>
90 A MAX. at 11 V

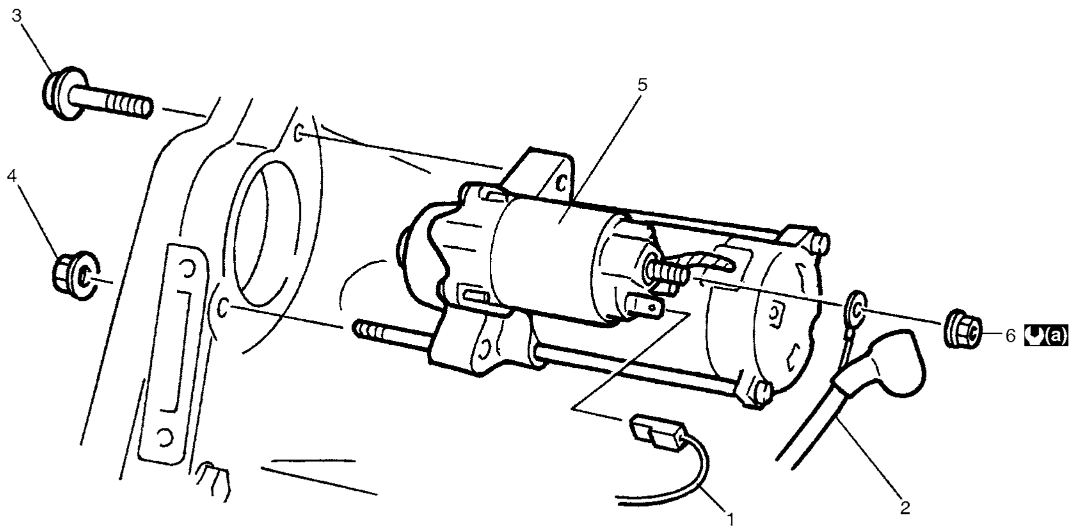


I2RH01190005-01

Repair Instructions

Starting Motor Dismounting and Remounting

S7RS0B1906001



I4RS0A190002-01

(a) :	9.8 N·m (0.98 kgf-m, 7.0 lb-ft)

Dismounting

1) Disconnect negative (–) battery lead at battery.
2) Disconnect magnetic switch lead wire (1) and battery cable (2) from starting motor terminals.
3) Detach shift & select control cable bracket from transaxle. (M/T model only)
4) Remove starting motor mount bolt (3) and nut (4).
5) Remove starting motor (5).

Remounting

Reverse the dismounting procedure noting the following.

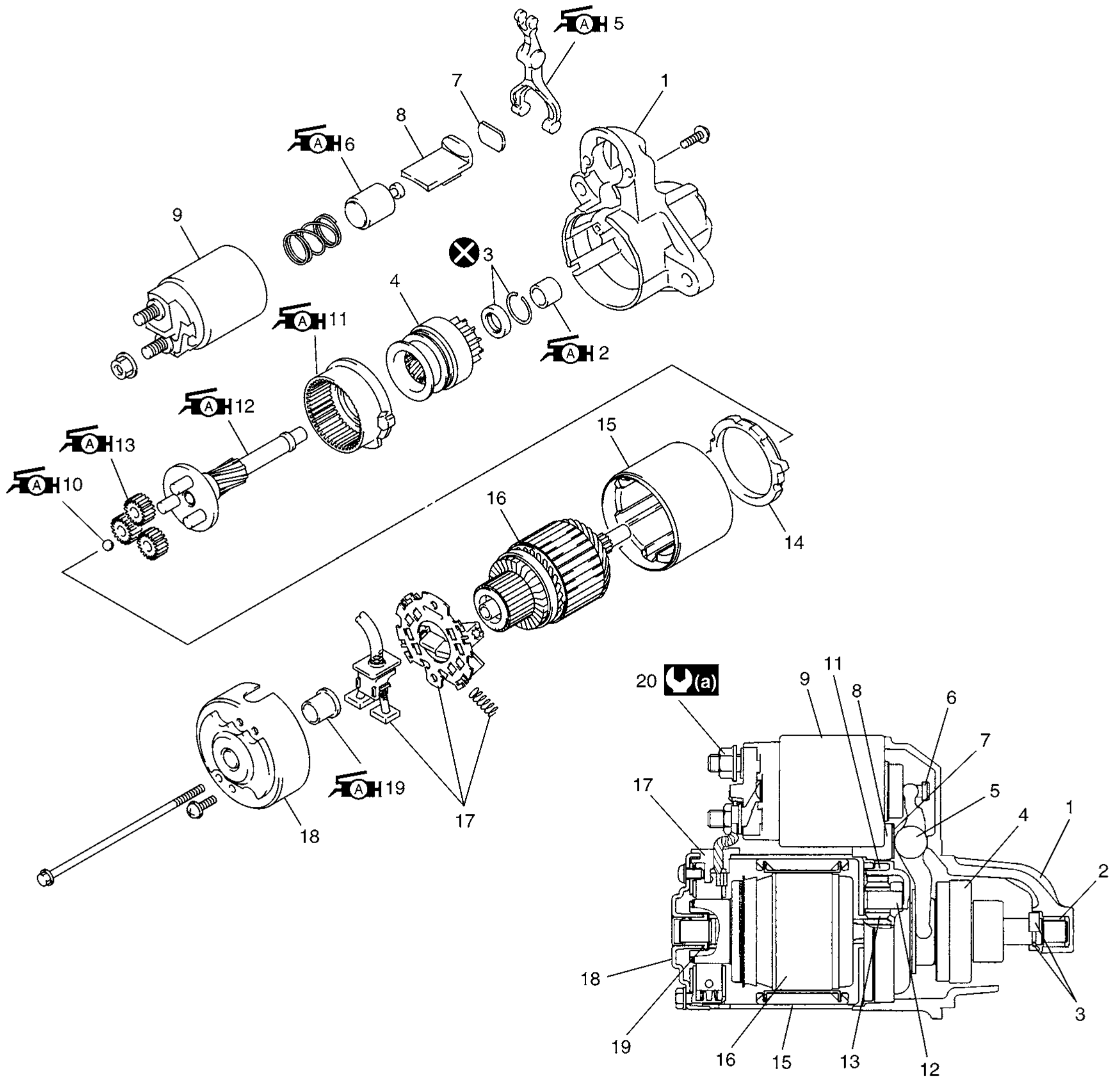
- Tighten battery cable nut (6) to specified torque.

Tightening torque

Starting motor battery cable nut (a): 9.8 N·m (0.98 kgf-m, 7.0 lb-ft)

Starting Motor Components

S7RS0B1906002



I4RS0A190003-01

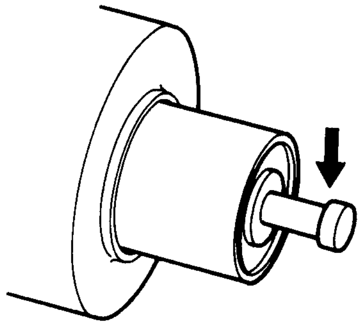
1. Front housing	7. Plate	13. Planetary gear	19. Rear bush
2. Bush	8. Seal rubber	14. Packing	20. Starting motor battery cable nut
3. Pinion stop ring	9. Magnetic switch	15. Yoke	(a): 9.8 N·m (0.98 kgf-m, 7.0 lb-ft)
4. Over-running clutch	10. Ball	16. Armature	: Do not reuse.
5. Lever	11. Internal gear	17. Brush assembly	: Apply grease 99000-25010 to sliding surface of each part.
6. Plunger	12. Planetary carrier shaft	18. Rear bracket	

Starting Motor Inspection

S7RS0B1906003

Plunger

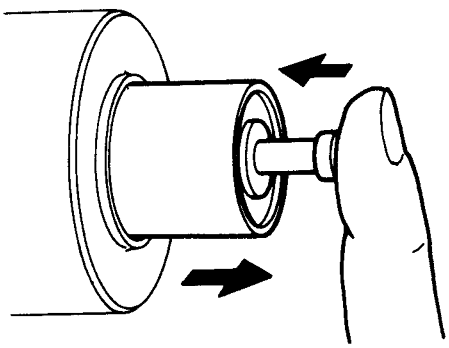
Inspect plunger for wear. Replace if necessary.



I2RH01190008-01

Magnetic Switch

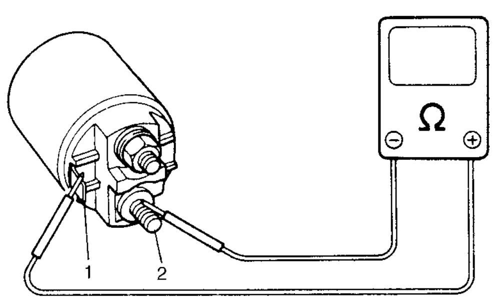
Push in plunger and release it. The plunger should return quickly to its original position. Replace if necessary.



I2RH01190009-01

Pull-in coil open circuit test

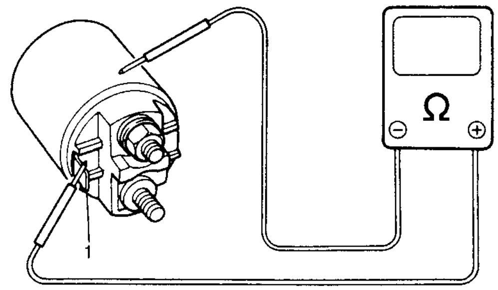
Check for continuity across magnetic switch "S" terminal (1) and "M" terminal (2). If no continuity, coil is open and should be replaced.



I2RH01190010-01

Hold-in coil open circuit test

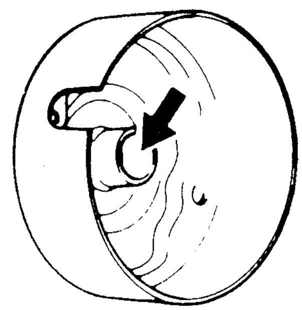
Check for continuity across magnetic switch "S" terminal (1) and coil case. If no continuity, coil is open and should be replaced.



I2RH01190011-01

Rear Bracket Bush

Inspect bush for wear or damage. Replace if necessary.

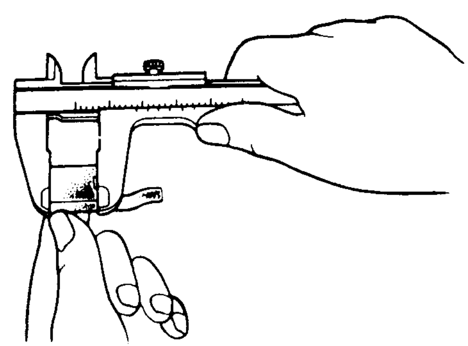


I2RH01190012-01

Brush

- Check brushes for wear.
  Measure length of brushes and if below the limit, replace the brush.

  <u>**Brush length**</u>
  Standard: 12.3 mm (0.48 in.)
  Limit: 7.0 mm (0.28 in.)



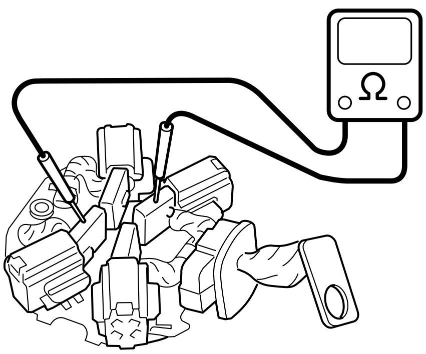
I2RH01190013-01

- Install brushes to each brush holder and check for smooth movement.

Spring
Inspect brush springs for wear, damage or other abnormal conditions. Replace if necessary.

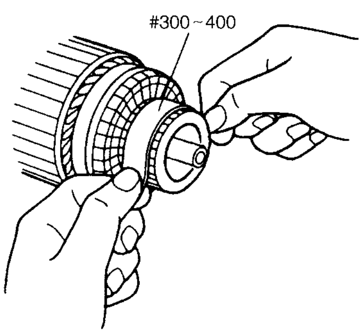
<u>Brush spring tension</u>
Standard: 2.2 kg (4.85 lb)
Limit: 0.6 kg (1.33 lb)

Brush Holder
- Check movement of brush in brush holder. If brush movement within brush holder is sluggish, check brush holder for distortion and sliding faces for contamination.
  Clean or correct as necessary.
- Check for continuity across insulated brush (positive side) and grounded brush (negative side).
  If continuity exists, brush holder is grounded due to defective insulation and should be replaced.



I4RS0A190004-01

Armature
- Inspect commutator for dirt or burn. Correct with sandpaper or lathe, if necessary.



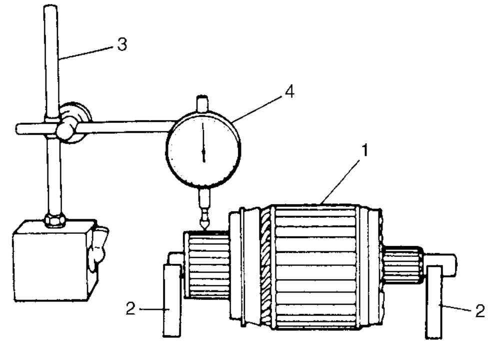
I2RH01190015-01

- Check commutator for uneven wear with armature (1) supported on V-blocks (2). If deflection of dial gauge (4) pointer exceeds limit, repair or replace.

  NOTE

  The following specification presupposes that the armature is free from bend. Bent armature must be replaced.

  <u>Commutator out of round</u>
  Standard: 0.05 mm (0.002 in.) or less
  Limit: 0.4 mm (0.016 in.)

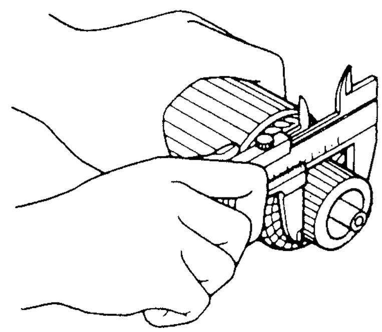


I2RH01190016-01

3.	Magnetic stand

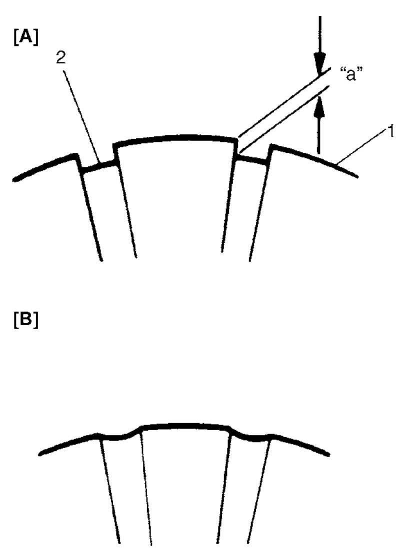
- Inspect the commutator for wear. If diameter is below limit, replace the armature.

  <u>Commutator outside diameter</u>
  Standard: 29.4 mm (1.16 in.)
  Limit: 28.8 mm (1.14 in.)


I2RH01190017-01

- Inspect the commutator (1) for insulator (2) depth. Correct or replace if below limit.

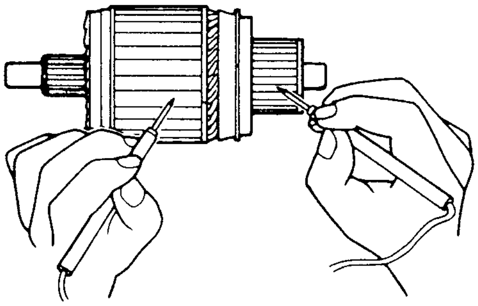
  <u>Commutator insulator depth “a”</u>
  Standard: 0.4 – 0.6 mm (0.016 – 0.023 in.)
  Limit: 0.2 mm (0.008 in.)



I3RH0A190005-01

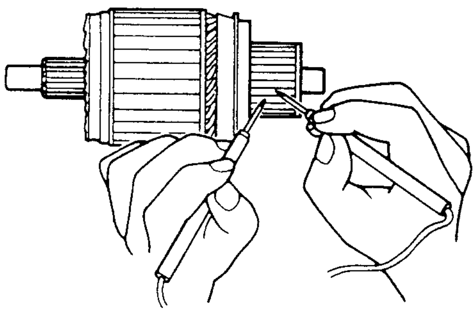
[A]:	Correct
[B]:	Incorrect

- Check the commutator and armature core. If there is continuity, the armature is grounded and must be replaced.



I2RH01190019-01

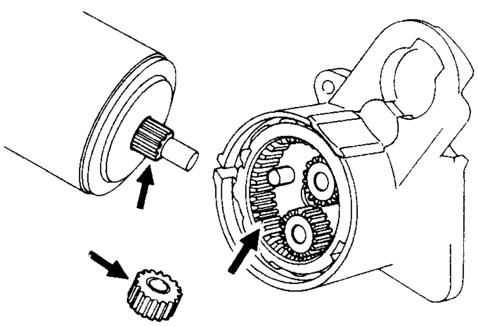
- Check for continuity between segments. If there is no continuity at any test point, there is an open circuit and the armature must be replaced.



I2RH01190020-01

Gears

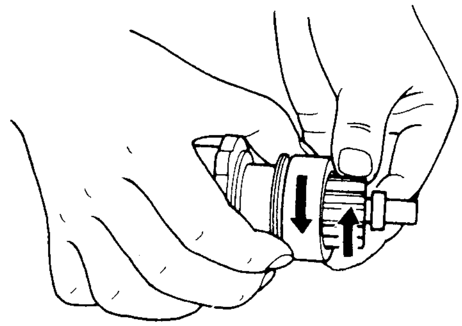
Inspect the internal gear and the planetary gears for wear, damage or other abnormal conditions. Replace if necessary.



I2RH01190021-01

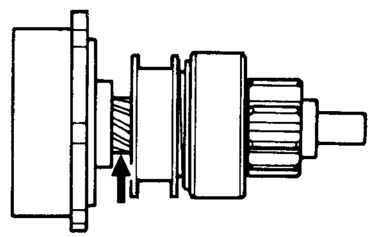
Pinion and Over-Running Clutch

- Inspect the pinion for wear, damage or other abnormal conditions.
  Check that clutch locks up when turned in direction of drive and rotates smoothly in reverse direction.
  Replace if necessary.



I2RH01190022-01

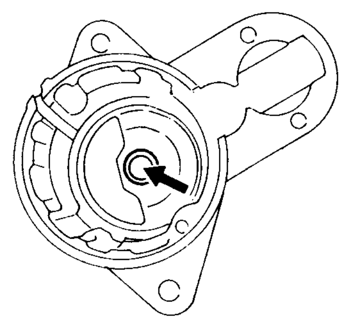
- Inspect the spline teeth for wear or damage. Replace if necessary.
  Inspect the pinion for smooth movement.



I2RH01190023-01

Front Housing Bush

Inspect the bush for wear or damage. Replace if necessary.



I2RH01190024-01

Specifications

Cranking System Specifications

S7RS0B1907001

Voltage			12 volts	
Output			1.2 kW	
Rating			30 seconds	
Direction of rotation			Clockwise as viewed from pinion side	
Brush length			Standard: 12.3 mm (0.48 in.)	Limit: 7.0 mm (0.28 in.)
Number of pinion teeth			8	
Performance		Condition	Guarantee	
Around at 20 °C (68 °F)	No load characteristic	11.0 V	90 A maximum 2370 r/min minimum	
	Load characteristic	7.5 V 300 A	10.65 N·m (1.065 kgf-m, 7.70 lb-ft) minimum 840 r/min minimum	
	Locked characteristic	4.0 V	780 A maximum 20 N·m (2.0 kgf-m, 14.5 lb-ft) minimum	
	Magnetic switch operating voltage		8 volts maximum	

Tightening Torque Specifications

S7RS0B1907002

Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
Starting motor battery cable nut	9.8	0.98	7.0	☞

NOTE

The specified tightening torque is also described in the following.
“Starting Motor Dismounting and Remounting”
“Starting Motor Components”

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

Special Tools and Equipment

Recommended Service Material

S7RS0B1908001

NOTE

Required service material is also described in the following.
“Starting Motor Components”

Charging System

General Description

Battery Description

S7RS0B1A01001

The battery has three major functions in the electrical system.

- It is a source of electrical energy for cranking the engine.
- It acts as a voltage stabilizer for the electrical system.
- It can, for a limited time, provide energy when the electrical load exceeds the output of the generator.

Carrier and Hold-Down

The battery carrier should be in good condition so that it will support the battery securely and keep it level. Before installing the battery, the battery carrier and hold-down clamp should be clean and free from corrosion and make certain there are no parts in carrier.
To prevent the battery from shaking in its carrier, the hold-down bolts should be tight enough but not over-tightened.

Electrolyte Freezing

The freezing point of electrolyte depends on its specific gravity. Since freezing may ruin a battery, it should be protected against freezing by keeping it in a fully charged condition. If a battery is frozen accidentally, it should not be charged until it is warmed.

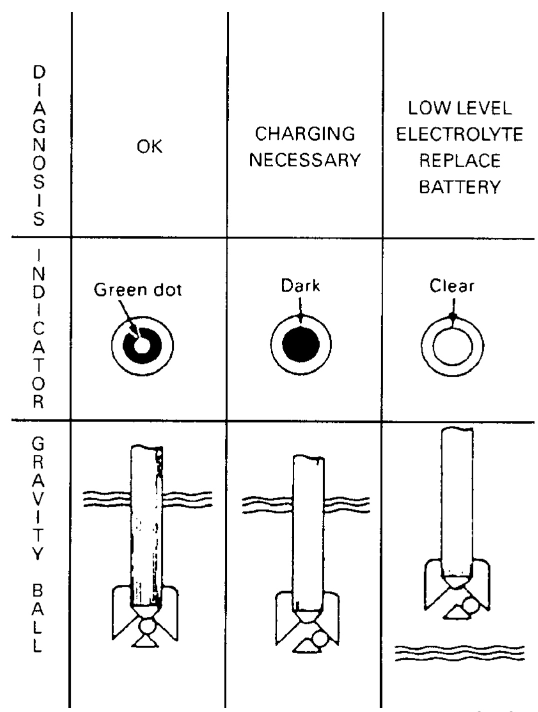
Sulfation

If the battery is allowed to stand for a long period in discharged condition, the lead sulfate becomes converted into a hard, crystalline substance, which will not easily turn back to the active material again during the subsequent recharging. "Sulfation" means the result as well as the process of that reaction. Such a battery can be revived by very slow charging and may be restored to usable condition but its capacity is lower than before.

Built-In Indicator (If Equipped)

The battery has a built-in temperature compensated indicator in the top of the battery. This indicator is to be used with the following diagnostic procedure. When checking the indicator, make sure that the battery has a clean top. A light may be needed in some poorly-lit areas.
Three types of indication available under normal operation are as follows.

- **Green dot**
  Battery is sufficiently charged for testing.
- **Dark**
  Battery must be charged before testing. If there is a cranking complaint, battery should be tested as described in "Battery Inspection". Charging and electrical systems should also be checked at this time.
- **Clear**
  This means that fluid level is below the bottom of hydrometer. Its possible cause is excessive or prolonged charging, a broken case, excessive tipping or normal battery deterioration. When the battery is found in such condition, it is possible that high charging voltage is caused by the faulty charging system and therefore, charging and electrical systems need to be checked. If there is a trouble in cranking and its cause lies in the battery, it should be replaced.

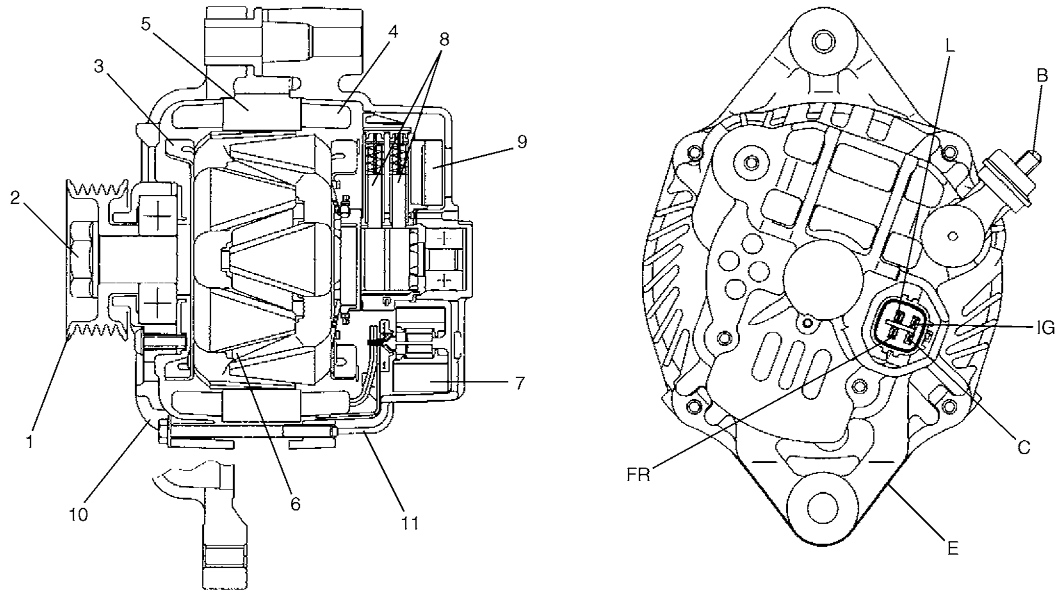


I2RH011A0001-01

Generator Description

S7RS0B1A01002

The basic charging system is the IC integral regulator charging system. The internal components are connected electrically as shown below.



I5JB0A1A0004-01

1. Pulley	6. Field coil	11. Rear housing	IG: Ignition terminal
2. Pulley nut	7. Rectifier	B: Generator output (Battery terminal)	L: Lamp terminal
3. Rotor fan	8. Brush	C: Generator cut terminal	
4. Stator coil	9. Regulator	E: Ground	
5. Stator core	10. Front housing	FR: Field duty monitor terminal	

Charging System Circuit

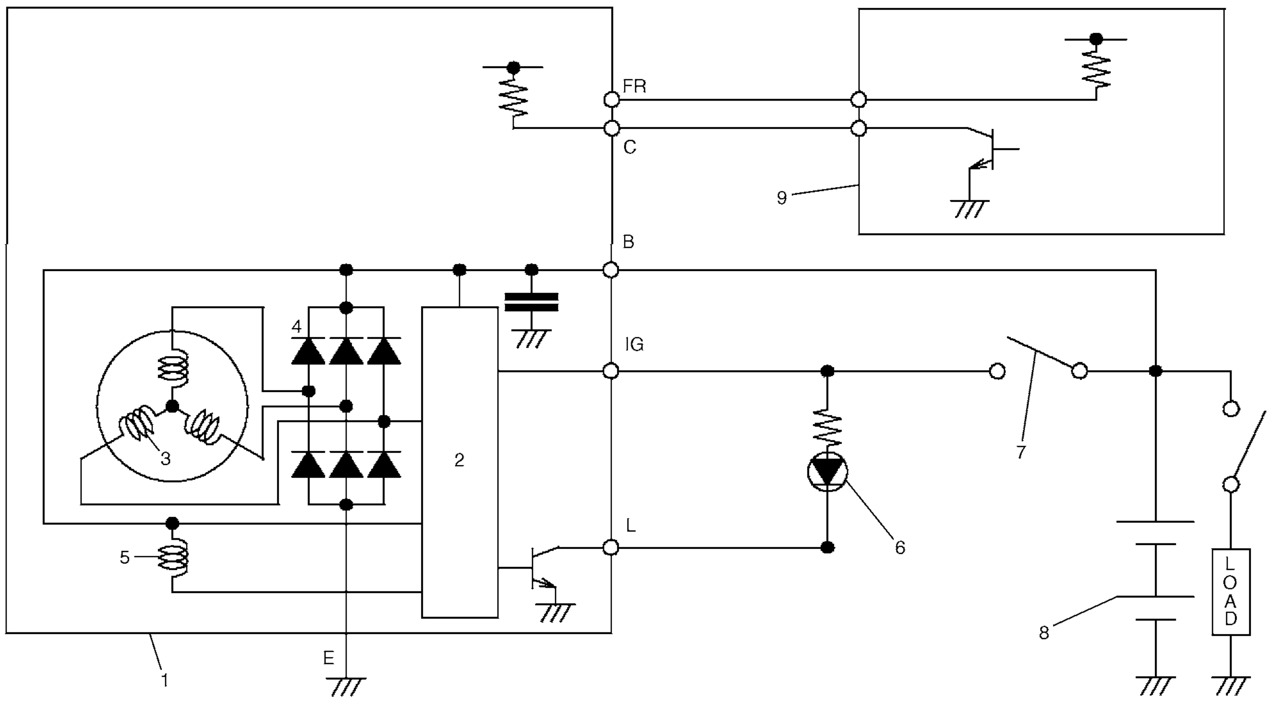
The generator features solid state regulator that it mounted inside the generator. All regulator components are enclosed into a solid mold, and this unit along with the brush holder assembly is attached to the rear housing. The regulator voltage is being controlled by ECM under some conditions while driving. Refer to “Generator Control System Description in Section 1A”.

The generator rotor bearings contain enough grease to eliminate the need for periodic lubrication.

Two brushes carry current through the two slip rings to the field coil mounted on the rotor, and under normal conditions will provide long period of attention-free service.

The stator windings are assembled inside a laminated core that forms part of the generator frame.

A rectifier bridge connected to the stator windings contains diodes, and electrically changes the stator AC. voltages to a D.C. voltage which appears at the generator output terminal.



I5JB0A1A0005-01

1. Generator	4. Diode	7. Main switch
2. I.C. regulator	5. Field coil (rotor coil)	8. Battery
3. Stator coil	6. Charge indicator light	9. ECM

Diagnostic Information and Procedures

Battery Inspection

S7RS0B1A04001

Common Causes of Failure

A battery is not designed to last indefinitely; however, with proper care, it will provide many years of service. If the battery performs satisfactorily during test but fails to operate properly for no apparent reason, the following are some factors that may point to the cause of trouble:

- Accessories left on overnight or for an extended period without the generator operating.
- Slow average driving speeds for short periods.
- Electrical load exceeding generator output particularly with addition of aftermarket equipment.
- Defects in charging system such as high resistance, slipping drive belt, loose generator output terminal, faulty generator or voltage regulator, Refer to “Generator Symptom Diagnosis”.
- Battery abuse, including failure to keep battery cable terminals clean and tight or loose battery hold down.
- Mechanical problems in electrical system such as shorted or pinched wires.

Visual Inspection

Check for obvious damage, such as cracked or broken case or cover, that could permit loss of electrolyte. If obvious damage is noted, replace battery. Determine cause of damage and correct as needed.

Generator Symptom Diagnosis

S7RS0B1A04002

⚠ CAUTION

- **Do not mistake polarities of “IG” terminal and “L” terminal.**
- **Do not create short circuit between “IG” and “L” terminals. Always connect these terminals through a lamp.**
- **Do not connect any load between “L” and “E” terminals.**
- **When connecting charger or booster battery to vehicle battery, refer to “Jump Starting in Case of Emergency”.**

Trouble in charging system will show up as one or more of the following conditions:

1) Faulty indicator lamp operation.
2) An undercharged battery as evidenced by slow cranking or indicator dark.
3) An overcharged battery as evidenced by excessive spewing of electrolyte from vents.

Condition	Possible cause	Correction / Reference Item
Noisy generator	Loose drive belt	*Adjust or replace drive belt.*
	Loose drive belt pulley	*Tighten by specified torque.*
	Loose mounting bolts	*Tighten by specified torque.*
	Worn or dirty bearings	*Replace.*
	Defective diode or stator	*Replace.*
Charge light does not light with ignition ON and engine off	Fuse blown	*Replace fuse and check for shorted circuit.*
	Indicator lamp (LED) faulty	*Replace combination meter.*
	Wiring connection loose	*Tighten loose connection.*
	IC regulator or field coil faulty	*Replace.*
	Poor contact between brush and slip ring	*Repair or replace.*
Charge light does not go out with engine running (battery requires frequent recharging)	Drive belt loose or worn	*Adjust or replace drive belt.*
	IC regulator or generator faulty	*Replace.*
	Wiring faulty	*Repair wiring.*

Generator Test (Undercharged Battery Check)

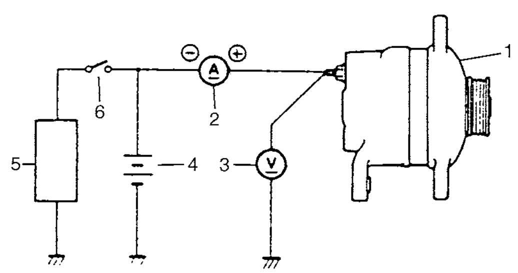
S7RS0B1A04003

This condition, as evidenced by slow cranking or indicator clear with dark or light yellow dot can be caused by one or more of the following conditions even though indicator lamp may be operating normal.
The following procedure also applies to cars with voltmeter and ammeter.

1) Make sure that undercharged condition has not been caused by accessories left on for extended period of time.
2) Check drive belt for proper tension.
3) If battery defect is suspected, refer to "Battery Description".
4) Inspect wiring for defects. Check all connections for tightness and cleanliness, battery cable connections at battery, starting motor, ignition ground cable and no "C" terminal circuit at ground.
5) Connect switch (6), load (5), battery (4), voltmeter (3) and ammeter (2) to generator (1) as shown in figure.
   Voltmeter: Set between generator "B" terminal and ground.
   Ammeter: Set between generator "B" terminal and battery (+) terminal.

   NOTE

   Use fully charged battery.



IYSQ011A0007-01

6) Measure current and voltage.

No-Load Check

1) Run engine from idling up to 2000 rpm and read meters.

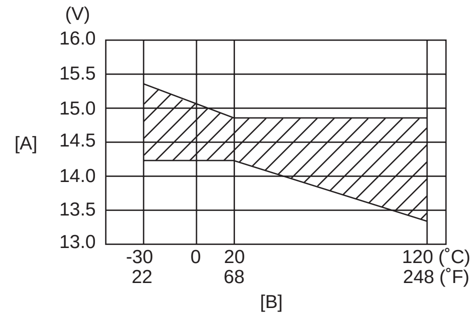
   NOTE

   Turn off switches of all accessories (wiper, heater etc.).

   <u>Specification for undercharged battery (No-load check)</u>
   Current: 10 A
   Voltage: 14.2 – 14.8 V (at 20 °C, 68 °F)

NOTE

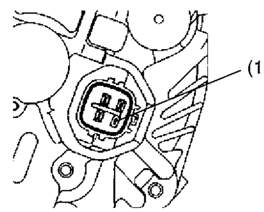
Consideration should be taken that voltage will differ somewhat with regulator case temperature as shown in figure.



I6RS0B1A1002-01

[A]:	Regulated voltage (V)
[B]:	Heat sink temperature (°C)

2) Using service wire, ground "C" terminal (1) of generator.



I5JB0A1A0011-01

3) Measure voltage between "B" terminal of generator and body ground.

   Voltage: 12.5 – 13.1 V (at 20 °C, 68 °F)

- **If voltage is higher than standard value**
  If voltage is higher than standard value, check ground of brushes.
  If brushes are not grounded, replace IC regulator.
  If voltage is lower than standard value, proceed to the following check.

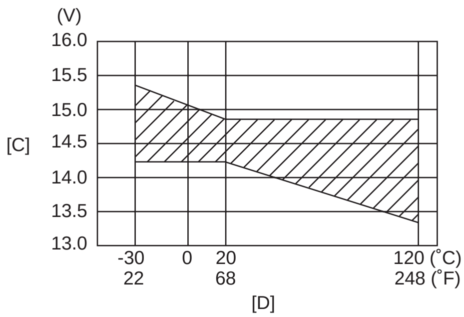
Load Check

1) Run engine at 2000 rpm and turn on head light and blower motor.
2) Measure current.
   If measure current is less than 30 A, repair or replace generator.

Generator Test (Overcharged Battery Check)

S7RS0B1A04004

1) To determine battery condition, refer to "Battery Description".
2) If obvious overcharge condition exists as evidenced by excessive spewing of electrolyte, measure generator "B" terminal voltage at engine 2000 rpm.



I6RS0C1A0001-02

3) If measured voltage is higher than upper limit value, proceed to disassemble generator.
4) Check ground of brushes. If brushes are not grounded, replace IC regulator. Then check field coil for grounds and shorts, referring to "Generator Inspection".

Repair Instructions

Jump Starting in Case of Emergency

S7RS0B1A06001

⚠ CAUTION

If vehicle is manual transaxle model and has a catalytic converter, do not push or tow it to start. Damage to its emission system and/or to other parts may result.

Both booster and discharged battery should be treated carefully when using jumper cables. Follow the procedure outlined as follows, being careful not to cause sparks.

⚠ WARNING

- **Departure from these conditions or procedure described as follows could result in:**
  - **Serious personal injury (particularly to eyes) or property damage from such causes as battery explosion, battery acid, or electrical burns.**
  - **Damage to electronic components of either vehicle.**
- **Remove rings, watches, and other jewelry. Wear approved eye protection.**
- **Be careful so that metal tools or jumper cables do not contact positive battery terminal (or metal in contact with it) and any other metal on vehicle, because a short circuit could occur.**
- **Never expose battery to open flame or electric spark. Batteries generate gas which is flammable and explosive.**
- **Do not allow battery fluid to contact eyes, skin, fabrics, or painted surface as fluid is a corrosive acid. Flush any contacted area with water immediately and thoroughly.**
- **Batteries should always be kept out of reach of children.**
- **Do not connect negative cable directly to negative terminal of dead battery.**

1) Set parking brake and place automatic transaxle in PARK (NEUTRAL on manual transaxle). Turn off ignition, turn off lights and all other electrical loads.
2) Check electrolyte level. If it is below low level line, add distilled water.
3) Attach end of one jumper cable to positive terminal of booster battery and the other end of the same cable to positive terminal of discharged battery. (Use 12-volt battery only to jump start engine).
4) Attach one end of the remaining negative cable to negative terminal of booster battery, and the other end to a solid engine ground (such as exhaust manifold) at least 45 cm (18 in.) away from battery of vehicle being started.
5) Start engine of vehicle with booster battery and turn off electrical accessories. Then start engine of the vehicle with discharged battery.

With Charging Equipment

⚠ CAUTION

When jump starting engine with charging equipment, be sure equipment used is 12-volt and negative ground. Do not use 24-volt charging equipment. Using such equipment can cause serious damage to electrical system or electronic parts.

Battery Dismounting and Remounting

S7RS0B1A06002

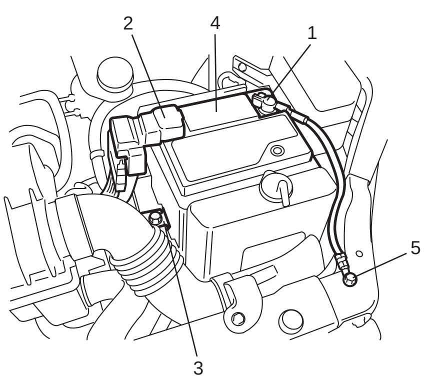
⚠ WARNING

When handling battery, following safety precautions should be followed:

- **Hydrogen gas is produced by battery. A flame or spark near battery may cause the gas to ignite.**
- **Battery fluid is highly acidic. Avoid spilling on clothing or other fabric. Any spilled electrolyte should be flushed with large quantity of water and cleaned immediately.**

Dismounting

1) Disconnect negative cable (1).
2) Disconnect positive cable (2).
3) Remove retainer (3).
4) Remove battery (4).



I4RS0B1A0006-01

5. Body ground bolt

Remounting

1) Reverse removal procedure.
2) Tighten battery cables securely.

Water Pump / Generator Drive Belt Tension Inspection and Adjustment

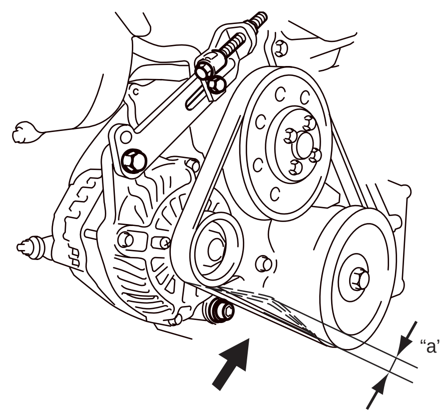
S7RS0B1A06003

⚠ WARNING

Disconnect negative cable at battery before checking and adjusting belt tension.

1) Inspect belt for cranks, cuts, deformation, wear and clealiness. If it is necessary to replace belt, refer to “Water Pump / Generator Drive Belt Removal and Installation”.
2) Check belt for tension. Belt is in proper tension when it deflects the following specification under thumb pressure (about 10 kg or 22 lb.).
   If belt tension is out of specification, go to next steps.

   Water pump / generator drive belt tension “a”
   Existing belt: 4.5 – 5.5 mm (0.18 – 0.22 in.) as deflection / 10 kg (22 lbs)
   New belt: 3.5 – 4 mm (0.14 – 0.16 in.)as deflection / 10 kg (22 lbs)



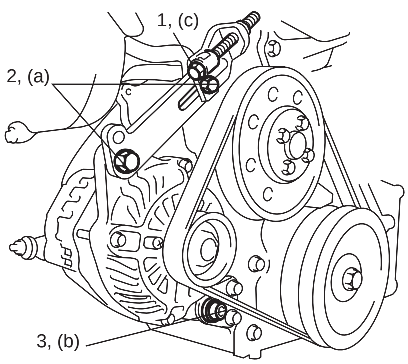
I5JB0A1A0008-01

3) After loosening generator bracket bolts (2) and pivot bolt (3), adjust belt tension to specification described at step 2) by loosening / tightening generator adjust bolt (1).
4) Tighten generator bracket bolts and pivot bolt as specified torque.

Tightening torque
Generator bracket bolt (a): 25 N·m (2.5 kgf-m, 18.0 lb-ft)
Generator pivot bolt (b): 50 N·m (5.0 kgf-m, 36.0 lb-ft)

5) Check belt tension for specification after turning crankshaft two rotations clockwise.
6) Tighten generator adjusting bolt (1) as specified torque.

Tightening torque
Generator adjusting bolt (c): 7 N·m (0.7 kgf-m, 5.0 lb-ft) by the specified procedure.



I5RW0C160007-01

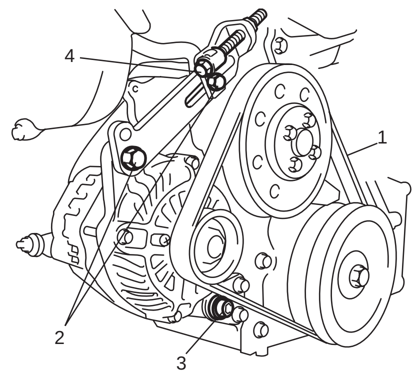
7) Connect negative cable at battery.

Water Pump / Generator Drive Belt Removal and Installation

S7RS0B1A06004

Removal

1) Disconnect negative cable at battery.
2) If vehicle equipped with A/C, remove compressor drive belt before removing water pump belt (1). Refer to “Compressor Drive Belt Removal and Installation in Section 7B” or “Compressor Drive Belt Removal and Installation in Section 7B”.
3) Loosen drive belt adjusting bolt (2) and generator pivot bolt (3).
4) Loosen generator adjusting bolt (4), and then remove water pump belt.



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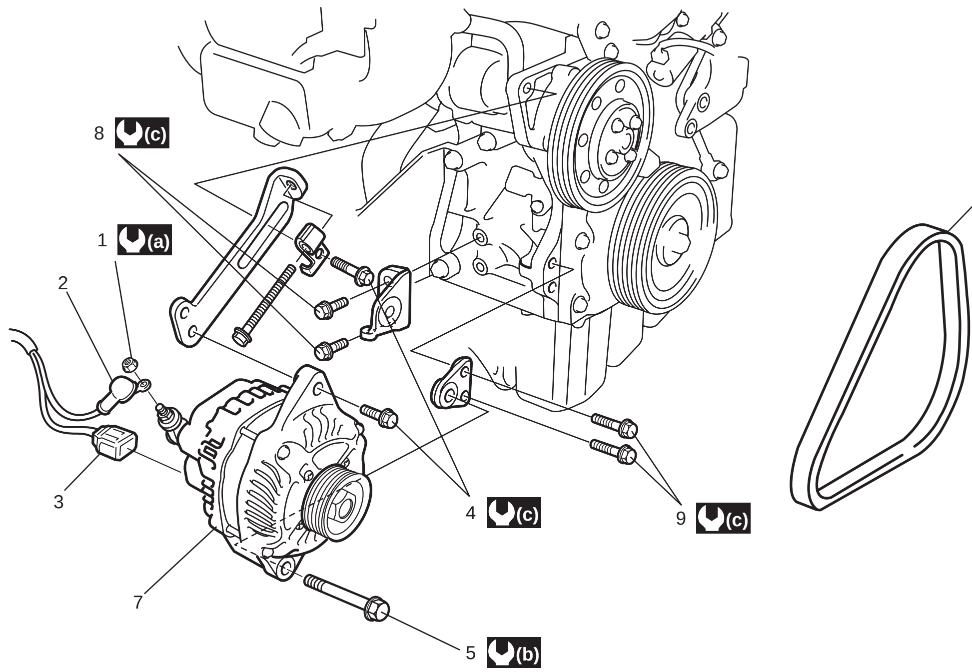
Installation

Reverse removal procedure for installation noting the following.

- Adjust belt tension referring to “Water Pump / Generator Drive Belt Tension Inspection and Adjustment” and “Compressor Drive Belt Inspection and Adjustment in Section 7B” or “Compressor Drive Belt Inspection and Adjustment in Section 7B”.

Generator Unit Components

S7RS0B1A06005



I6RS0C1A0003-02

1. "B" terminal nut	5. Generator pivot bolt	(a) : 5 N·m (0.5 kgf-m, 3.5 lb-ft)
2. "B" terminal wire	6. Generator belt	(b) : 50 N·m (5.0 kgf-m, 36.0 lb-ft)
3. Connector	7. Generator	(c) : 25 N·m (2.5 kgf-m, 18.5 lb-ft)
4. Generator adjusting bolt	8. Generator bracket bolt	

Generator Dismounting and Remounting

S7RS0B1A06006

Dismounting

1) Disconnect negative (–) cable at battery.
2) Remove right side drive shaft referring to "Front Drive Shaft Assembly Removal and Installation in Section 3A".
3) Disconnect generator lead wire ("B" terminal wire) and coupler from generator.
4) Remove generator belt. Refer to "Water Pump / Generator Drive Belt Removal and Installation".
5) Remove generator bracket bolts and generator pivot bolt.
6) Remove generator.

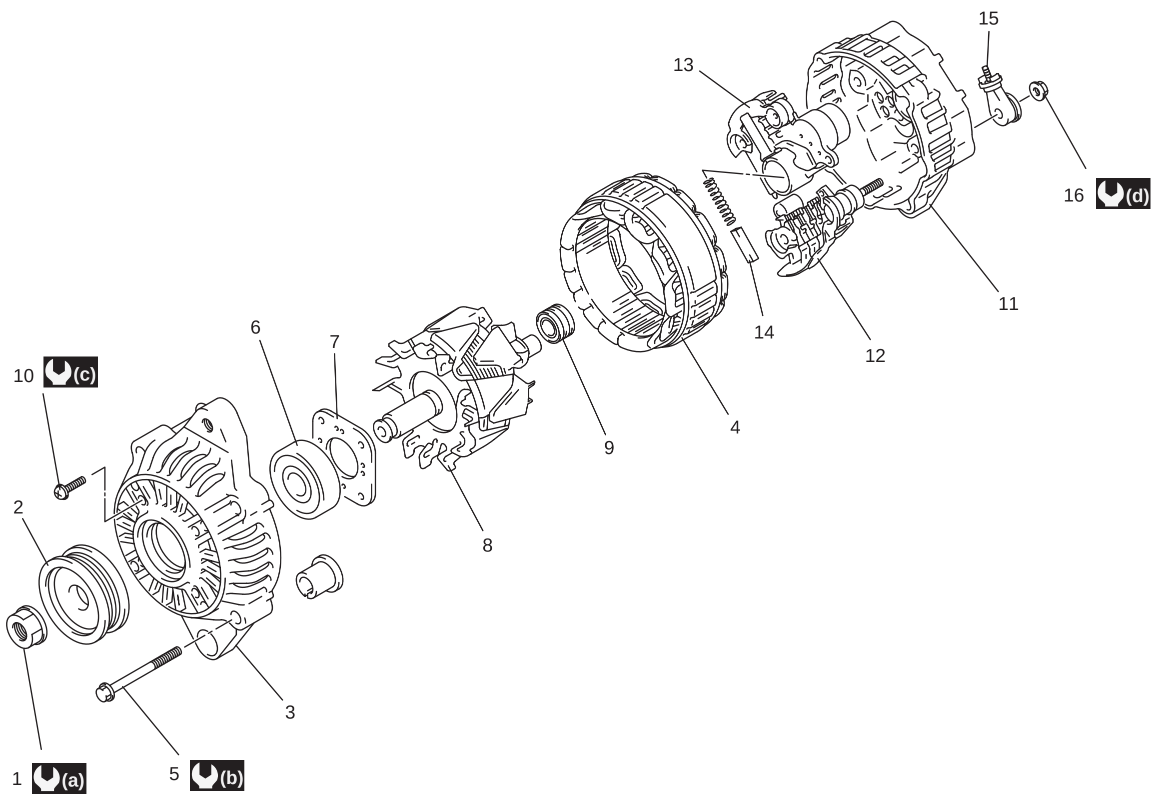
Remounting

Reverse dismounting procedure for remounting noting the followings.

- Tighten each bolt and nut to specified torque referring to "Generator Unit Components".
- Adjust belt tension referring to "Water Pump / Generator Drive Belt Tension Inspection and Adjustment".

Generator Components

S7RS0B1A06007



I4RS0B1A0007-01

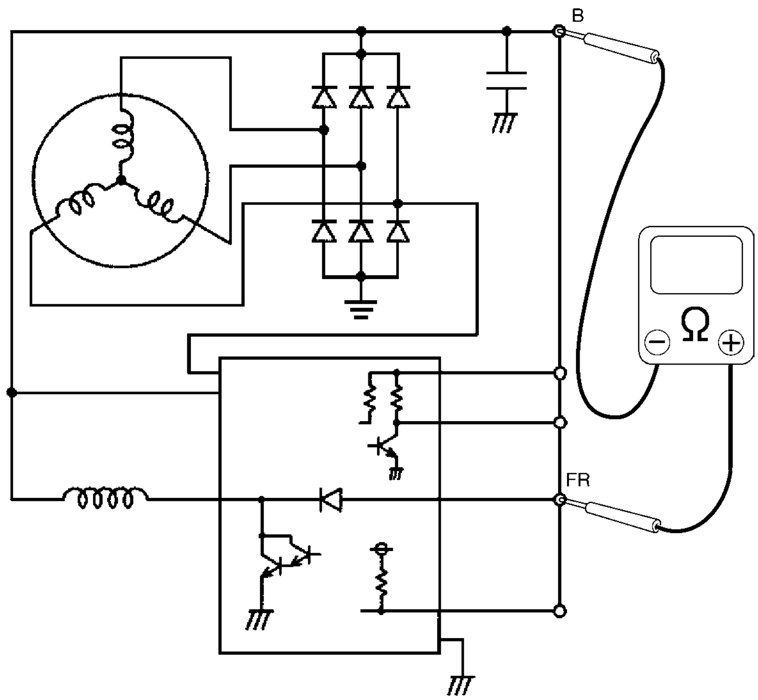
1. Pulley nut	6. Drive end bearing	11. Rear housing	16. “B” terminal nut
2. Pulley	7. Bearing retainer	12. Rectifier	(a) : 118 N·m (11.8 kgf-m, 85.5 lb-ft)
3. Front housing	8. Rotor	13. Regulator	(b) : 4.5 N·m (0.45 kgf-m, 3.5 lb-ft)
4. Stator	9. Rear end bearing	14. Brush	(c) : 3.5 N·m (0.35 kgf-m, 2.5 lb-ft)
5. Frame bolt	10. Retainer screw	15. “B” terminal	(d) : 8.0 N·m (0.8 kgf-m, 6.0 lb-ft)

Generator Inspection

S7RS0B1A06008

Rotor

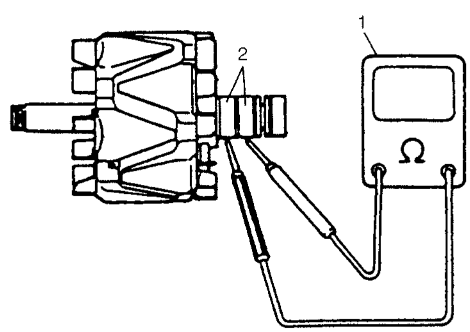
- Using ohmmeter, connect positive terminal to “FR” terminal and connect negative terminal to “B” terminal of generator, check that continuity between “B” terminal and “FR” terminal. If there is no continuity, replace rotor or regulator.



I5JB0A1A0012-01

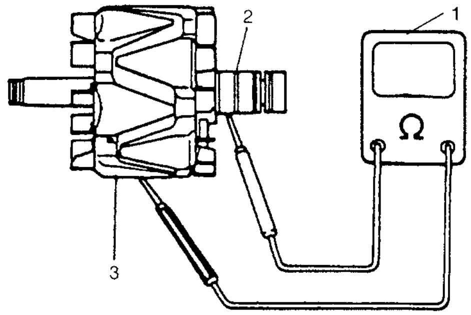
- Using an ohmmeter (1), check for continuity between slip rings (2) of rotor. If there is no continuity, replace the rotor.

Standard resistance between slip rings of rotor
: 1.7 – 2.0 Ω



I4RS0B1A0005-01

- Using an ohmmeter (1), check that there is no continuity between slip ring (2) and rotor core (3). If there is continuity, replace the rotor.



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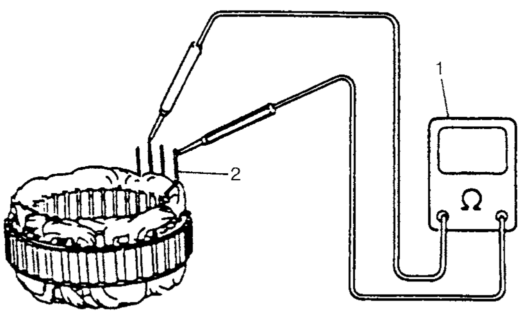
- Check slip rings for roughness or scoring. If rough or scored, replace the rotor.

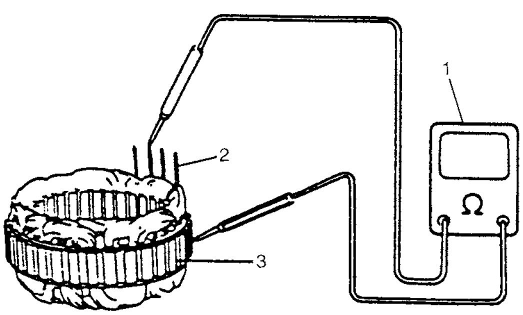
Stator

- Using an ohmmeter (1), check all leads (2) for continuity. If there is no continuity, replace the stator.



I4RS0B1A0009-01

- Using an ohmmeter (1), check that there is no continuity between coil leads (2) and stator core (3). If there is continuity, replace the stator.



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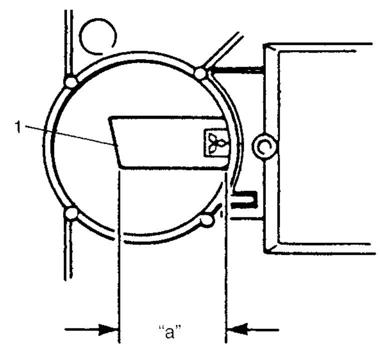
Brush and Brush Holder

Check each brush (1) for wear by measuring its length as shown. If brush is found worn down to service limit, replace brush.

<u>Exposed brush length “a”</u>
Standard: 16 mm (0.63 in.)
: Limit: 5.0 mm (0.20 in.)



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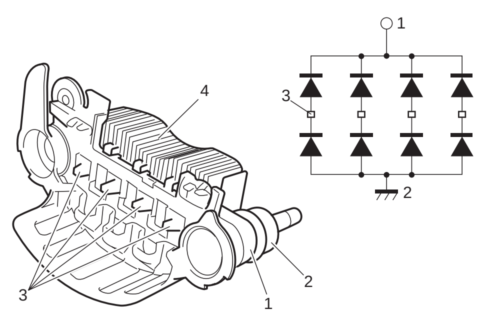
Rectifier

Using ohmmeter, check continuity between “B” terminal (1) or “E” terminal (2) and each diode lead (3).
Check both directions by reversing probes of ohmmeter and there should be only one-way continuity in each case. If check result is not satisfactory, replace rectifier (4).



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Specifications

Charging System Specifications

S7RS0B1A07001

Battery

Battery
: 48AH/20H, 40.6AH/5H 12 V

Nominal output	12 V
Rated capacity	48 Ah/20 h
	40.6 Ah/5 h
Cold cranking amperes	300 A (DIN)

Generator

Type	80A type
Rated voltage	12 V
Nominal output	80A
Permissible max. speed	18,000 r/min.
No-load speed	1200 r/min. (rpm)
Regulated voltage	14.2 – 14.8 V at 25 °C (77 °F)
Exposed brush length	Standard: 16 mm (0.63 in.) Limit: 5.0 mm (0.02 in.)
Permissible ambient temperature	–30 to 100 °C (–22 to 212 °F)
Polarity	Negative ground
Rotation	Clockwise viewed from pulley side

Tightening Torque Specifications

S7RS0B1A07002

Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
Generator bracket bolt	25	2.5	18.0	☞
Generator pivot bolt	50	5.0	36.0	☞
Generator adjusting bolt	7	0.7	5.0	by the specified procedure. ☞

NOTE

The specified tightening torque is also described in the following.
“Generator Unit Components”
“Generator Components”

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

Exhaust System

General Description

Exhaust System Description

S7RS0B1B01001

The exhaust system consists of an exhaust manifold, three-way catalytic converter (TWC) in catalyst case, exhaust pipes, a muffler and seals, gasket and etc.
The three-way catalytic converter is an emission control device added to the exhaust system to lower the levels of Hydrocarbon (HC), Carbon Monoxide (CO), and Oxides of Nitrogen (NOx) pollutants in the exhaust gas.

Diagnostic Information and Procedures

Exhaust System Check

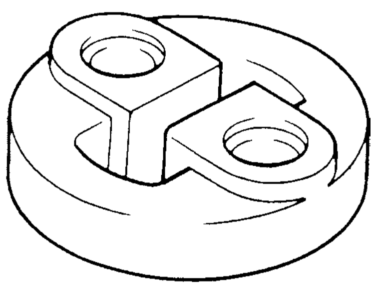
S7RS0B1B04001

⚠ WARNING

To avoid the danger of being burned, do not touch the exhaust system when the system is hot. Any service on the exhaust system should be performed when the system is cool.

At every interval of periodic maintenance service, and when vehicle is raised for other service, check exhaust system as follows:

- Check rubber mountings for damage, deterioration, and out of position.



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- Check exhaust system for leakage, loose connection, dent and damage.
- If bolts or nuts are loosened, tighten them to specified torque referring to “Exhaust System Components”.
- Check nearby body areas damaged, missing, or mispositioned part, open seam, hole connection or any other defect which could permit exhaust fumes to seep into vehicle.
- Make sure that exhaust system components have enough clearance from underbody to avoid overheating and possible damage to passenger compartment carpet.
- Any defect should be fixed at once.

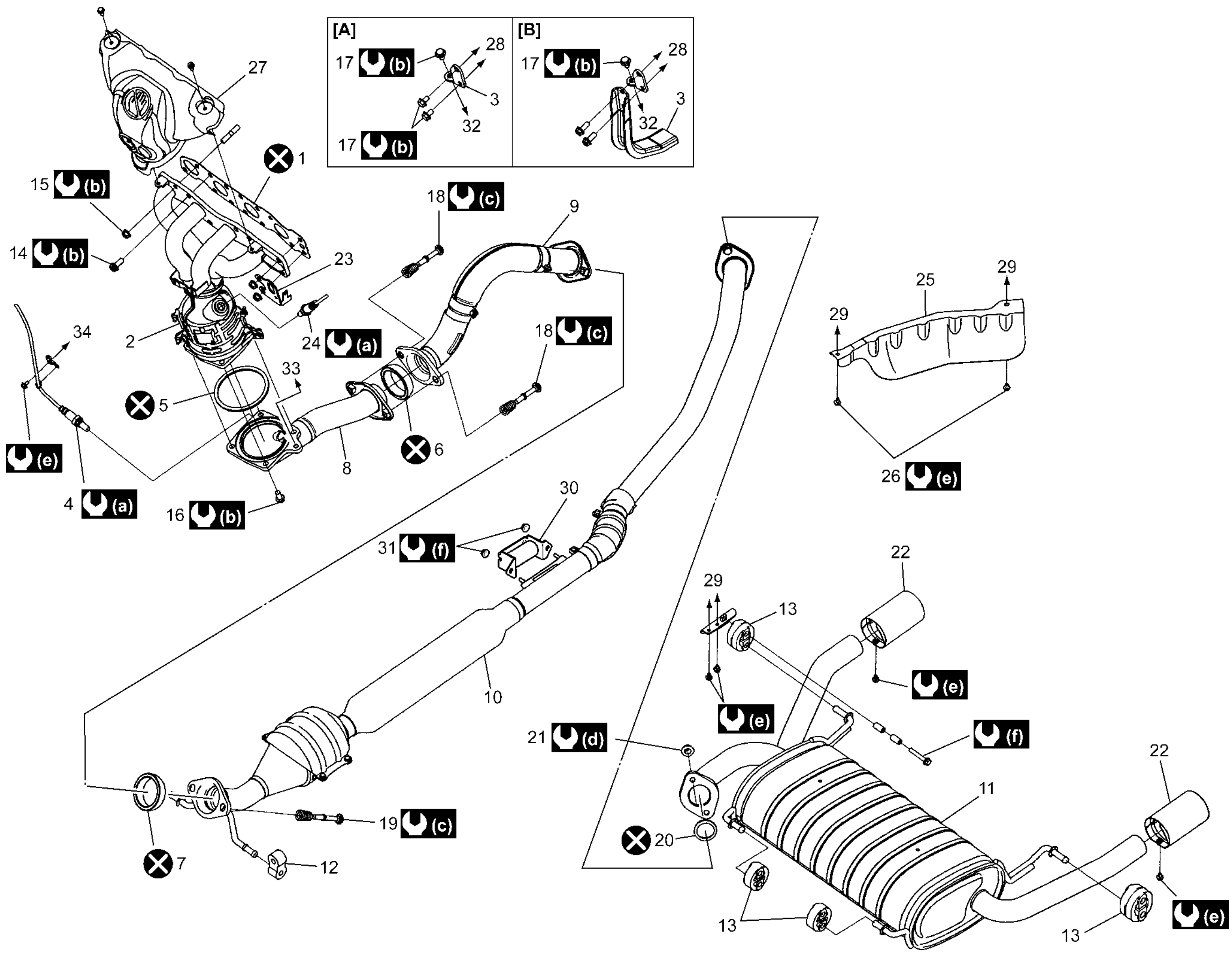
Repair Instructions

Exhaust System Components

S7RS0B1B06001

⚠ WARNING

To avoid the danger of being burned, do not touch the exhaust system when the system is hot. Any service on the exhaust system should be performed when the system is cool.



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[A]: MT model	14. Exhaust manifold bolt	29. To vehicle body
[B]: AT model	15. Exhaust manifold nut	30. Damper
1. Exhaust manifold gasket	16. Exhaust No.1 pipe bolt	31. Damper nut
2. Exhaust manifold	17. Exhaust manifold stiffener bolt	32. To exhaust pipe No.1
3. Exhaust manifold stiffener	18. Exhaust No.2 pipe bolt	33. To exhaust manifold stiffener
4. Heated oxygen sensor No.2 (connector color: green)	19. Exhaust center pipe bolt	34. To oil pan
5. Exhaust pipe No.1 gasket	20. Exhaust pipe No.2 gasket	(a) : 45 N·m (4.5 kgf-m, 32.5 lb-ft)
6. No.1 seal ring	21. Muffler nut	(b) : 50 N·m (5.0 kgf-m, 36.5 lb-ft)
7. No.2 seal ring	22. Muffler tail pipe	(c) : 43 N·m (4.3 kgf-m, 31.0 lb-ft)
8. Exhaust No.1 pipe	23. Engine hook	(d) : 60 N·m (6.0 kgf-m, 43.5 lb-ft)
9. Exhaust No.2 pipe	24. Heated oxygen sensor No.1 (connector color: gray)	(e) : 10 N·m (1.0 kgf-m, 7.5 lb-ft)
10. Exhaust center pipe	25. Heat insulator	(f) : 25 N·m (2.5 kgf-m, 18.0 lb-ft)
11. Muffler	26. Heat insulator bolt	⊗ : Do not reuse.
12. Center pipe mounting	27. Exhaust manifold cover	
13. Muffler mounting	28. To cylinder block	

Exhaust Manifold Removal and Installation

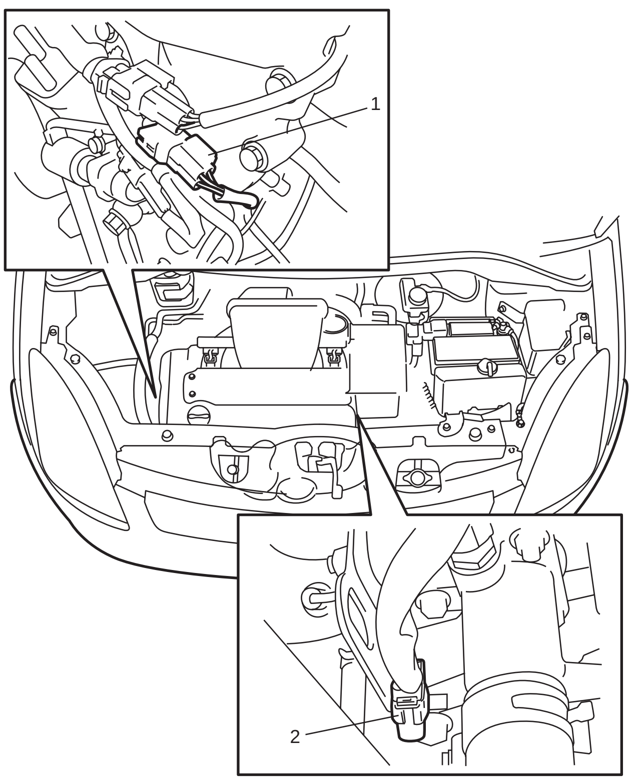
S7RS0B1B06002

Removal

WARNING

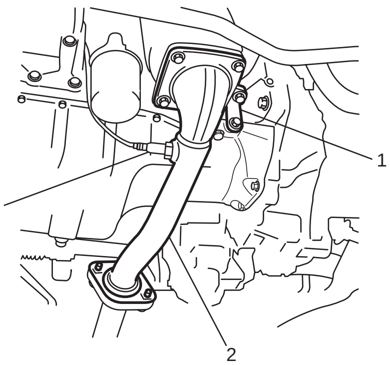
To avoid danger of being burned, do not service exhaust system while it is still hot. Service should be performed after system cools down.

1) Disconnect negative cable at battery.
2) Remove engine cover.
3) Remove front bumper with front grille referring to “Front Bumper and Rear Bumper Components in Section 9K”.
4) Remove radiator referring to “Radiator Removal and Installation in Section 1F” for equipped with A/C.
5) With hose connected, detach A/C condenser from vehicle body for equipped with A/C.
6) Remove exhaust manifold cover from exhaust manifold.
7) Disconnect heated oxygen sensor No.2 connector (1) (connector color: green) and heated oxygen sensor No.1 connector (2) (connector color: black), and then detach it from its stay.



I6RS0C1B0002-01

8) Remove exhaust manifold stiffener (1).
9) Remove heated oxygen sensors (3) from exhaust manifold and exhaust No.1 pipe, if necessary.
10) Disconnect exhaust No.1 pipe (2) from exhaust manifold.



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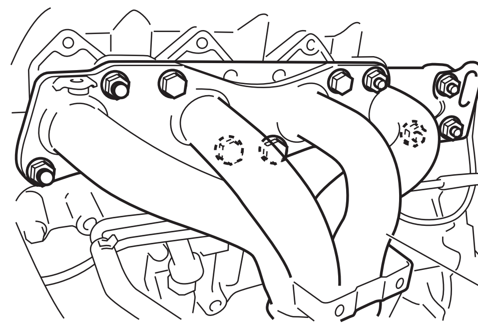
11) Remove exhaust manifold (1) and its gasket from cylinder head.



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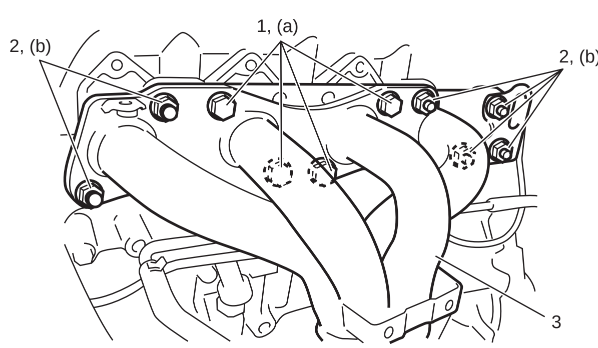
Installation

1) Install new gasket to cylinder head. Then install exhaust manifold (3).
   Tighten manifold bolts (1) and nuts (2) to specified torque.

   Tightening torque
   Exhaust manifold bolt (a): 50 N·m (5.0 kgf-m, 36.5 lb-ft)
   Exhaust manifold nut (b): 50 N·m (5.0 kgf-m, 36.5 lb-ft)

   NOTE

   Be sure to install exhaust manifold bolts and nuts to proper location referring to “Exhaust System Components”.



I6RS0C1B0004-01

2) Install new seal ring and connect exhaust No.1 pipe (1) to exhaust manifold.
   Tighten pipe fasteners to specified torque.

   Tightening torque
   Exhaust No.1 pipe bolt (a): 50 N·m (5.0 kgf-m, 36.5 lb-ft)

3) Install exhaust manifold stiffener (2).
   Tighten exhaust manifold stiffener bolts to specified torque.

   Tightening torque
   Exhaust manifold stiffener bolt (b): 50 N·m (5.0 kgf-m, 36.5 lb-ft)

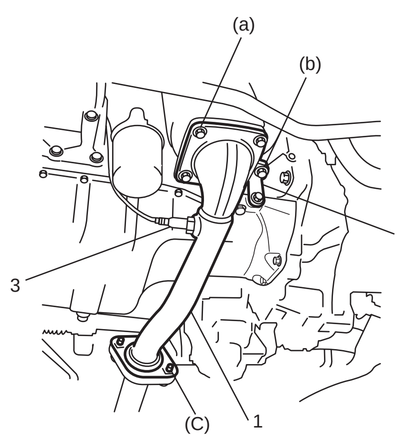
4) Install new seal ring and connect exhaust No.1 pipe (1) to exhaust No.2 pipe. Tighten pipe fasteners to specified torque.

   Tightening torque
   Exhaust No.2 pipe bolt (c): 43 N·m (4.3 kgf-m, 31.0 lb-ft)

5) Install heated oxygen sensors (3) referring to "HO2S-1 and HO2S-2 Removal and Installation in Section 1C", if removed.

   NOTE

   Be sure to identify heated oxygen sensor No.1 and No.2 by its connector color.



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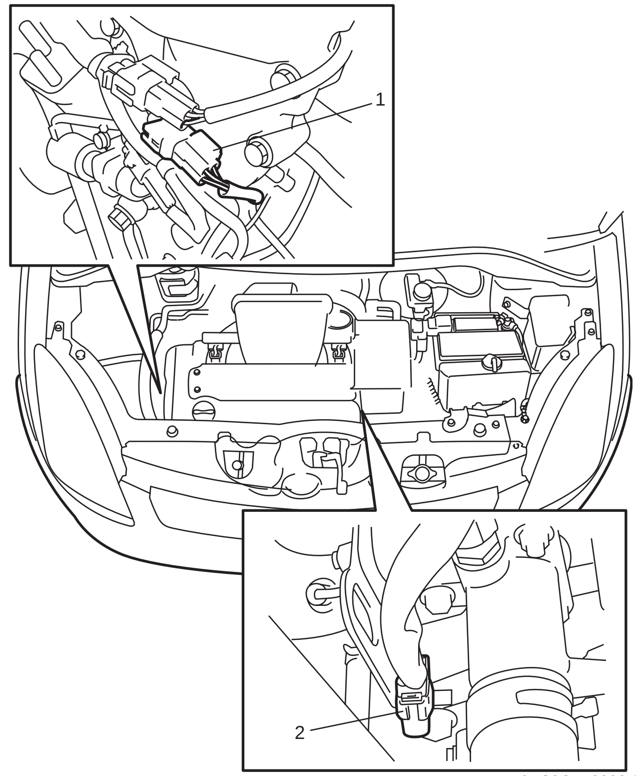
6) Connect heated oxygen sensor No.2 connector (1) (connector color: green) and heated oxygen sensor No.1 connector (2) (connector color: black), and then fit coupler to bracket securely.



I6RS0C1B0002-01

7) Install exhaust manifold cover to exhaust manifold.
8) Install A/C condenser to vehicle body for equipped with A/C.
9) Install radiator referring to "Radiator Removal and Installation in Section 1F" for equipped with A/C.
10) Install front bumper with front grille by referring to "Front Bumper and Rear Bumper Components in Section 9K".
11) Install engine cover.
12) Connect negative cable at battery.
13) Check exhaust system for exhaust gas leakage.

Exhaust Pipe and Muffler Removal and Installation

S7RS0B1B06003

For replacement of exhaust pipe, be sure to hoist vehicle and observe WARNING under "Exhaust System Components" and the following.

⚠ CAUTION

Exhaust manifold have three way catalytic converter in it, it should not be exposed to any impulse.
Be careful not to drop it or hit it against something.

- Tighten bolts and nuts to specified torque when reassembling. Refer to "Exhaust System Components".
- After installation, start engine and check each joint of exhaust system for leakage.

Specifications

Tightening Torque Specifications

S7RS0B1B07001

Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
Exhaust manifold bolt	50	5.0	36.5	☞
Exhaust manifold nut	50	5.0	36.5	☞
Exhaust No.1 pipe bolt	50	5.0	36.5	☞
Exhaust manifold stiffener bolt	50	5.0	36.5	☞
Exhaust No.2 pipe bolt	43	4.3	31.0	☞

NOTE

The specified tightening torque is also described in the following.
“Exhaust System Components”

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

Section 2

Suspension

CONTENTS

Precautions

Precautions

Precautions on Suspension

S7RS0B2000001

Emergency Flat Tire Repair Kit handle Warning
Refer to “Warning for Handling Emergency Flat Tire Repair Kit in Section 00”.

Suspension Caution
Refer to “Suspension Caution in Section 00”.

Wheels and Tires Caution
Refer to “Wheels and Tires Caution in Section 00”.

General Precautions
Refer to “General Precautions in Section 00”.

Vehicle Lifting Points
Refer to “Vehicle Lifting Points in Section 0A”.

Fastener Caution
Refer to “Fastener Caution in Section 00”.

Fastener Information
Refer to “Fasteners Information in Section 0A”.

Brake Caution
Refer to “Brake Caution in Section 00”.

Suspension General Diagnosis

Diagnostic Information and Procedures

Suspension, Wheels and Tires Symptom Diagnosis

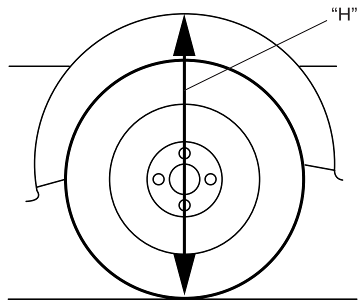
S7RS0B2104001

Condition	Possible cause	Correction / Reference Item
Vehicle pulls (Leads)	Mismatched or uneven tires	*Replace tires.*
	Tires not adequately inflated	*Adjust tire pressure.*
	Broken or sagging coil springs	*Replace coil springs.*
	Radial tire lateral force	*Replace tire.*
	Disturbed wheel alignment	*Check and adjust wheel alignment.*
	Brake dragging in one road wheel	*Repair brake.*
	Loose, bent or broken front or rear suspension parts	*Tighten or replace related suspension parts.*
Abnormal or excessive tire wear	Sagging or broken coil spring	*Replace coil spring.*
	Tire out of balance	*Adjust balance or replace tire.*
	Disturbed wheel alignment	*Check and adjust wheel alignment.*
	Faulty strut (shock absorber)	*Replace strut (shock absorber).*
	Hard driving	*Replace tires.*
	Overloaded vehicle	*Replace tires and check suspension parts.*
	Not rotated tires	*Replace or rotate tires.*
	Worn or loose wheel bearing	*Replace wheel bearing.*
	Wobbly wheel or tire	*Replace wheel or tire.*
	Tires not adequately inflated	*Adjust tire pressure.*
Wheel tramp	Blister or bump on tire	*Replace tire.*
	Improper strut (shock absorber) action	*Replace strut (shock absorber).*
Shimmy, shake or vibration	Tire or wheel out of balance	*Balance wheel or replace tire and/or wheel.*
	Loosen wheel bearings	*Replace wheel bearings.*
	Worn tie-rod ends	*Replace tie-rod ends.*
	Worn lower ball joints	*Replace front suspension control arm.*
	Excessive wheel runout	*Repair or replace wheel and/or tire.*
	Blister or bump on tire	*Replace tire.*
	Excessively loaded radial runout of tire / wheel assembly	*Replace tire or wheel.*
	Disturbed wheel alignment	*Check and adjust wheel alignment.*
	Loose or worn steering linkage	*Tighten or replace steering linkage.*
	Loose steering gear case bolts	*Tighten steering gear case bolts.*
Abnormal noise, front end	Worn, sticky or loose tie-rod ends, lower ball joints, tie-rod inside ball joints or drive shaft joints	*Replace tie-rod end, suspension arm, tie-rod or drive shaft joint.*
	Damaged struts or mountings	*Repair or replace struts or mountings.*
	Worn suspension arm bushings	*Replace suspension arm bushings.*
	Loose stabilizer bar	*Tighten bolts or nuts and/or replace bushes.*
	Loose wheel nuts	*Tighten wheel nuts.*
	Loose suspension bolts or nuts	*Tighten suspension bolts or nuts.*
	Broken or damaged wheel bearings	*Replace wheel bearings.*
	Broken suspension springs	*Replace suspension springs.*
	Poorly lubricated or worn strut bearings	*Replace strut bearing.*
	Malfunction of Power Steering System	*Check and correct malfunction.*
Low or uneven trim height	Broken or sagging coil springs	*Replace coil springs.*
	Over loaded	*Check loading.*
NOTE	Incorrect coil springs	*Replace coil spring.*
See NOTE *1.	Tires not adequately inflated	*Adjust tire pressure.*
Ride too soft	Faulty strut (shock absorber)	*Replace strut (shock absorber).*
Suspension bottoms	Overloaded	*Check loading.*
	Faulty strut (shock absorber)	*Replace strut (shock absorber).*
	Incorrect, broken or sagging coil springs	*Replace coil spring.*

Condition	Possible cause	Correction / Reference Item
Body leans or sways in corners	Loose stabilizer bar	*Tighten stabilizer bar bolts or nuts, or replace bushes.*
	Faulty strut (shock absorber) or mounting	*Replace strut (shock absorber) or tighten mounting.*
	Broken or sagging coil springs	*Replace coil springs.*
	Overloaded	*Check loading.*
Cupped tires	Front struts defective	*Replace struts.*
	Worn wheel bearings	*Replace wheel bearings.*
	Excessive tire or wheel run-out	*Replace tire and/or wheel.*
	Worn ball joints	*Replace front suspension control arm.*
	Tire out of balance	*Adjust tire balance.*

NOTE

***1: Right-to-left trim height (“H”) difference should be within 15 mm (0.6 in.) with curb weight. (same with rear side.)**



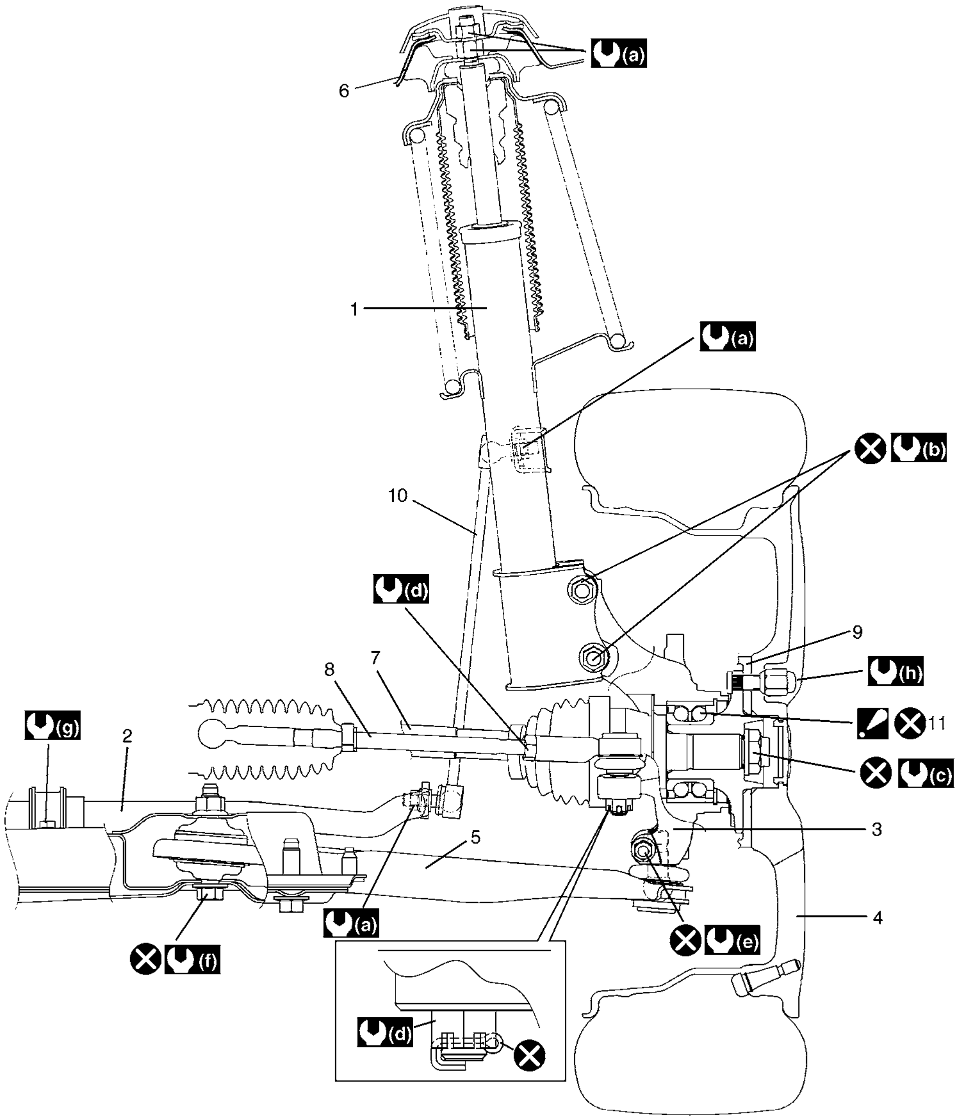
I2RH01210001-01

Front Suspension

General Description

Front Suspension Construction

S7RS0B2201001



I7RS0B220001-01

1.	Strut assembly	8.	Tie-rod	(d) :	45 N·m (4.5 kgf-m, 32.5 lb-ft)
2.	Stabilizer bar	9.	Brake disc	(e) :	60 N·m (6.0 kgf-m, 43.5 lb-ft)
3.	Steering knuckle	10.	Stabilizer bar joint	(f) :	95 N·m (9.5 kgf-m, 68.0 lb-ft)
4.	Wheel	11.	Wheel bearing : Rubber seal side of bearing faces vehicle outside.	(g) :	23 N·m (2.3 kgf-m, 17.0 lb-ft)
5.	Suspension control arm	(a) :	50 N·m (5.0 kgf-m, 36.5 lb-ft)	(h) :	85 N·m (8.5 kgf-m, 61.5 lb-ft)
6.	Vehicle body	(b) :	90 N·m (9.0 kgf-m, 65.5 lb-ft)	:	Do not reuse.
7.	Drive shaft	(c) :	200 N·m (20.0 kgf-m, 145.0 lb-ft)		

Front Wheel Alignment Construction

S7RS0B2201002

Among factors for front wheel alignment, only toe setting can be adjusted. Camber and caster are not adjustable. Therefore, should camber or caster be out of specification due to the damage caused by hazardous road conditions or collision, whether the damage is in body or in suspension should be determined and damaged body should be repaired or damaged suspension should be replaced.

Preliminary Checks Prior to Adjustment Front Wheel Alignment

Steering and vibration complaints are not always the result of improper wheel alignment. An additional item to be checked is the possibility of tire lead due to worn or improperly manufactured tires. “Lead” is the vehicle deviation from a straight path on a level road without hand pressure on the steering wheel. Refer to “Radial Tire Lead / Pull Description in Section 2D” in order to determine if the vehicle has a tire lead problem. Before making any adjustment affecting wheel alignment, the following checks and inspections should be made to ensure correctness of alignment readings and alignment adjustments:

- Check all tires for proper inflation pressures and approximately the same tread wear.
- Check for loose of ball joints. Check tie-rod ends; if excessive looseness is noted, it must be corrected before adjusting.
- Check for run-out of wheels and tires.
- Check vehicle trim heights; if it is out of limit and a correction is needed, it must be done before adjusting toe.
- Check for loose of suspension control arms.
- Check for loose or missing stabilizer bar attachments.
- Consideration must be given to excess loads, such as tool boxes. If this excess load is normally carried in vehicle, it should remain in vehicle during alignment checks.
- Consider condition of equipment being used to check alignment and follow manufacturer’s instructions.
- Regardless of equipment used to check alignment, vehicle must be placed on a level surface.

NOTE

To prevent possible incorrect reading of toe, camber or caster, vehicle front and rear end must be moved up and down a few times before inspection.

Repair Instructions

Front Wheel Alignment Inspection and Adjustment

S7RS0B2206001

Toe Inspection and Adjustment

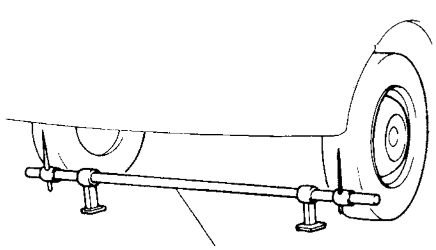
Preparation for toe inspection and adjustment.

- Place vehicle in unloaded state on level surface.
- Set steering wheel in straight state.
- Check that inflation pressure of each tire is adjusted properly and wheel is free from deflection.
- Check that each suspension part is free from bend, dent, wear or damage in any other form.
- Check that ground clearance at the right and left is just about the same.

Inspection

Measure toe using toe-in gauge (1).

If toe is out of specified value, adjust it at the tie-rod.



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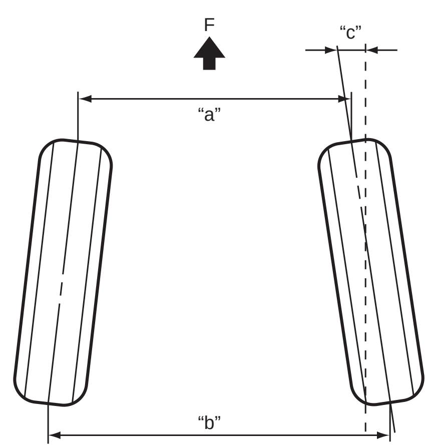
Front toe (total) “b”-“a”

: 0 + 1.0 / – 0.5 mm (0 + 0.0394 / – 0.0197 in.)



I7RS0A220002-02

F: Forward

Adjustment

1) Loosen right and left tie-rod end lock nuts (1) first.
2) Rotate right and left tie-rods (2) by the same amount to align toe to specification. In this adjustment, the lengths “A” of both right and left tie-rod should be equal.

NOTE

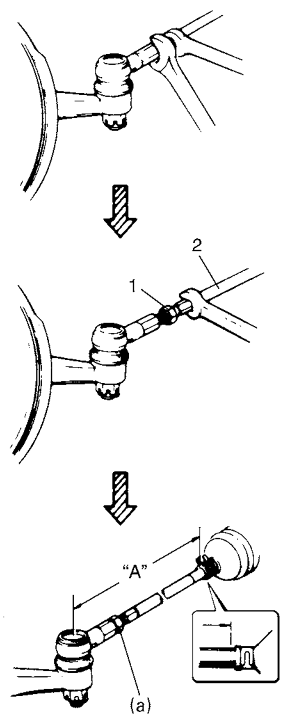
Before rotating tie-rods (2), apply grease between tie-rods and rack boots so that boots won’t be twisted.

3) After adjustment, tighten lock nuts (1) to specified torque.

Tightening torque
Tie-rod end lock nut (a): 45 N·m (4.5 kgf-m, 32.5 lb-ft)

NOTE

Make sure that rack boots are not twisted.



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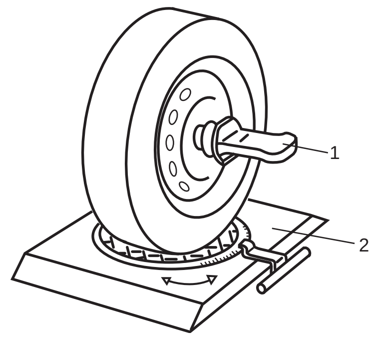
Camber and Caster Check

Check camber and caster by camber caster kingpin gauge (1) and turning radius gauge (2).
If measured value is out of specified value, check following items for damage, deformation and crack.

- Strut and component
- Suspension control arm and bush
- Suspension frame
- Wheel hub, steering knuckle or wheel bearing
- Vehicle body



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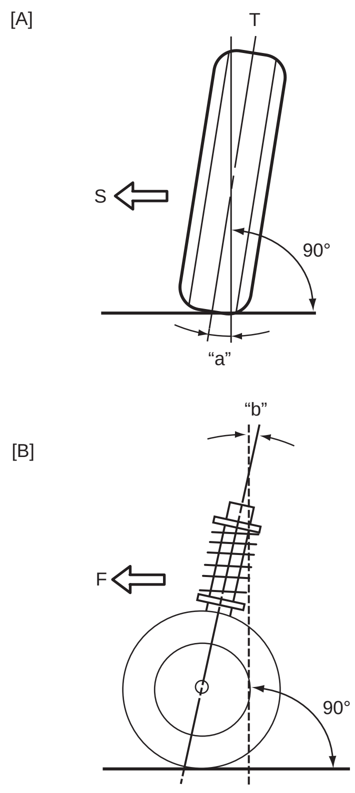
Front camber “a”
: 0 ± 1°

Front caster “b”
: 5°12’ ± 2°

NOTE

Front camber and caster are not adjustable.



I7RS0B220004-01

[A]: Camber (Front view)	S: Body center
[B]: Caster (Side view)	T: Center line of wheel
F: Forward	

Steering Angle Check and Adjustment

When tie-rod or tie-rod end was replaced, check toe and then also steering angle with turning radius gauge.
If measured value is out of specified value, perform inspection and adjustment of toe.

Steering angle
Inside: 33.8° ± 3°
Outside: 29.8° (Reference)

Reference Information

Side slip

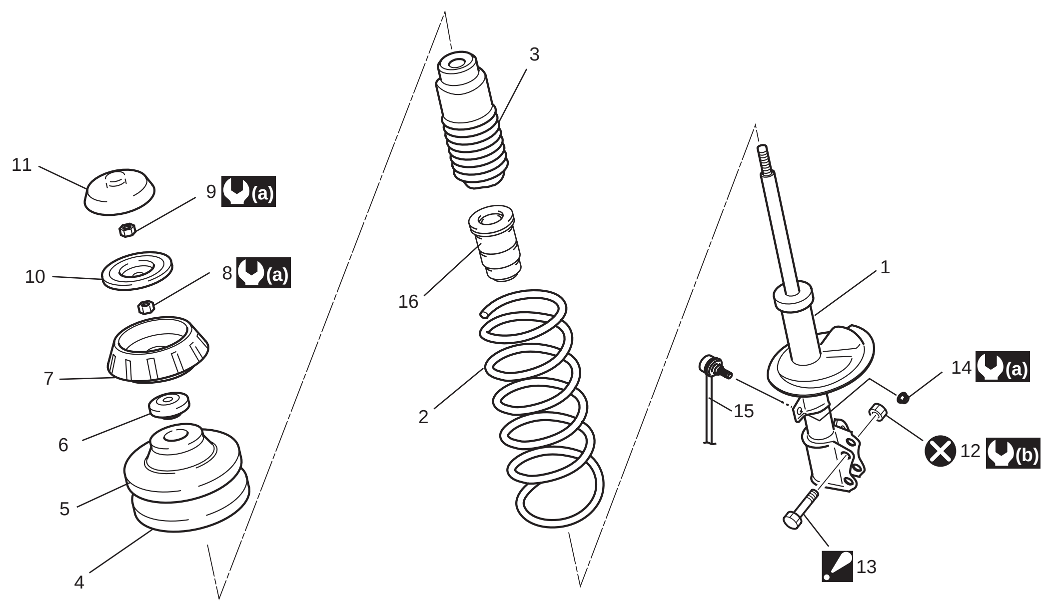
When checked with side slip tester, side slip should satisfy following specification.

Side slip
0 to IN 3.0 mm/m (0 to IN 0.118 in/3.3 ft)

If side slip is greatly different, toe or front wheel alignment may not be correct.

Front Strut Assembly Components

S7RS0B2206002



I6RS0C220006-02

1. Strut assembly	6. Strut bearing	11. Strut rod cap	16. Bump stopper
2. Coil spring	7. Strut support	12. Strut bracket nut	(a) : 50 N·m (5.0 kgf-m, 36.5 lb-ft)
3. Dust cover	8. Strut support lower nut	13. Strut bracket bolt :Insert from vehicle front side.	(b) : 90 N·m (9.0 kgf-m, 65.5 lb-ft)
4. Coil spring seat	9. Strut nut	14. Stabilizer joint nut	: Do not reuse.
5. Coil spring upper seat	10. Rebound stopper	15. Stabilizer joint	

Front Strut Assembly Removal and Installation

S7RS0B2206003

Removal

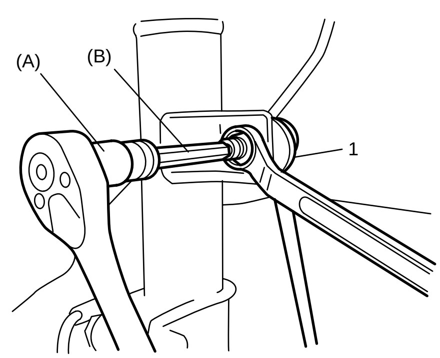
1) Remove windshield wiper arms with wiper blades.
2) Remove cowl top covers referring to "Cowl Top Components in Section 9K".

NOTE

When servicing component parts of strut assembly, remove strut rod cap and then loosen strut nut a little before removing strut assembly. This will make service work easier. Note that the nut must not be removed at this point.

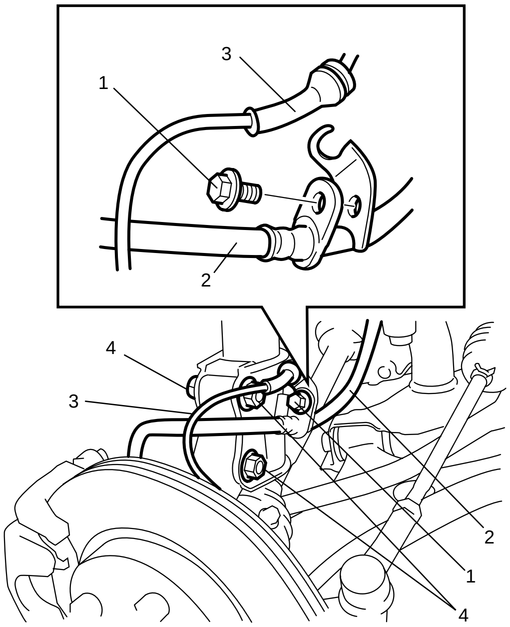
3) Hoist vehicle, allowing front suspension to hang free.
4) Remove wheel and disconnect stabilizer joint (1) from strut bracket.
   When loosening joint nut, hold stud with special tools.

   Special tool
   (A): 09900–00411 socket
   (B): 09900–00413 5 mm



I4RS0A220004-01

5) Remove brake hose mounting bolt (1) and remove brake hose (2) from bracket and then wheel speed sensor harness (3) from strut bracket as shown in figure.
6) Remove strut bracket bolts and nuts (4).

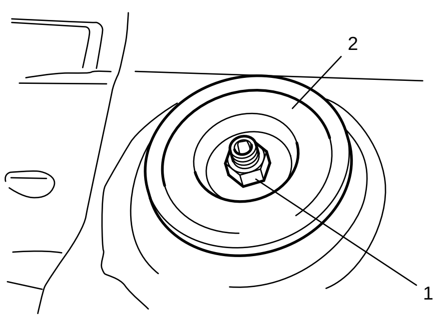


I4RS0A220005-01

7) Remove strut rod cap.
8) Remove strut nut (1), and remove rebound stopper (2).

NOTE

Hold strut by hand so that it will not fall off.



I4RS0A220006-01

9) Remove strut assembly.

Installation

Install strut assembly by reversing removal procedure, noting the following instructions.

⚠ CAUTION

Never reuse strut bracket nuts.
Nuts are pre-coated with friction stabilizer.
Be sure to replace pre-coated nut with a new one, or nut may loosen.

- Insert bolts in such direction as shown in figure.
- Tighten all fasteners to specified torque.

Tightening torque
Strut bracket nut (a): 90 N·m (9.0 kgf-m, 65.5 lb-ft)
Brake hose mounting bolt (c): 25 N·m (2.5 kgf-m, 18.0 lb-ft)
Stabilizer joint nut (d): 50 N·m (5.0 kgf-m, 36.5 lb-ft)

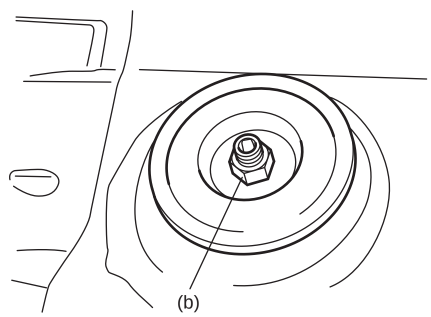
- Lower hoist and vehicle in unloaded condition, tighten strut nut (b) to specified torque.

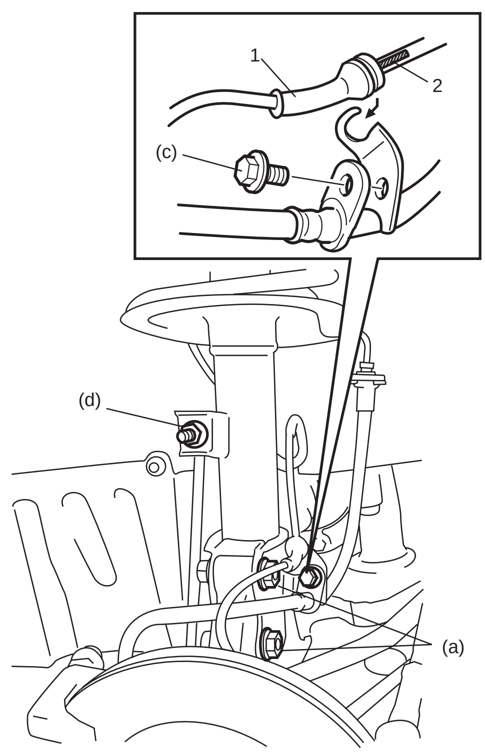
Tightening torque
Strut nut (b): 50 N·m (5.0 kgf-m, 36.5 lb-ft)

- Install windshield wiper arms with blades referring to "Windshield Wiper Removal and Installation in Section 9D".

NOTE

- **Don't twist brake hose and wheel speed sensor harness when installing them.**
- **Install wheel speed sensor harness (1) which marking (2) in figure is placed to open hook side of the bracket.**





I4RS0B220012-01

- Tighten wheel nuts to specified torque.

  Tightening torque
  Wheel nut: 85 N·m (8.5 kgf-m, 61.5 lb-ft)

- After installation, confirm front wheel alignment.

Front Strut Assembly Disassembly and Assembly

S7RS0B2206004

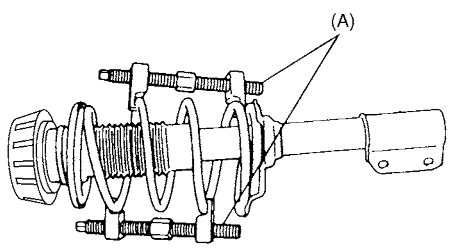
⚠ WARNING

Use a regular coil spring compressor and follow the operation procedure described in the Instruction Manual.

Disassembly

1) Attach special tool (A) to coil spring as shown. Turn special tool bolts alternately until coil spring tension is released. Rotate the strut around its axis to confirm that the coil spring is released or not.

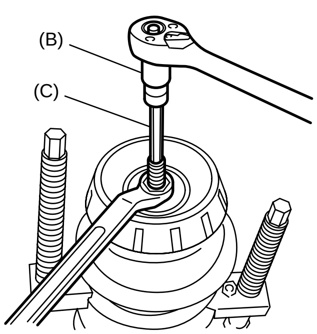
   Special tool
   (A): 09940-71431



I4RS0A220009-01

2) While keeping coil spring compressed with special tools as shown, remove strut support lower nut.

   Special tool
   (B): 09900-00411 socket
   (C): 09900-00414 6 mm



I4RS0A220007-01

3) Disassemble strut assembly.

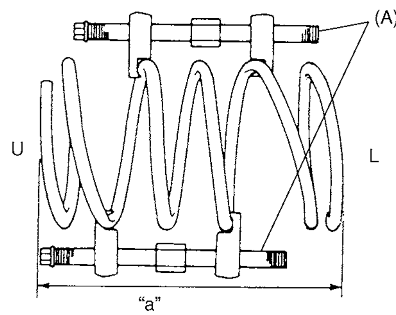
Assembly

For assembly, reverse disassembly procedure, noting the following instructions.

1) Compress coil spring with special tool (A) until total length becomes about 280 mm (11.0 in.) as shown.

   Special tool
   (A): 09940–71431

   Length
   “a”: 280 mm (11.0 in.)



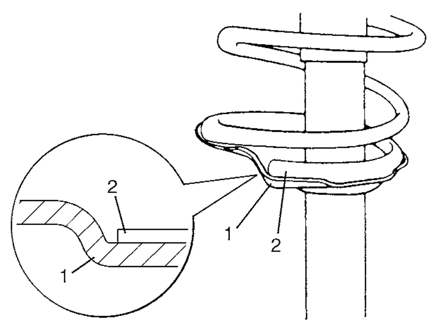
I4RS0A220010-01

U: Upper side (small dia.)	L: Lower side (large dia.)

2) Install compressed coil spring to strut, and place coil spring end (2) onto spring lower seat (1) as shown.

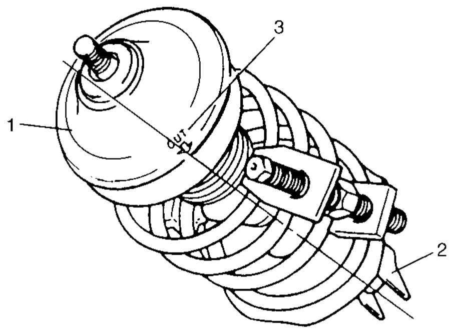
   NOTE

   End of coil spring must not interfere with step of spring lower seat.



I4RS0A220011-01

3) Install bump stopper onto strut rod. For installing direction, refer to the figure in “Front Suspension Construction”.
4) Pull strut rod as far up as possible and use care not to allow it to retract into strut.
5) Install spring seat on coil spring and then spring upper seat (1) aligning “OUT” mark (3) on spring upper seat and center of strut bracket (2).

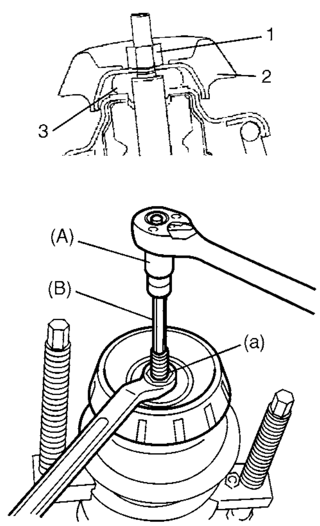


I4RS0A220012-01

6) Install strut bearing (3), strut support (2) and strut support lower nut (1) in this sequence.
Tighten strut support lower nut (1) to specified torque.
When tightening strut support lower nut, hold stud with special tools.

Special tool
(A): 09900–00411 socket
(B): 09900–00414 6 mm

Tightening torque
Strut support lower nut (a): 50 N·m (5.0 kgf-m, 36.5 lb-ft)

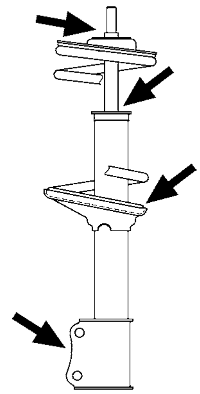


I6RS0B220006-01

Front Strut Assembly Check

S7RS0B2206005

- Inspect strut for oil leakage, damage or deformation.
- If defect is found, replace strut as an assembly unit, because it can not be disassembled.



I4RS0A220014-01

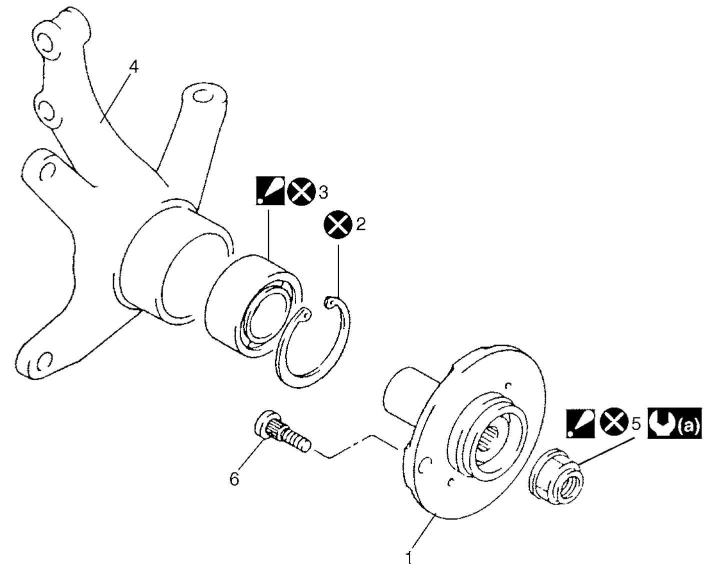
- Inspect strut function referring to the following procedures:
1) Check and adjust tire pressures as specified.
2) Bounce vehicle body up and down 3 or 4 times continuously by pushing front end of the vehicle side body to check strut.
Also, note how many times vehicle body rebounds to stop after force application.
3) Repeat the same procedure to the other strut to confirm that the both side struts equally respond.

If conditions of struts are in doubt, compare them with known-good vehicle or strut.

- Inspect bearing for wear, abnormal noise or gripping.
If defective, replace.
- Inspect coil spring seat for cracks or deformation.
If defective, replace.
- Inspect bump stopper for deterioration.
If defective, replace.
- Inspect rebound stopper and strut mount for wear, cracks or deformation.
If defective, replace.

Front Wheel Hub and Steering Knuckle Components

S7RS0B2206006



I7RS0B220005-03

1. Front wheel hub	3. Wheel bearing : Face grooved rubber seal side to wheel hub.	5. Drive shaft nut : Calk, after tightening.	(a) : 200 N·m (20.0 kgf-m, 145 lb-ft)
2. Circlip	4. Steering knuckle	6. Hub bolt	: Do not reuse.

Front Wheel Hub, Steering Knuckle and Wheel Bearing Removal and Installation

S7RS0B2206007

⚠ CAUTION

When removing and installing steering knuckle assembly, be careful not to damage dust boots of suspension control arm joint by drive shaft dust cover and brake dust cover.

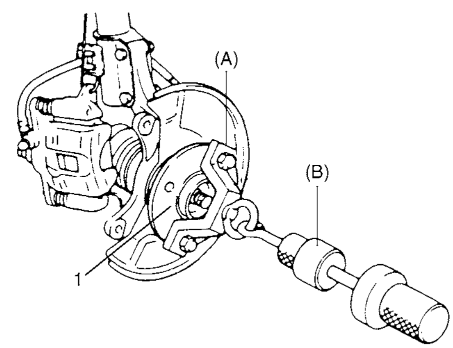
Removal

1) Hoist vehicle and remove wheel.
2) Uncaulk drive shaft nut.
3) Depress foot brake pedal and hold it. Remove drive shaft nut.
4) Remove brake disc referring to "Front Brake Disc Removal and Installation in Section 4B".
5) Pull out wheel hub (1) with special tools.

Special tool
(A): 09943-17912
(B): 09942-15511

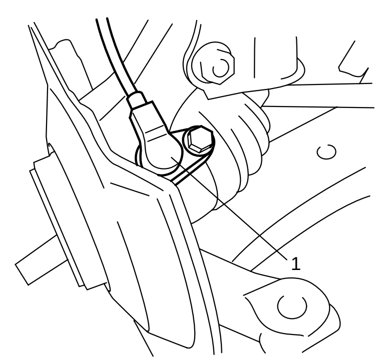
⚠ CAUTION

When wheel hub is removed, replace wheel bearing with new one.



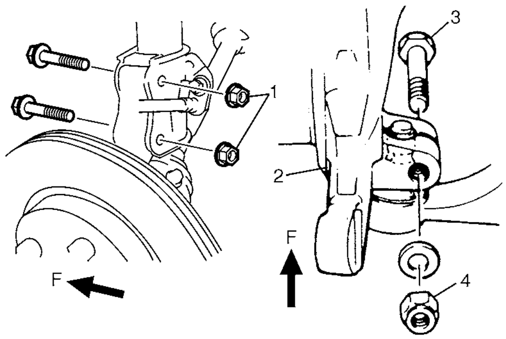
I3RM0A220023-01

6) Remove cotter pin and tie-rod end nut, and then disconnect tie-rod end from steering knuckle referring to "Tie-Rod End Removal and Installation in Section 6C".
7) Remove wheel speed sensor (1) from steering knuckle.



I4RS0B220005-01

8) Loosen strut bracket nuts (1).
9) Remove ball joint bolt (3) and nut (4).
10) Remove strut bracket bolts from strut bracket and then steering knuckle (2).



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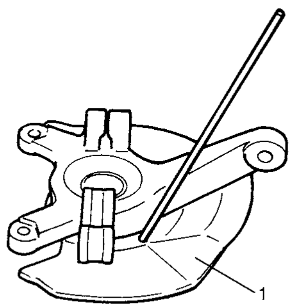
F: Vehicle front

11) Uncaulk and remove dust cover (1).



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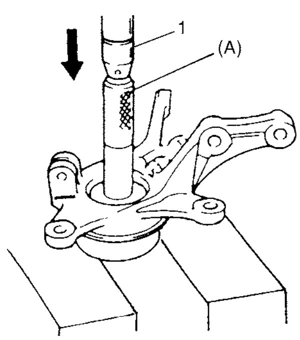
12) Remove circlip from steering knuckle.
13) Using hydraulic press (1) and special tool, remove wheel bearing.

Special tool
(A): 09913-75520

⚠ CAUTION

When installing wheel bearing, replace it with new one.



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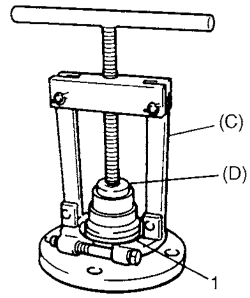
14) Remove wheel bearing outside inner race (1).

Special tool
(C): 09913-65810
(D): 09913–85230



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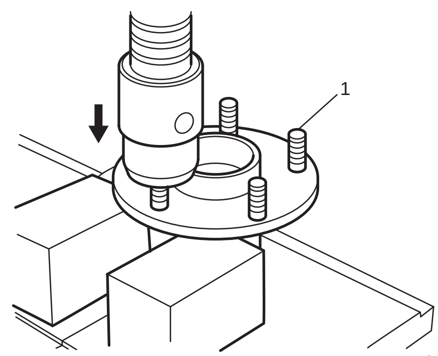
15) Remove hub bolts (1) with copper hammer or hydraulic press.

⚠ CAUTION

Never remove bolt unless replacement is necessary.
Be sure to use a new bolt for replacement.

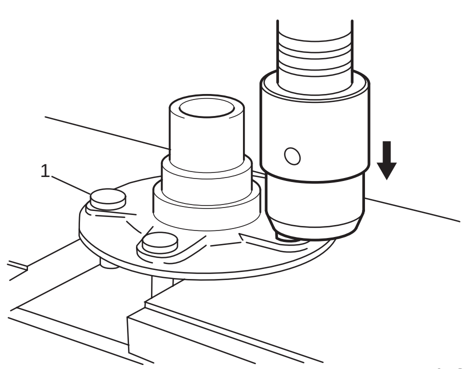


I6RS0C220008-01

Installation

For installation, reverse removal procedure, noting the following instructions.

1) Insert new hub bolt (1) in hub hole. Rotate hub bolt slowly to assure that serrations are aligned with those made by original bolt.



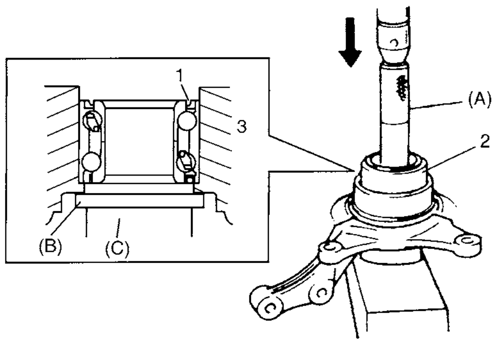
I6RS0C220009-01

2) Face grooved rubber seal side (1) of new wheel bearing (2) upward as shown in figure and press-fit it into knuckle (3) using special tool.

Special tool
(A): 09913-75510
(B): 09926–68310
(C): 09951–18210

⚠ **CAUTION**

When installing wheel bearing, replace wheel bearing and circlip with new one.



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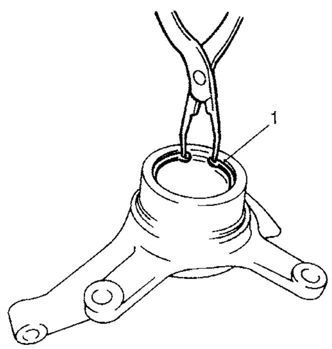
3) Install circlip (1).



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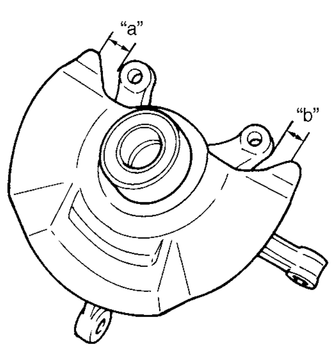
4) Drive in dust cover so that dimensions “a” and “b” become equal as shown in the figure.

⚠ **CAUTION**

When drive in dust cover, be careful not to deform it.



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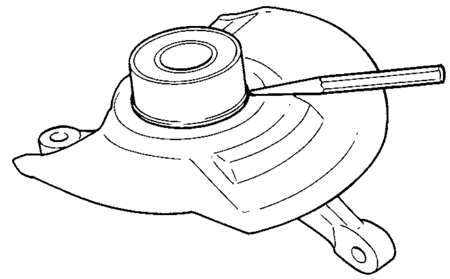
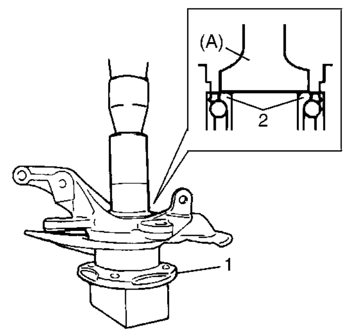
5) Caulk more than 6 places with a punch.



I2RH01220039-01

6) Using special tool and hydraulic press, press fit wheel hub (1) into wheel bearing (2) (Face grooved rubber seal side to wheel hub).

Special tool
(A): 09913–75510



I3RM0A220026-01

7) Install ball joint bolt (1) and nut (2) from the direction as shown in figure.
8) Tighten new suspension control arm ball joint nut (2) to specified torque.

Tightening torque
Suspension control arm ball joint nut (a): 60 N·m (6.0 kgf-m, 43.5 lb-ft)

⚠ **CAUTION**

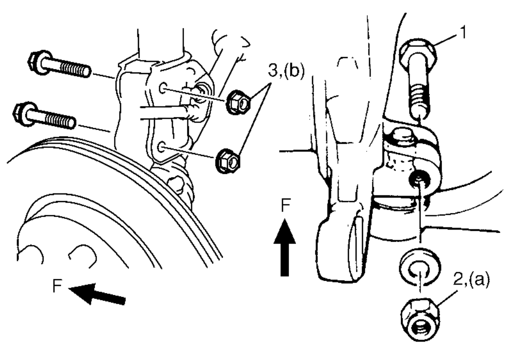
Never reuse the removed suspension control arm ball joint nut.

9) Tighten strut bracket new nuts (3) to specified torque.

Tightening torque
Strut bracket nut (b): 90 N·m (9.0 kgf-m, 65.5 lb-ft)

⚠ **CAUTION**

Never reuse strut bracket nuts.
Nuts are pre-coated with friction stabilizer.
Be use to replace pre-coated nut with a new one, or may loosen.

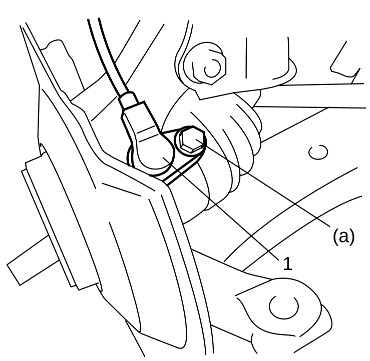


I4RS0B220015-01

F: Vehicle front

10) Install wheel speed sensor (1).

Tightening torque
Wheel speed sensor mounting bolt (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)



I4RS0B220006-01

11) Connect tie-rod end to steering knuckle and then install cotter pin referring to "Tie-Rod End Removal and Installation in Section 6C".
12) Install brake disc (2) and brake caliper (3).
13) Tighten caliper carrier bolt to specified torque.

Tightening torque
Caliper carrier bolt: 85 N·m (8.5 kgf-m, 61.5 lb-ft)

14) Depress foot brake pedal and hold it there.
Tighten new drive shaft nut (1) to specified torque.

Tightening torque
Drive shaft nut (b): 200 N·m (20.0 kgf-m, 145.0 lb-ft)

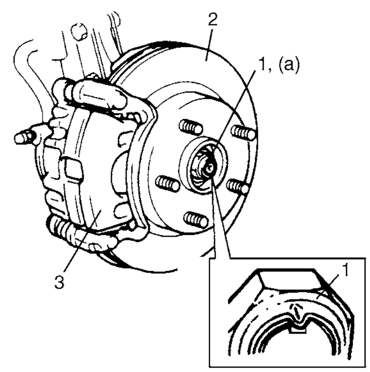
⚠ **CAUTION**

Never reuse drive shaft nut (1).

15) Caulk drive shaft nut (1) as shown.

⚠ **CAUTION**

Be careful not to damage the drive shaft nut while caulking it. If it is damaged, replace it with new one.



I6RS0C220005-01

16) Tighten wheel nuts to specified torque.

Tightening torque
Wheel nut: 85 N·m (8.5 kgf-m, 61.5 lb-ft)

17) After installing, confirm front wheel alignment.

Front Wheel Hub, Disc, Nut and Bearing Check

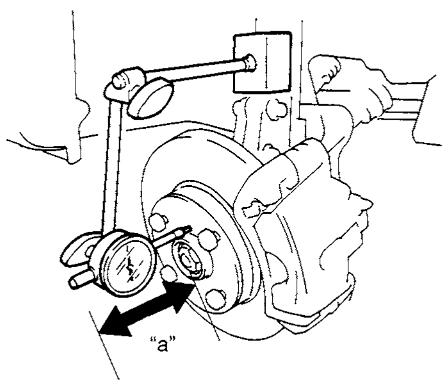
S7RS0B2206008

- Inspect each wheel disc for dents, distortion and cracks.
  A disc in badly damaged condition must be replaced.
- Check rust of installation face inside of wheel disc.
  As rust affects adversely, remove it thoroughly.
- Check wheel nuts for tightness and, as necessary, retighten them to specification.
- Check wheel bolt press-fitted into wheel hub for wear, damage, poor thread condition, and looseness.
  Replace defective bolt with a new one.
  When bolt installation is found loose, replace both bolt and wheel hub with new ones.

  Tightening torque
  Wheel nut: 85 N·m (8.5 kgf-m, 61.5 lb-ft)

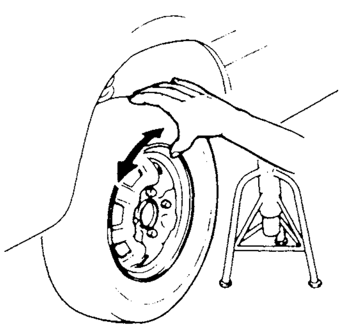
- Check wear of wheel bearing. When measuring thrust play, apply a dial gauge to wheel hub as shown in figure.

  <u>Front wheel bearing thrust play limit</u>
  "a": 0.1 mm (0.004 in.)



I7RS0A220010-02

- Check wheel bearing noise and smooth wheel rotation by rotating wheel in figure.
  If defective, replace bearing.



I2RH01220011-01

Suspension Control Arm / Bushing Removal and Installation

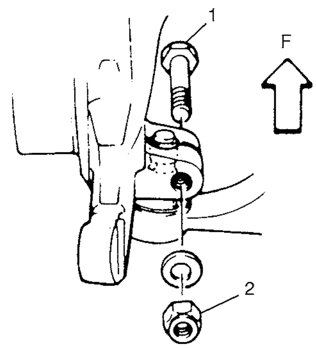
S7RS0B2206009

⚠ **CAUTION**

When removing and installing steering knuckle assembly, be careful not to damage dust boots of suspension control arm joint by drive shaft dust cover and brake dust cover.

Removal

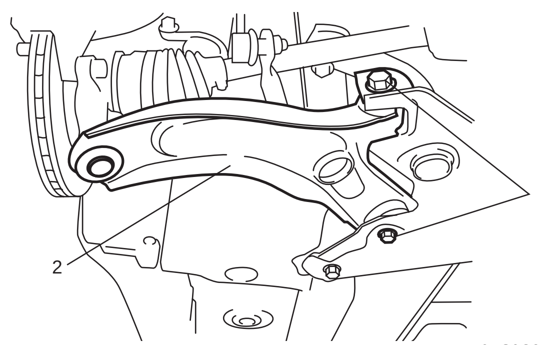
1) Remove suspension control arm ball joint bolt (1) and nut (2).



I2RH01220046-01

F: Vehicle front

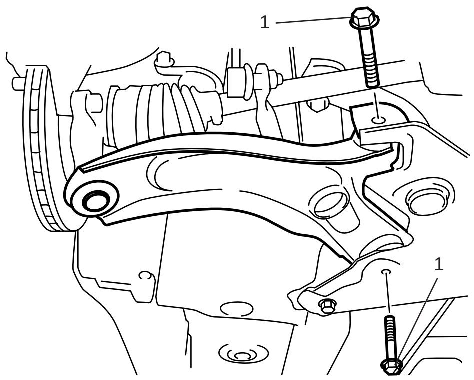
2) Remove suspension control arm bolts (1).
3) Remove suspension control arm (2).



I6RS0C220010-02

Installation

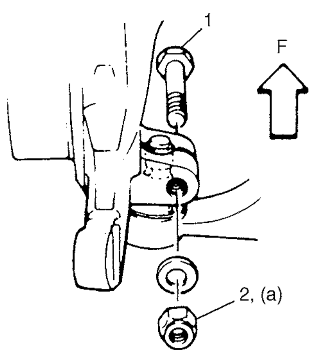
1) Install suspension control arm as shown but tighten new suspension control arm bolts (1) only temporarily.



I6RS0C220011-01

2) Install suspension control arm ball joint to steering knuckle. Align ball stud groove with steering knuckle bolt hole. Then install suspension control arm ball joint bolt (1) from the direction as shown in figure. Tighten new suspension control arm ball joint nut (2) to specified torque.

Tighting torque
Suspension control arm ball joint nut (a): 60 N·m (6.0 kgf-m, 43.5 lb-ft)



I2RH01220054-01

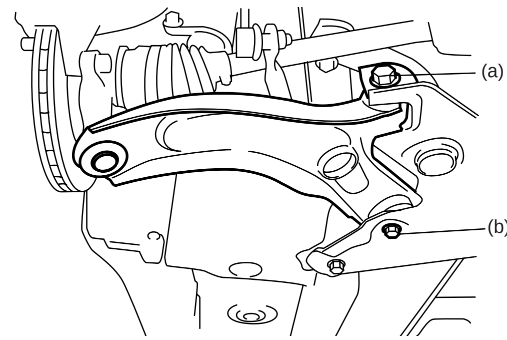
F: Vehicle front

3) Lower hoist and vehicle in unloaded condition, tighten new suspension control arm front bolt and suspension control arm rear bolt to specified torque.

⚠ CAUTION

Never reuse suspension control arm front and rear mounting bolts.
Bolts are pre-coated with friction stabilizer.
Be sure to replace pre-coated bolt with a new one, or bolt may loosen.

Tightening torque
Suspension control arm front bolt (a): 95 N·m (9.5 kgf-m, 68.0 lb-ft)
Suspension control arm rear bolt (b): 95 N·m (9.5 kgf-m, 68.0 lb-ft)



I6RS0C220012-01

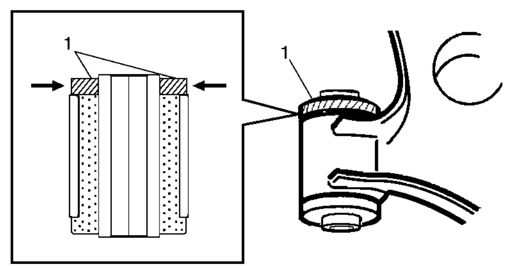
4) Confirm front wheel alignment referring to “Front Wheel Alignment Inspection and Adjustment”.

Suspension Control Arm / Bushing Disassembly and Assembly

S7RS0B2206010

Disassembly

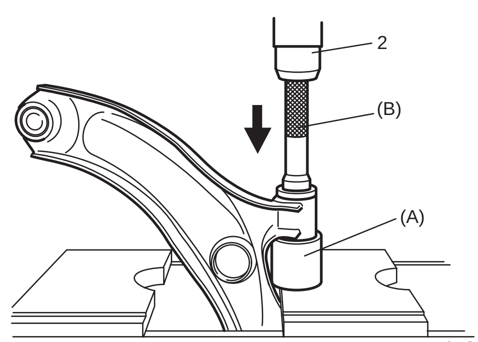
1) Cut off bushing flange (rubber) (1) with knife.



I4RS0B220019-01

2) Push out bushing by using hydraulic press (2) and special tools.

Special tool
(A): 09943–76310
(B): 09913–75821



I6RS0C220013-01

Assembly

1) Front bushing
   Press-fit front bushing (1) by using special tools and press (2).

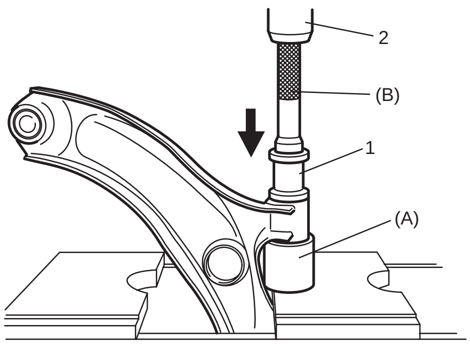
   Special tool
   (A): 09943–76310
   (B): 09913–75821

   ⚠ CAUTION

   Be sure to use new bushing.

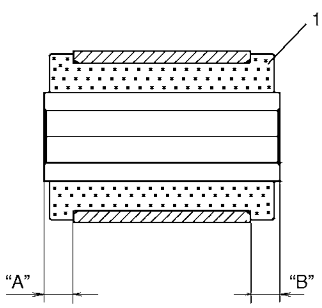
   NOTE

   - **Before installing bushing, apply soap water on its circumference to facilitate bushing installation.**



I6RS0C220014-01

2) Press-fit bushing (1) so that dimensions “A” and “B” in figure become equal.



I4RS0A220033-01

Suspension Control Arm / Steering Knuckle Check

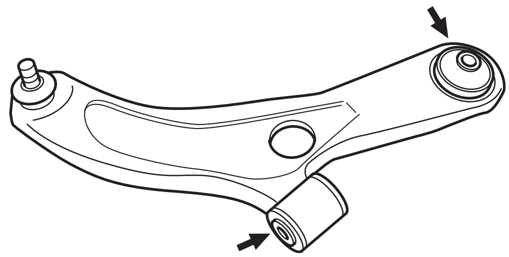
S7RS0B2206011

Inspect for cracks, deformation or damage.
If defective, replace.

Suspension Control Arm Bushing Check

S7RS0B2206012

Inspect for damage, wear or deterioration.
If defective, replace.



I6RS0C220015-01

Suspension Control Arm Joint Check

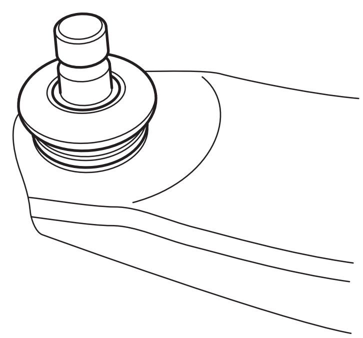
S7RS0B2206013

- Check smooth rotation of ball stud.
- Check damages of ball stud.
- Check damages of dust cover.

NOTE

Suspension control arm and arm joint cannot be separated.

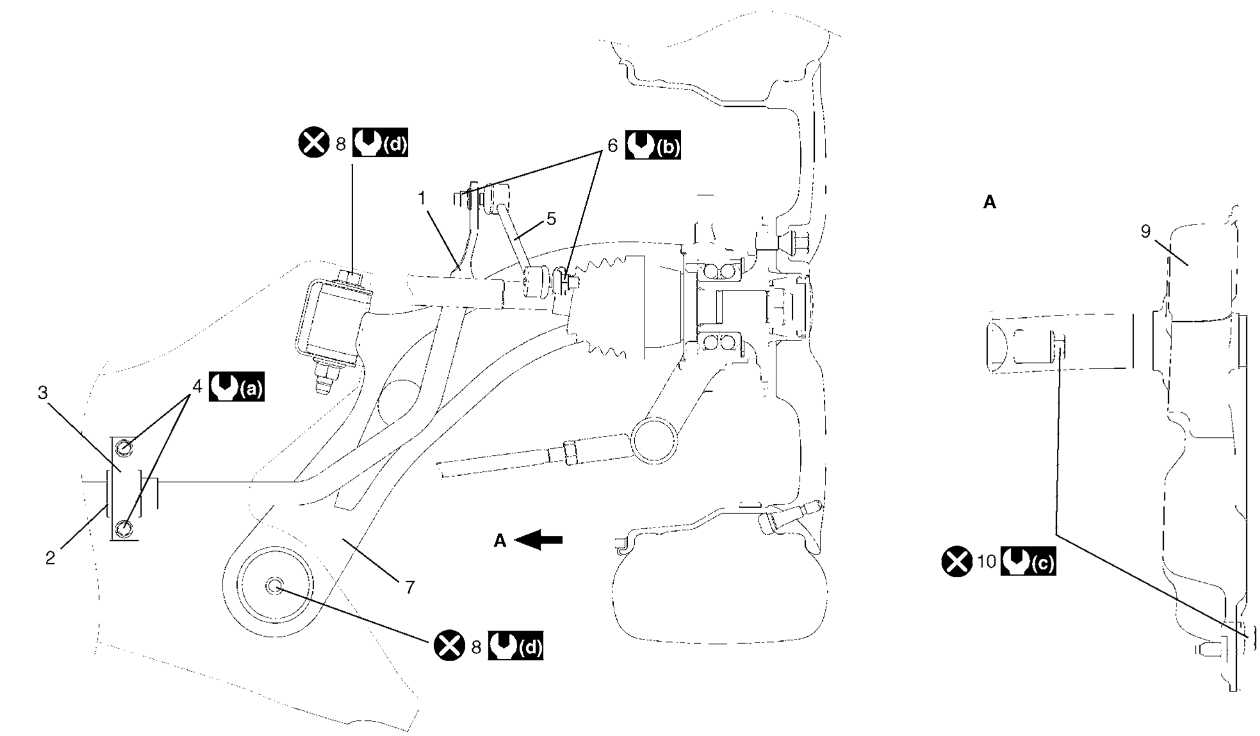
If there is any damage to either parts, control arm assembly must be replaced as a complete unit.



I4RS0B220023-01

Front Suspension Frame, Stabilizer Bar and/or Bushings Components

S7RS0B2206014



I6RS0C220016-01

A: View A	4. Stabilizer bar mounting bracket bolt	8. Suspension control arm mounting bolt	(b) : 50 N·m (5.0 kgf-m, 36.5 lb-ft)
1. Stabilizer bar	5. Stabilizer joint	9. Front suspension frame	(c) : 150 N·m (15.0 kgf-m, 108.5 lb-ft)
2. Stabilizer bushing	6. Stabilizer joint nut	10. Front suspension frame mounting bolt	(d) : 95 N·m (9.5 kgf-m, 68.0 lb-ft)
3. Stabilizer mounting bracket	7. Suspension control arm	(a) : 23 N·m (2.3 kgf-m, 17.0 lb-ft)	: Do not reuse.

Front Suspension Frame, Stabilizer Bar and/or Bushings Removal and Installation

S7RS0B2206015

WARNING

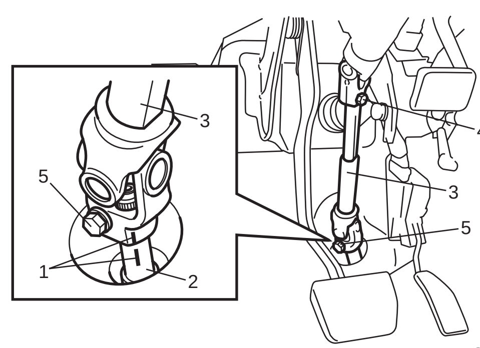
Do not touch exhaust system to avoid danger of being burned when it is still hot.
Any service on exhaust system should be performed when it is cool.
When removing front suspension frame, be sure to apply some supporting equipment (such as mission jack) under it at well-balanced position in the center section so as to prevent from its drop.

Removal

CAUTION

Be sure to set front wheels (tires) in straight direction and remove ignition key from key cylinder before performing the following steps; otherwise, contact coil of air bag system may get damaged.

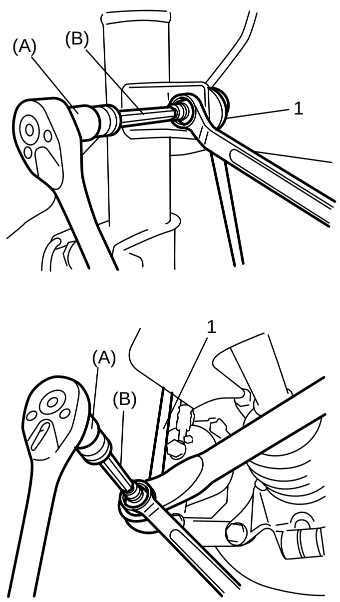
1) Remove steering joint cover.
2) Make alignment marks (1) on pinion shaft (2) and joint of steering lower shaft (3) for a guide during reinstallation.
3) Loosen joint bolt (steering column side) (4) and remove joint bolt (pinion shaft side) (5) and disconnect steering lower shaft (3) from pinion shaft (2).



I4RS0B630013-01

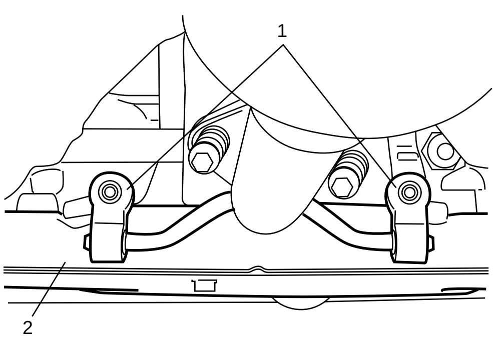
4) Hoist vehicle and remove both wheels referring to "Wheel Removal and Installation in Section 2D".
5) Remove cotter pins and tie-rod end nuts, and then disconnect both tie-rod ends from steering knuckles referring to "Tie-Rod End Removal and Installation in Section 6C".
6) Disconnect couplers of torque sensor and P/S motor.
7) Remove suspension control arm referring to "Suspension Control Arm / Bushing Removal and Installation".
8) Remove stabilizer joints (1).
   When loosening joint nut, hold stud with special tools.

   Special tool
   (A): 09900–00411 socket
   (B): 09900–00413 5 mm



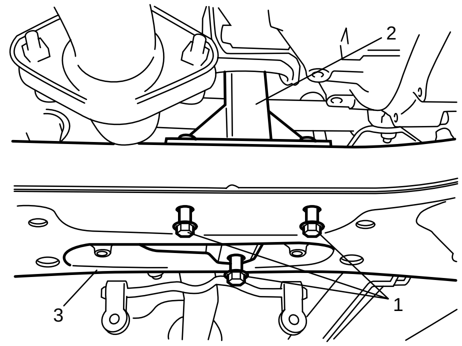
I4RS0A220038-01

9) Support engine assemble by using supporting device referring to "Engine Supporting Points in Section 0A".
10) Disconnect muffler No.1 mounting (1) from suspension frame (2).



I4RS0A220040-01

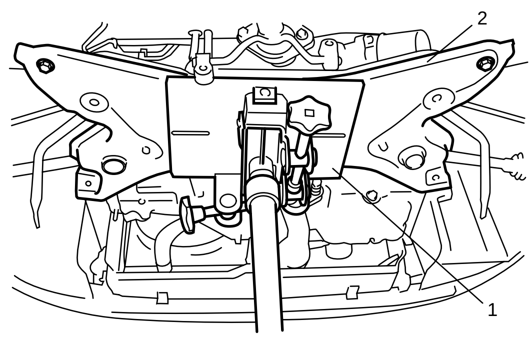
11) Remove engine rear mounting bolts (1) from engine rear mounting (2).



I4RS0A220041-01

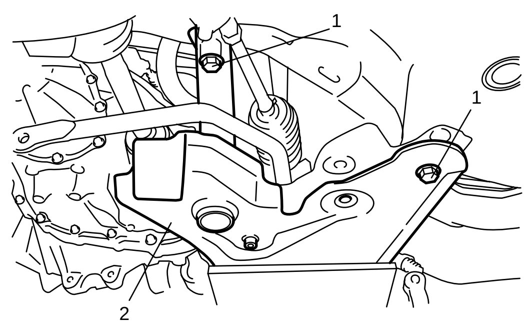
3. Suspension frame

12) Support front suspension frame (2) by using mission jack (1).



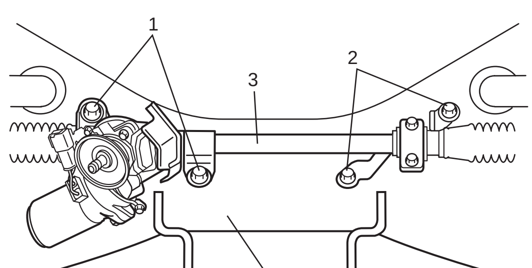
I4RS0A220042-01

13) Remove front suspension frame mounting bolts (1), and then lower mission jack and remove front suspension frame (2) with stabilizer bar and steering gear case.



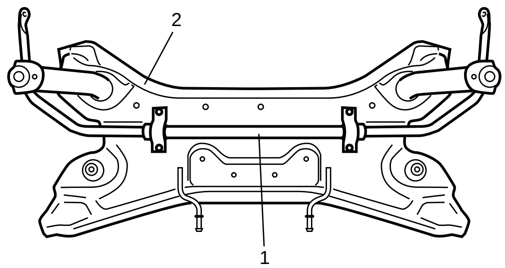
I4RS0A220043-01

14) Remove steering gear case mounting No.1 bolts (1) and No.2 bolts (2), then remove gear case (3) from front suspension frame (4).



I4RS0B220010-02

15) Remove stabilizer bar (1) and bushing from front suspension frame (2).



I4RS0A220044-01

Installation

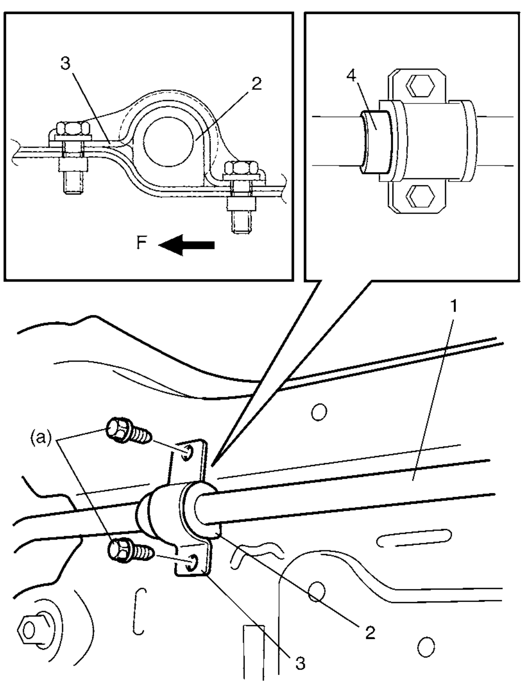
1) When installing stabilizer, loosely assemble all components while insuring that stabilizer is centered, side-to-side.
2) Install stabilizer bar (1), stabilizer bushing (2) and stabilizer mounting bracket (3) to front suspension frame as shown in figure.

NOTE

For correct installation of stabilizer bar, side-to-side, be sure that stopper ring (4) on stabilizer bar aligns with mount bush, both right and left, as shown in figure.

3) Tighten stabilizer bar mounting bracket bolts to specified torque.

Tightening torque
Stabilizer bar mounting bracket bolt (a): 23 N·m (2.3 kgf-m, 17.0 lb-ft)

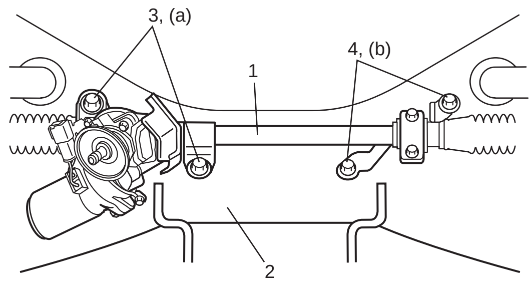


I4RS0A220055-01

F: Forward

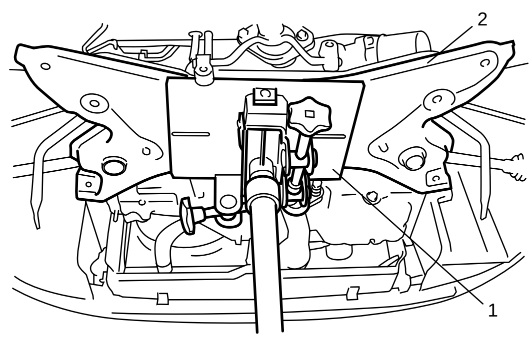
4) Mount steering gear case (1) to front suspension frame (2) and tighten gear case mounting No.1 bolts (3) and No.2 bolts (4) to specified torque.

Tightening torque
Steering gear case mounting No.1 bolt (a): 55 N·m (5.5 kgf-m, 40.0 lb-ft)
Steering gear case mounting No.2 bolt (b): 55 N·m (5.5 kgf-m, 40.0 lb-ft)



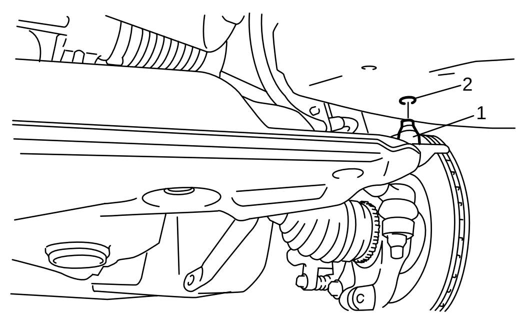
I4RS0B220011-02

5) Support front suspension frame (2) with stabilizer bar by using mission jack (1), and jack up it.



I4RS0A220046-01

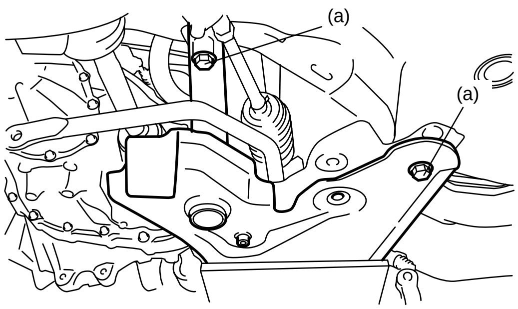
6) Align lugs (1) (right and left) of front suspension frame with holes (2) in vehicle body respectively.



I4RS0A220047-01

7) Tighten front suspension frame mounting bolts (a) to specified torque.

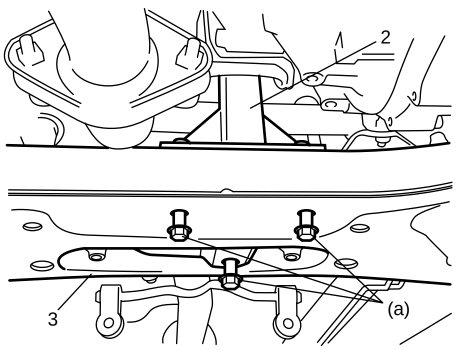
Tightening torque
Front suspension frame mounting bolt (a): 150 N·m (15.0 kgf-m, 108.5 lb-ft)



I4RS0A220048-01

8) Lower mission jack.
9) Tighten engine rear mounting bolts (a) to specified torque.

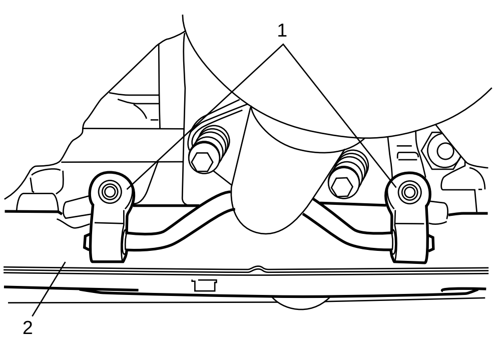
Tightening torque
Engine rear mounting bolt (a): 55 N·m (5.5 kgf-m, 40.0 lb-ft)



I4RS0A220049-01

2. Engine rear mounting	3. Suspension frame

10) Connect muffler No.1 mounting (1) to front suspension frame (2).

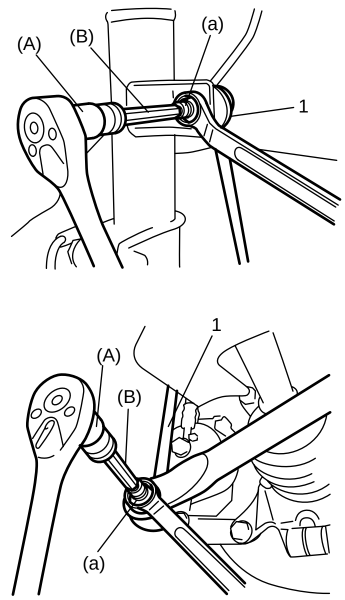


I4RS0A220040-01

11) Remove supporting device from engine.
12) Install stabilizer joints (1), and tighten nuts to specified torque.
When tightening, hold stud with special tools.

Special tool
(A): 09900–00411 socket
(B): 09900–00413 5 mm

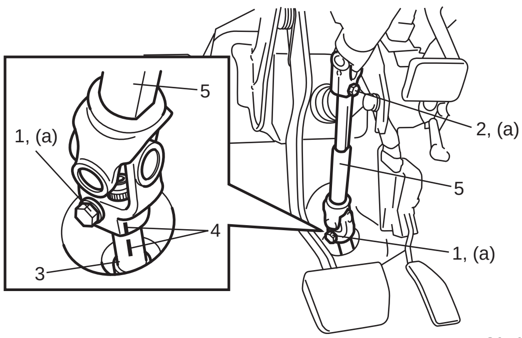
Tightening torque
Stabilizer joint nut (a): 50 N·m (5.0 kgf-m, 36.5 lb-ft)



I4RS0A220051-01

13) Install suspension control arm referring to “Suspension Control Arm / Bushing Removal and Installation”.
14) Connect couplers of torque sensor and P/S motor.
15) Connect tie-rod ends to knuckles (right & left) and then install cotter pins referring to “Tie-Rod End Removal and Installation in Section 6C”.
16) Be sure that steering wheel and brake discs (right & left) are all straight-ahead position and then insert steering lower shaft (5) into steering pinion shaft (3) with matching marks (4).
17) Tighten steering shaft joint lower bolt (1) and upper bolt (2) to specified torque (Lower side first and then upper side).

Tightening torque
Steering shaft joint bolt (a): 25 N·m (2.5 kgf-m, 18.5 lb-ft)



I4RS0B630016-01

18) Install both wheels and tighten wheel bolts to specified torque.

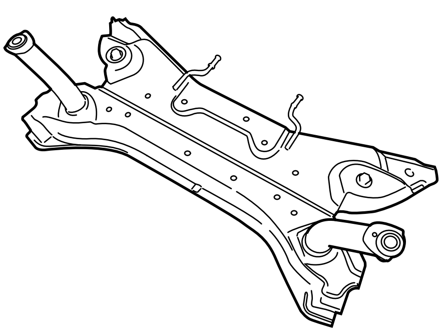
Tightening torque
Wheel bolt: 85 N·m (8.5 kgf-m, 61.5 lb-ft)

19) Lower hoist.
20) Check toe setting. Adjust as required refer to “Front Wheel Alignment Inspection and Adjustment”.

Front Suspension Frame Check

S7RS0B2206016

Inspect for cracks, deformation or damage.
If defective, replace.

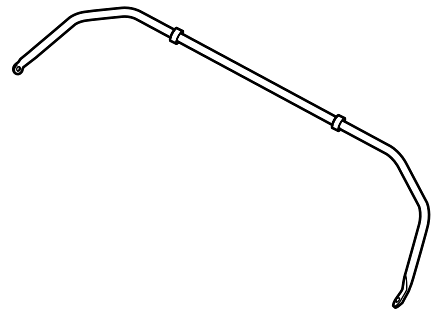

I4RS0A220054-01

Front Stabilizer Bar, Bushing and/or Joint Check

S7RS0B2206017

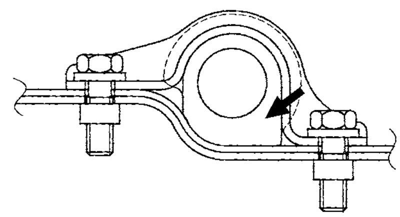
Stabilizer Bar

Inspect for damage or deformation.
If defective, replace.


I4RS0A220052-01

Stabilizer Bushing

Inspect for damage, wear or deterioration.
If defective, replace.


I4RS0A220056-01

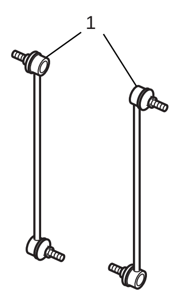
Stabilizer Joint

1) Check for smooth rotation.
2) Check damages of ball stud.
3) Check damages of dust cover.

NOTE

Stabilizer joint (1) cannot be disassembled.

If there is any damage to either parts, stabilizer joint assembly must be replaced as a complete unit.



I4RH01220007-01

Front Suspension Fasteners Check

S7RS0B2206018

Check each bolt and nut fastening suspension parts for tightness. Tighten loose one, if any, to specified torque, referring to “Front Suspension Construction”.

Specifications

Tightening Torque Specifications

S7RS0B2207001

Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
Tie-rod end lock nut	45	4.5	32.5	☞
Strut bracket nut	90	9.0	65.5	☞ / ☞
Brake hose mounting bolt	25	2.5	18.0	☞
Stabilizer joint nut	50	5.0	36.5	☞ / ☞
Strut nut	50	5.0	36.5	☞
Wheel nut	85	8.5	61.5	☞ / ☞ / ☞
Strut support lower nut	50	5.0	36.5	☞
Suspension control arm ball joint nut	60	6.0	43.5	☞ / ☞
Wheel speed sensor mounting bolt	11	1.1	8.0	☞
Caliper carrier bolt	85	8.5	61.5	☞
Drive shaft nut	200	20.0	145.0	☞
Suspension control arm front bolt	95	9.5	68.0	☞
Suspension control arm rear bolt	95	9.5	68.0	☞
Stabilizer bar mounting bracket bolt	23	2.3	17.0	☞
Steering gear case mounting No.1 bolt	55	5.5	40.0	☞
Steering gear case mounting No.2 bolt	55	5.5	40.0	☞
Front suspension frame mounting bolt	150	15.0	108.5	☞
Engine rear mounting bolt	55	5.5	40.0	☞
Steering shaft joint bolt	25	2.5	18.5	☞
Wheel bolt	85	8.5	61.5	☞

NOTE

The specified tightening torque is also described in the following.
"Front Suspension Construction"
"Front Strut Assembly Components"
"Front Wheel Hub and Steering Knuckle Components"
"Front Suspension Frame, Stabilizer Bar and/or Bushings Components"

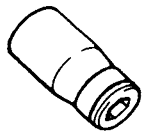
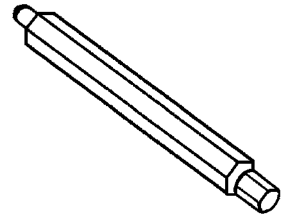
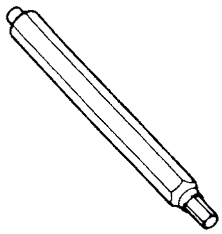
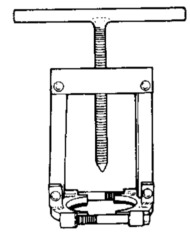
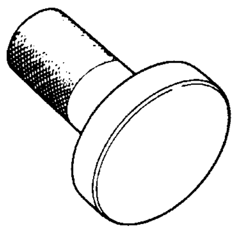
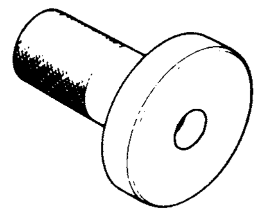
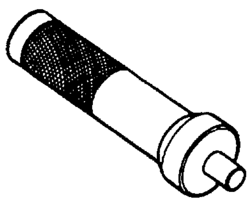
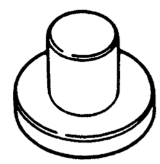
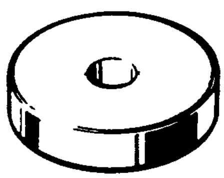
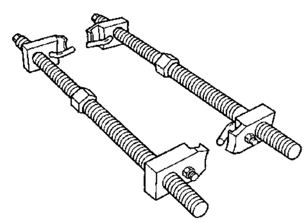
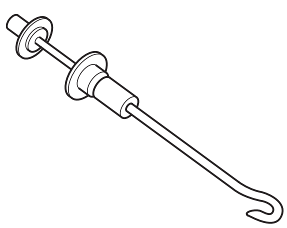
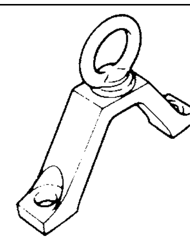
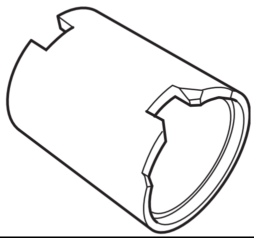
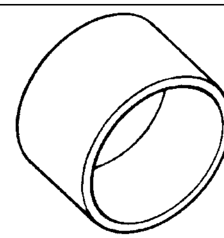
Reference:

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

Special Tools and Equipment

Special Tool

S7RS0B2208001

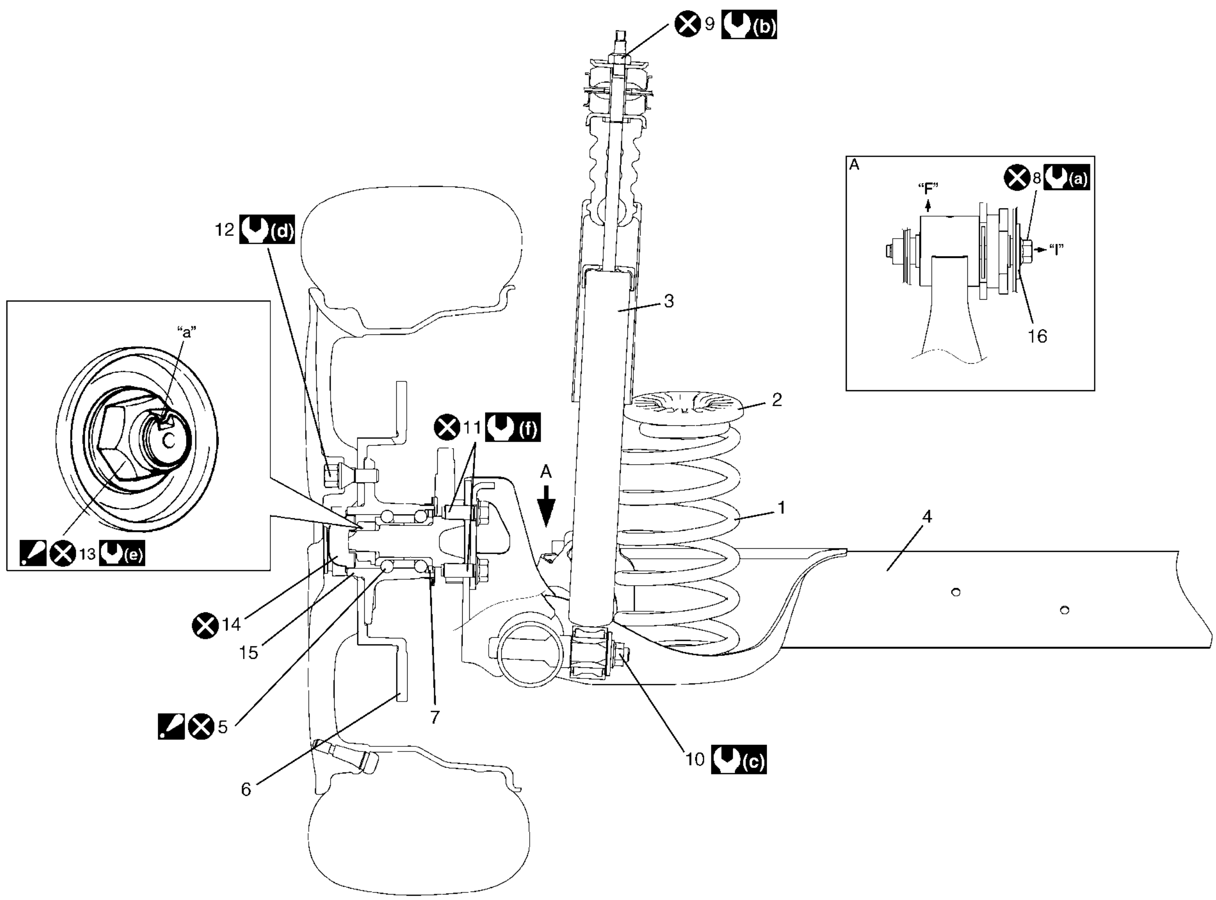
09900–00411 Hexagon bit socket ☞ / ☞ / ☞ / ☞ / ☞ / ☞ 	09900–00413 Hexagon bit (5 mm) ☞ / ☞ / ☞ 
09900–00414 Hexagon bit (6 mm) ☞ / ☞ 	09913–65810 Crankshaft bearing puller ☞ 
09913–75510 Bearing installer ☞ / ☞ 	09913–75520 Bearing installer ☞ 
09913–75821 Bearing installer attachment ☞ / ☞ 	09913–85230 Bearing remover tool ☞ 
09926–68310 Differential bevel pinion bearing installer ☞ 	09940–71431 Suspension spring compressor ☞ / ☞ 
09942–15511 Sliding hammer ☞ 	09943–17912 Wheel hub remover ☞ 
09943–76310 Bush remover ☞ / ☞ 	09951–18210 Oil seal remover & installer No. 2 ☞ 

Rear Suspension

General Description

Rear Suspension Construction

S7RS0B2301001



I6RS0C230001-03

A:	View A	7.	Circlip	14.	Spindle cap	(c) :	90 N·m (9.0 kgf-m, 65.0 lb-ft)
1.	Rear coil spring	8.	Rear trailing arm bolt	15.	Wheel hub	(d) :	85 N·m (8.5 kgf-m, 61.5 lb-ft)
2.	Rear spring upper seat	9.	Rear shock absorber upper nut	16.	Washer	(e) :	175 N·m (17.5 kgf-m, 126.5 lb-ft)
3.	Rear shock absorber	10.	Rear shock absorber lower nut	"F":	Vehicle front	(f) :	88 N·m (8.8 kgf-m, 64.0 lb-ft)
4.	Rear axle	11.	Rear spindle bolt	"I":	Body inside	:	Do not reuse.
5.	Wheel bearing : Seal side of bearing comes brake back plate side.	12.	Wheel nut	(a) :	73 N·m (7.3 kgf-m, 53.0 lb-ft)		
6.	Brake disc	13.	Rear spindle nut : Caulk spindle nut as shown "a".	(b) :	28 N·m (2.8 kgf-m, 20.0 lb-ft)		

Repair Instructions

Rear Wheel Alignment Inspection

S7RS0B2306017

Measure toe and camber referring to "Front Wheel Alignment Inspection and Adjustment in Section 2B".

NOTE

Rear suspension is not adjustable structure.

Rear toe (total)
: IN 3.8 ± 3.8 mm (IN 0.1969 ± 0.1969 in)

Rear camber
: –1° ± 1

If measured value is out of specified value, check following items for damage, deformation and crack.

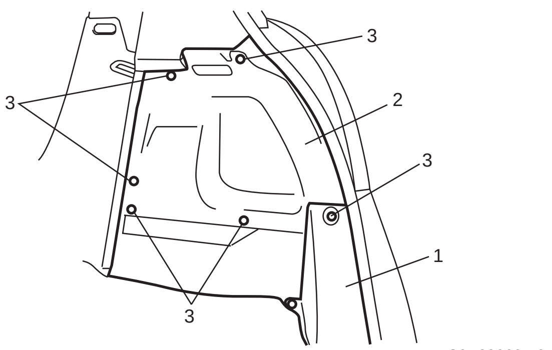
- Rear axle (torsion beam)
- Spindle, wheel hub or wheel bearing
- Vehicle body

Rear Shock Absorber Removal and Installation

S7RS0B2306001

Removal

1) Hoist vehicle and remove rear wheels.
2) Remove tail end member trim (1) and quarter inner trim (2).



3. Clip

3) Support rear axle by using floor jack to prevent it from lowering.
4) Remove shock absorber lower nut.
5) Remove shock absorber upper nut. Then remove shock absorber, a pair of upper washers and lower washer.

Installation

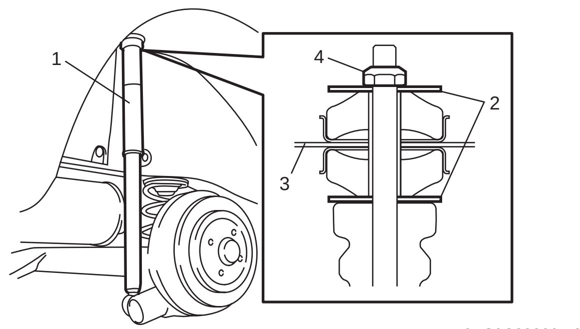
1) Install shock absorber (1), a pair of upper washers (2) and lower washer.
   Tighten new rear shock absorber upper nut (4) and lower nut temporarily at this step.

⚠ **CAUTION**

Never reuse the removed rear shock absorber upper nut.

NOTE

A pair of upper washers (2) are installed as shown in figure.



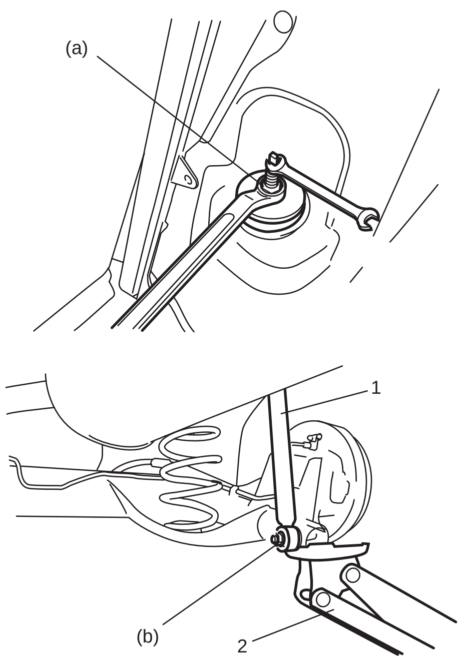
3. Body panel

2) Remove floor jack (2) from rear axle.
3) Install rear wheels and tighten wheel nuts specified torque.

Tightening torque
Wheel nut: 85 N·m (8.5 kgf-m, 61.5 lb-ft)

4) Lower hoist and vehicle in unloaded condition, tighten shock absorber nuts to specified torque.

Tightening torque
Rear shock absorber upper nut (a): 28 N·m (2.8 kgf-m, 20.0 lb-ft)
Rear shock absorber lower nut (b): 90 N·m (9.0 kgf-m, 65.0 lb-ft)



I4RS0B230003-01

5) Install tail end member trim and quarter inner trim.

Rear Shock Absorber Inspection

S7RS0B2306002

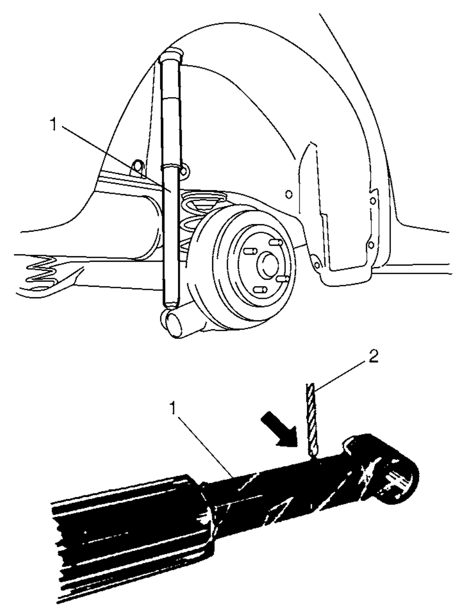
- Inspect for deformation or damage.
- Inspect bushings for wear or damage.
- Inspect for evidence of oil leakage.

Replace any defective parts.

⚠ WARNING

When handling rear shock absorber (1) in which high-pressure gas is sealed, make sure to observe the following precautions.

- **Don't disassemble it.**
- **Don't put it into the fire.**
- **Don't store it where it gets hot.**
- **Before disposing it, be sure to drill a hole (approximately 3 mm (0.12 in.) diameter) (2) in it where indicated by arrow in the figure and let gas and oil out.**
  Be sure to wear eye shield since the gas itself is harmless but the absorber drill hole debris maybe blown out.



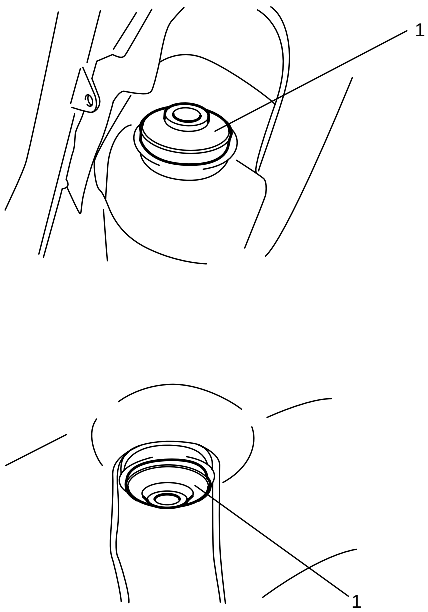
I4RS0A230005-01

Rear Shock Absorber Bush Removal and Installation

S7RS0B2306003

Removal

1) Remove rear shock absorber referring to “Rear Shock Absorber Removal and Installation”.
2) Remove rear shock absorber bushes (1).



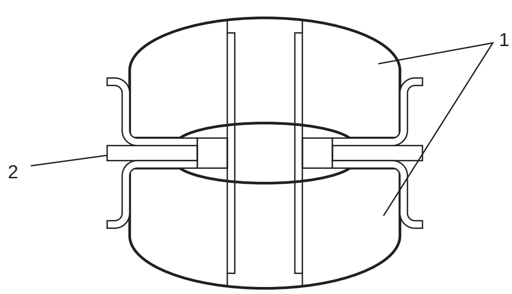
I4RS0A230006-01

Installation

1) Install rear shock absorber bushes (1).

NOTE

For proper installing direction of shock absorber bushes (1), refer to the figure.



I4RS0A230007-01

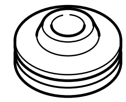
2. Body panel

2) Install rear shock absorber referring to “Rear Shock Absorber Removal and Installation”.

Rear Shock Absorber Bush Inspection

S7RS0B2306004

Inspect for cracks, deformation or damage. Replace any defective parts.



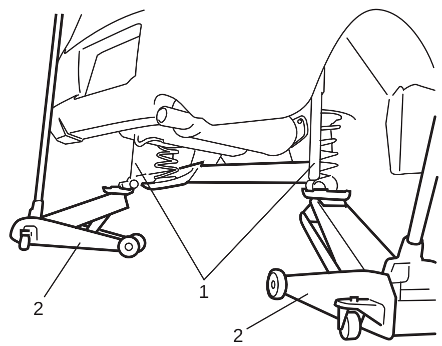
I4RS0A230008-01

Rear Coil Spring Removal and Installation

S7RS0B2306005

Removal

1) Hoist vehicle and remove rear wheels.
2) Support rear axle (1) by using two floor jacks (2) to prevent it from lowering.



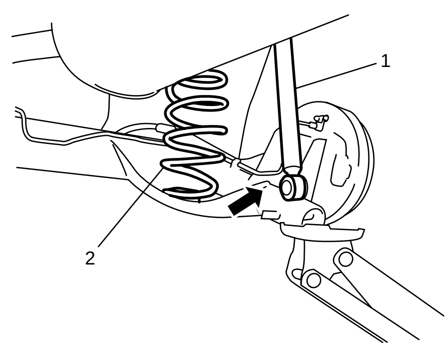
I6RS0C230006-01

3) Detach shock absorbers (1) lower side (right & left) from rear axle.
4) Lower rear axle gradually as far down as the coil spring (2) can be removed.

⚠ CAUTION

Be careful not to lower rear axle down too much.
It may cause damage to brake flexible hose, wheel speed sensor lead wire and parking brake cable.

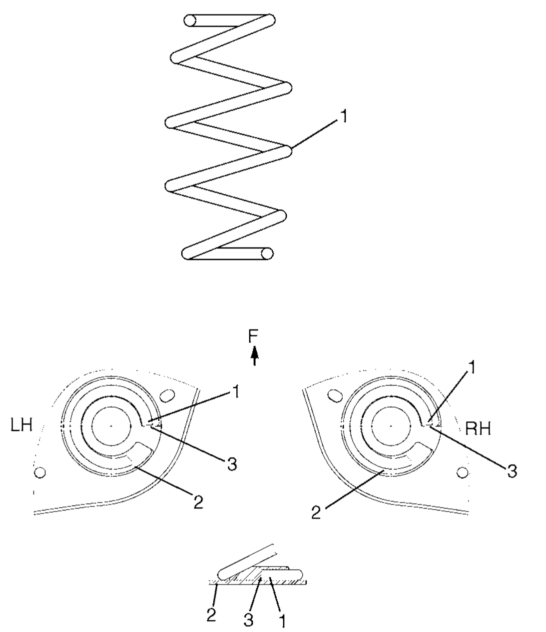
5) Remove coil spring (2).



I4RS0A230010-01

Installation

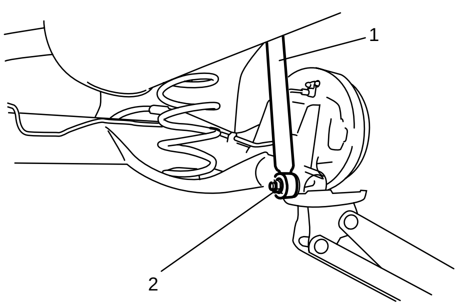
1) Install coil spring (1) on spring seat (2) of rear axle and mate spring open end with stepped part (3) of spring lower seat and raise rear axle.



I4RS0A230011-01

F: Vehicle front

2) Install shock absorbers (1) lower side (right & left) to rear axle.
   Install washers and tighten shock absorber lower nuts (2) temporarily by hand at this step.



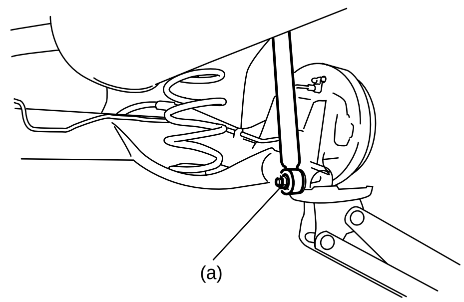
I4RS0A230012-01

3) Remove floor jacks from rear axle.
4) Install wheels and tighten wheel nuts to specified torque.

   Tightening torque
   Wheel nut: 85 N·m (8.5 kgf-m, 61.5 lb-ft)

5) Lower hoist and vehicle in unloaded condition, tighten shock absorber lower nuts (a) to specified torque.

   Tightening torque
   Rear shock absorber lower nut (a): 90 N·m (9.0 kgf-m, 65.0 lb-ft)

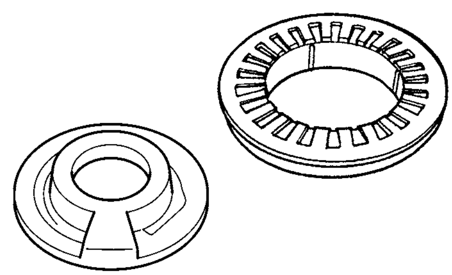


I4RS0A230013-01

Spring Upper Seat / Spring Lower Seat Inspection

S7RS0B2306006

Inspect for cracks, deformation or damage. Replace any defective part.



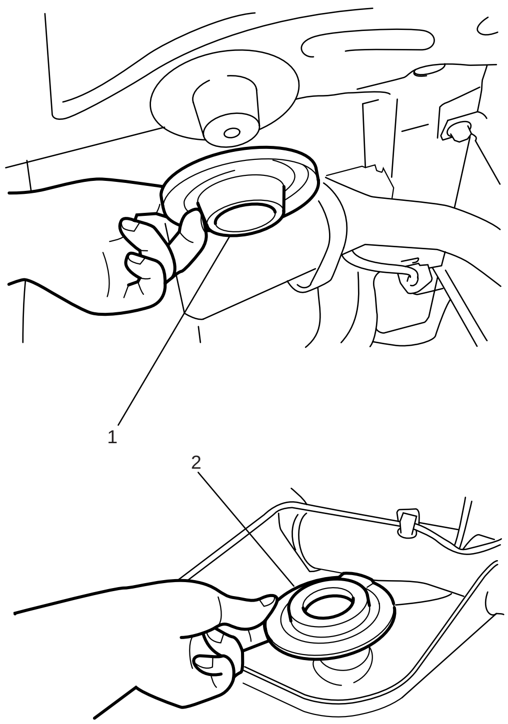
I4RS0A230015-01

Spring Upper Seat and Lower Seat Removal and Installation

S7RS0B2306007

Removal

1) Remove coil spring referring to “Rear Coil Spring Removal and Installation”.
2) Remove spring upper seat (1) and lower seat (2).



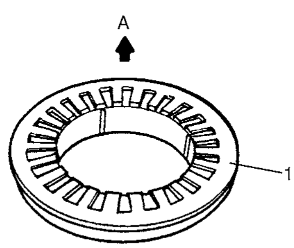
I4RS0A230016-01

Installation

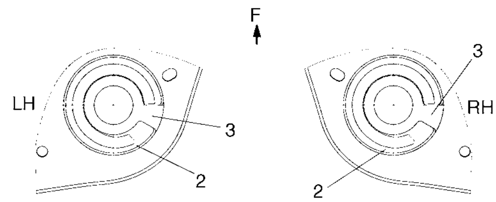
1) Install spring upper seat (1) and lower seat (2).

NOTE

For proper installing direction of spring upper seat (1) and lower seat (2), refer to the figure.



I3RM0A230021-01



I4RS0A230017-01

A:	Vehicle body side (Upper side)
F:	Vehicle front
3.	Stepped part

2) Install coil spring referring to “Rear Coil Spring Removal and Installation”.

Rear Axle Removal and Installation

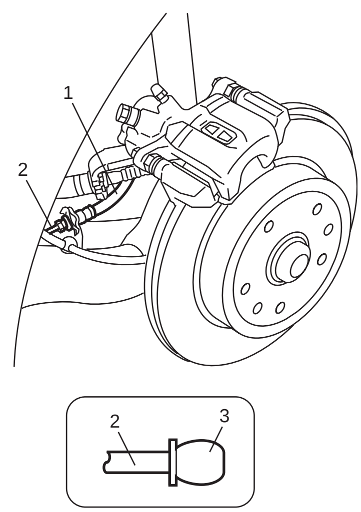
S7RS0B2306008

Removal

1) Hoist vehicle and remove rear wheels (right & left).
2) Disconnect rear brake caliper flexible hoses (1) (right & left) from brake pipes (2) and put bleeder plug cap (3) onto pipe (2) prevent fluid from spilling.

⚠ CAUTION

Do not drop brake fluid onto painted surface.

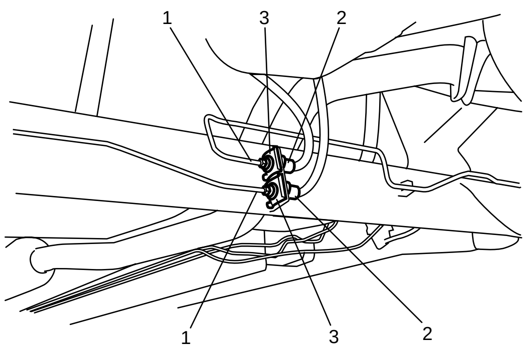


I6RS0B230002-01

3) Remove rear brake caliper assemblies (right & left) and brake discs (right & left). For details, refer to Step 2) to 3) of "Removal" under "Rear Brake Disc Removal and Installation in Section 4C".
4) Remove rear wheel hubs (right & left). For details, refer to Step 3) to 5) of "Removal" under "Rear Wheel Hub Removal and Installation".
5) Disconnect brake pipes (1) from brake hoses (2) and remove E-rings (3).

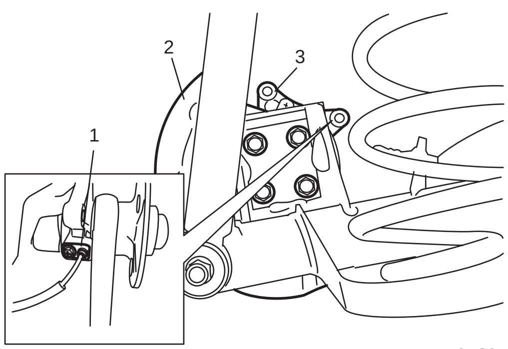
⚠ CAUTION

Do not drop brake fluid onto painted surface.



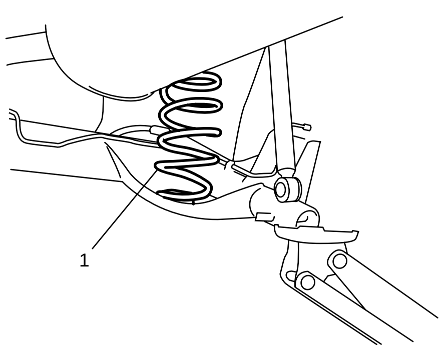
I4RS0A230018-01

6) Disconnect wheel speed sensors (1) and lead wire clamps (right & left).
7) Remove brake disc dust cover (2) and spindles (3) (right & left) from rear axle.



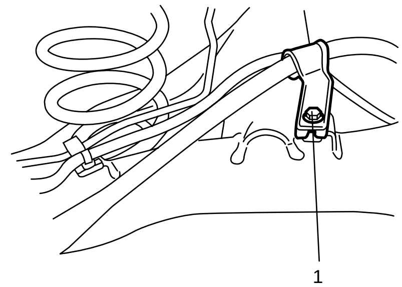
I6RS0B230003-01

8) Remove coil springs (1) (right & left) referring to "Rear Coil Spring Removal and Installation".



I4RS0A230020-01

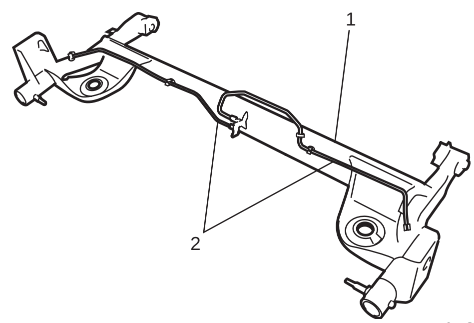
9) Disconnect wheel speed sensor clamp and parking brake cable clamp from rear axle.



I4RS0A230021-01

1. Parking brake cable clamp bolt

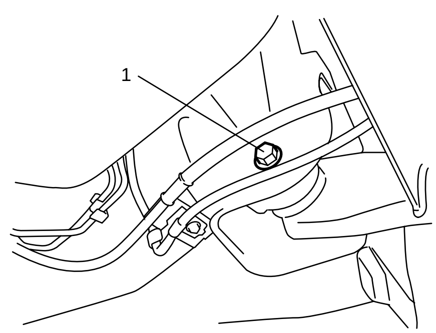
10) While supporting rear axle (1) at both ends (right & left), remove rear trailing arm bolts and then remove rear axle from chassis by lowering floor jack gradually.
11) Remove brake pipes (2) from rear axle (1) if necessary.



I6RS0B230004-01

Installation

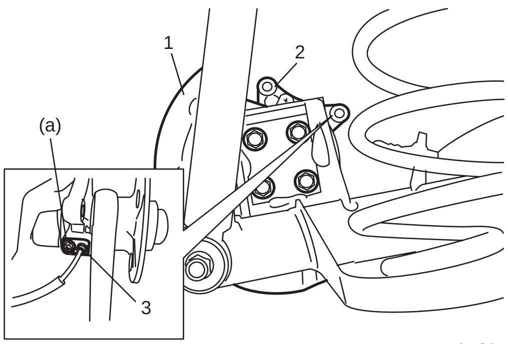
1) Install brake pipes to rear axle.
2) Place rear axle on floor jacks.
   Then install trailing arm, washers and new trailing arm bolts (1) (right & left) and tighten bolts temporarily by hand.



I4RS0A230023-01

3) Install coil springs (right & left) on spring seats of rear axle referring to "Spring Upper Seat and Lower Seat Removal and Installation" and "Rear Coil Spring Removal and Installation".
4) Install shock absorbers lower side (right & left) and washers referring to "Rear Shock Absorber Removal and Installation".
5) Install brake dust covers, spindles and wheel speed sensors (right and left) referring to "Spindle Removal and Installation".
6) Connect wheel speed sensors (1) and lead wire clamps (2) (right & left).

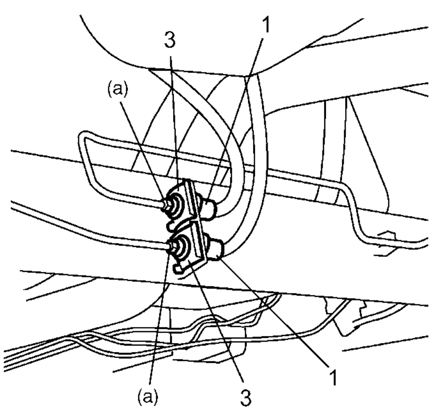
Tightening torque
Wheel speed sensor bolt (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)



I6RS0B230005-01

7) Connect brake flexible hoses (1) to bracket on rear axle with E-rings (3) (right & left) and tighten brake pipe flare nuts (a) to specified torque.

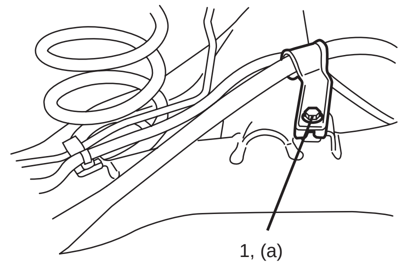
Tightening torque
Brake pipe flare nut (a): 16 N·m (1.6 kgf-m, 11.5 lb-ft)



I4RS0A230028-01

8) Install wheel speed sensor clamp and parking brake clamp and tighten parking brake clamp bolts (1) to specified torque.

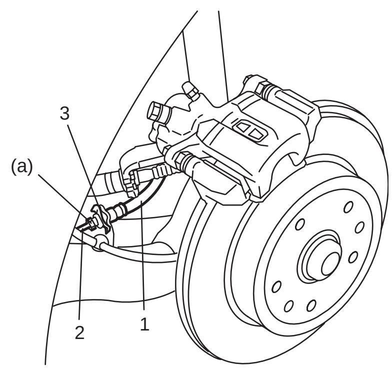
Tightening torque
Parking brake cable clamp bolt (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)



I6RS0B230006-01

9) Install rear wheel hubs (right & left) referring to "Rear Wheel Hub Removal and Installation".
10) Install brake discs (right & left) and rear brake caliper assemblies (right & left) referring to "Rear Brake Disc Removal and Installation in Section 4C".
11) Connect rear brake caliper flexible hoses (1) to brake pipes (2) with E-rings (3) (right & left). Tighten brake pipe flare nuts to specified torque.

Tightening torque
Brake pipe flare nut (a): 16 N·m (1.6 kgf-m, 11.5 lb-ft)



I6RS0B230007-01

12) Fill reservoir with brake fluid and bleed brake system. For bleeding operation, see “Air Bleeding of Brake System in Section 4A”.
13) Install wheel and tighten wheel nuts to specified torque.

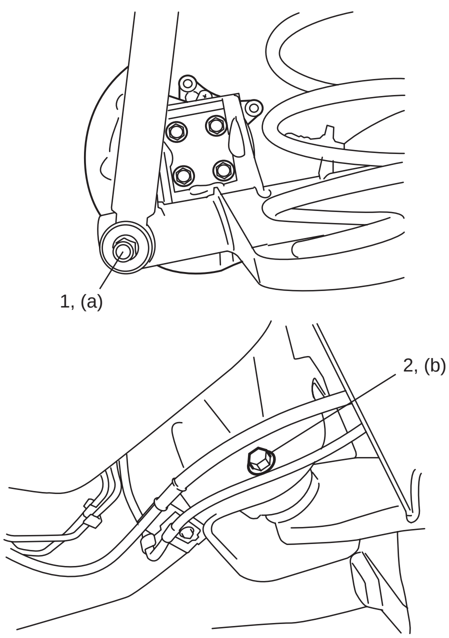
    Tightening torque
    Wheel nut: 85 N·m (8.5 kgf-m, 61.5 lb-ft)

14) Adjust parking brake cable. For adjustment, refer to “Parking Brake Inspection and Adjustment in Section 4D”.
15) Lower hoist and bounce vehicle up and down several times to stabilize suspension.
16) Tighten shock absorber lower nuts (1) and trailing arm bolts (2) to specified torque.

    NOTE

    When tightening these nuts and bolts, be sure that vehicle is not on hoist and in unloaded condition.

    Tightening torque
    Rear shock absorber lower nut (a): 90 N·m (9.0 kgf-m, 65.0 lb-ft)
    Trailing arm bolt (b): 73 N·m (7.3 kgf-m, 53.0 lb-ft)



I6RS0B230008-01

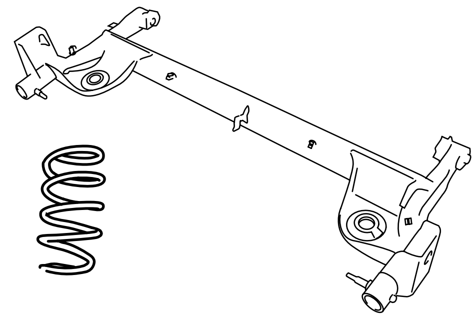
17) Perform brake test (foot brake and parking brake).
18) Check each installed part for fluid leakage.

Trailing Arm, Rear Axle and Coil Spring Inspection

S7RS0B2306009

- Inspect for cracks, deformation or damage.
- Inspect bushing for damage, wear or breakage.

Replace any defective part.



I4RS0A230031-01

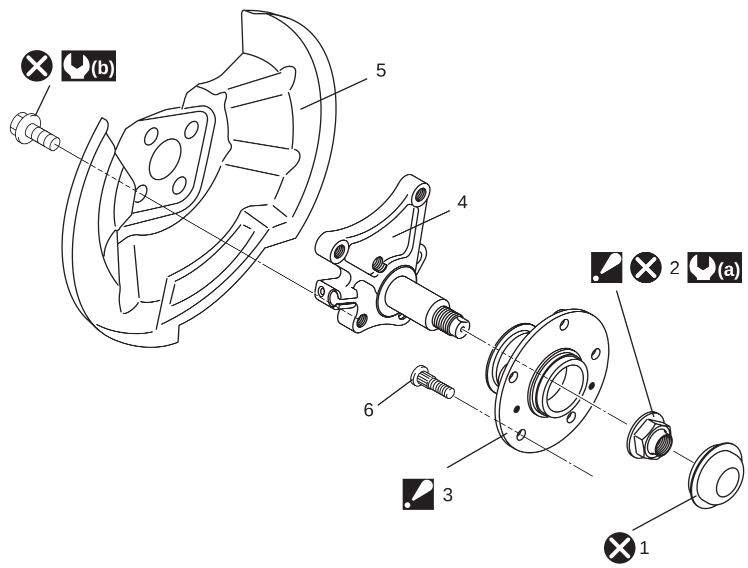
Rear Axle Bush Inspection

S7RS0B2306010

Inspect for cracks, deformation or damage. Replace any defective part.

Rear Wheel Hub Components

S7RS0B2306011



I6RS0C230002-03

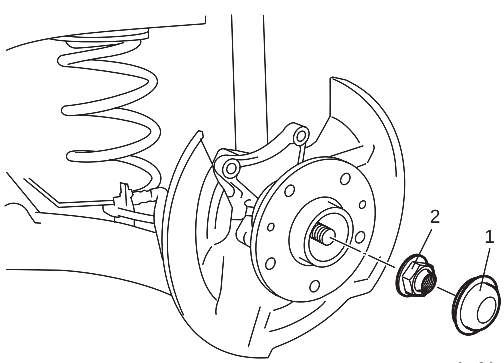
1. Spindle cap	4. Spindle	(a) : 175 N·m (17.5 kgf-m, 126.5 lb-ft)
2. Rear axle nut :Calk, after Tightening	5. Disc dust cover	(b) : 88 N·m (8.8 kgf-m, 64.0 lb-ft)
3. Rear wheel hub :Never disassemble wheel hub assembly	6. Hub bolt	: Do not reuse.

Rear Wheel Hub Removal and Installation

S7RS0B2306012

Removal

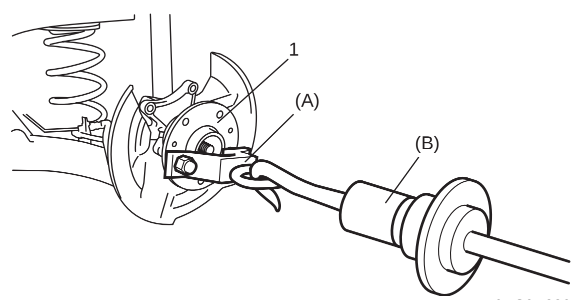
1) Hoist vehicle and remove wheel.
2) Remove rear brake caliper assembly and rear brake disc referring to “Rear Brake Disc Removal and Installation in Section 4C”.
3) Remove spindle cap (1) by hammering lightly at 3 locations around it so as not to deform or cause damage to seating part of cap.
4) Uncaulk and remove rear axle nut (2).



I6RS0B230010-01

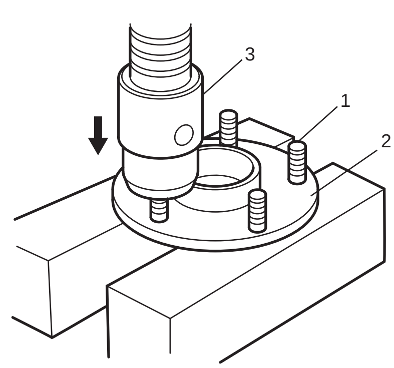
5) Using special tools, draw out wheel hub (1).

Special tool
(A): 09943–17912
(B): 09942–15511



I6RS0B230011-01

6) Remove wheel stud bolt (1) from wheel hub (2) by using hydraulic press (3).

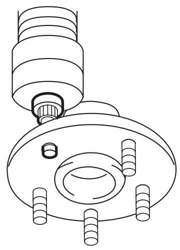


I6RS0C230003-01

Installation

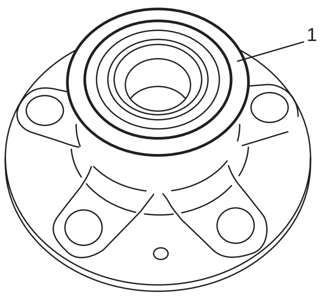
Install wheel hub by reversing removal procedure noting the following instructions.

- Insert new wheel stud bolt in wheel hub hole and rotate it slowly to assure serrations are aligned with those made by replaced bolt.



I6RS0C230004-01

- Never apply grease to encoder (1).



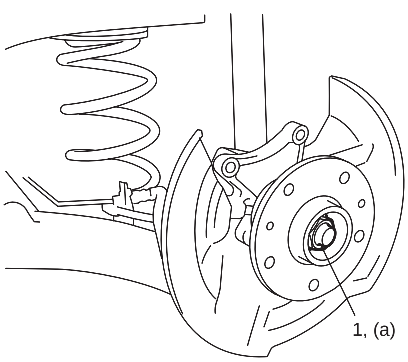
I6RS0B230012-01

- Install new rear axle nut (1) and tighten to specified torque.

⚠ CAUTION

Never reuse rear axle nut. Otherwise, nut may loosen.

Tightening torque
Rear axle nut (a): 175 N·m (17.5 kgf-m, 126.5 lb-ft)



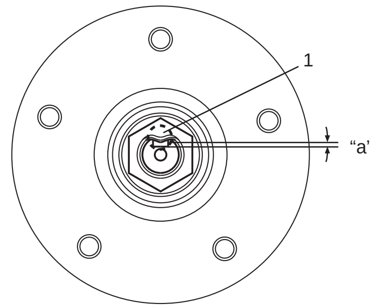
I6RS0B230013-01

- Caulk new rear axle nut (1) as shown.

⚠ CAUTION

Take care while staking nut. If a split occurs in staked area of nut, replace it with new one.

Stake specification
"a": 0.5 mm (0.02 in.) or more



I6RS0B230014-01

- Install new spindle cap.

Rear Wheel Disc, bolt and Bearing Inspection

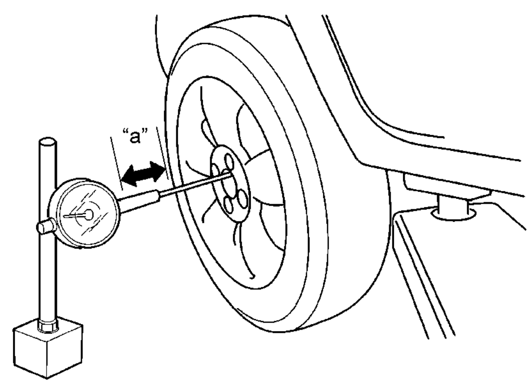
S7RS0B2306013

- Check tightness of wheel nuts and, if necessary, retighten to specified torque.
- Check wheel disc deformation, damage, crack and etc.
  Replace defective disc with new one.
- Check installation face inside of wheel disc for rust. As rust affects adversely, remove it thoroughly.

Tightening torque
Wheel nut: 85 N·m (8.5 kgf-m, 61.5 lb-ft)

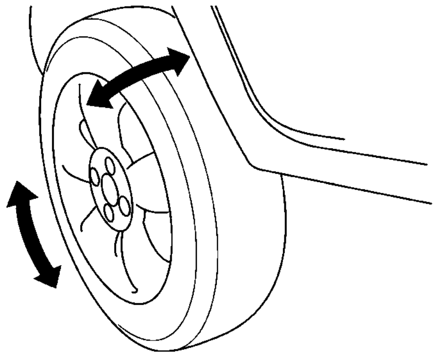
- Check wear of wheel bearings. When measuring thrust play, apply a dial gauge to axle shaft center. When the thrust play exceeds limit, replace bearing.

Rear wheel bearing thrust play limit
"a": 0.1 mm (0.004 in.)



I7RS0A230002-02

- Check noise and smooth rotation of wheel by rotating wheel. If it is defective, replace bearing.



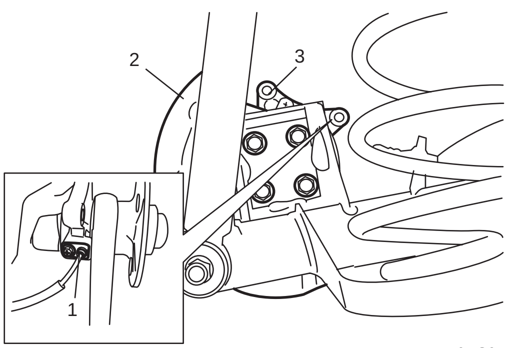
I3RM0A230050-01

Spindle Removal and Installation

S7RS0B2306014

Removal

1) Remove rear brake caliper assembly and brake disc. For details, refer to Step 2) to 4) of “Removal” under “Rear Brake Disc Removal and Installation in Section 4C”.
2) Remove rear wheel hub. For details, refer to Step 3) to 5) of “Removal” under “Rear Wheel Hub Removal and Installation”.
3) Disconnect wheel speed sensor (1).
4) Remove brake disc dust cover (2) and spindle (3) from rear axle.



I6RS0B230015-01

Installation

1) Install brake disc dust cover (1), spindle (2) and new spindle bolts (3) and then tighten spindle bolts to specified torque.

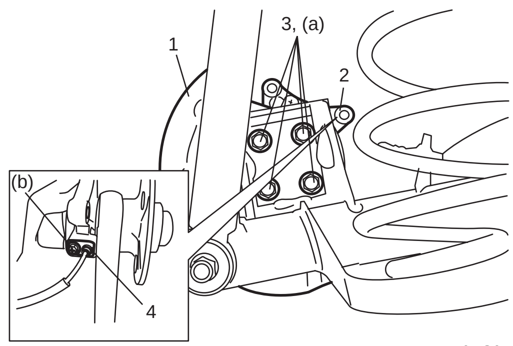
⚠ **CAUTION**

Never reuse the removed rear spindle bolts.
Bolts are pre-coated with friction stabilizer.
Be sure to replace pre-coated bolt with a new one, or bolt may loosen.

Tightening torque
Rear spindle bolt (a): 88 N·m (8.8 kgf-m, 64.0 lb-ft)

2) Connect wheel speed sensor (4) and tighten wheel speed sensor bolt to specified torque.

Tightening torque
Wheel speed sensor bolt (b): 11 N·m (1.1 kgf-m, 8.0 lb-ft)



I6RS0B230016-01

3) Install rear wheel hub referring to “Rear Wheel Hub Removal and Installation”.
4) Install brake disc and rear brake caliper assembly referring to “Rear Brake Disc Removal and Installation in Section 4C”.
5) Install wheel and tighten wheel nuts to specified torque.

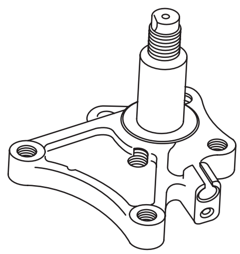
Tightening torque
Wheel nut: 85 N·m (8.5 kgf-m, 61.5 lb-ft)

6) Adjust parking brake cable. For adjustment, see “Parking Brake Inspection and Adjustment in Section 4D”.
7) Perform brake test (foot brake and parking brake).
8) Check each installed part for fluid leakage.

Spindle Inspection

S7RS0B2306015

- Inspect for cracks, deformation or damage. Replace any defective part.



I6RS0B230017-01

Rear Suspension Fasteners Inspection

S7RS0B2306016

Check each bolt and nut fastening suspension parts for tightness. Tighten loose one, if any, to specified torque referring to the figure in “Rear Suspension Construction”.

Specifications

Tightening Torque Specifications

S7RS0B2307001

Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
Wheel nut	85	8.5	61.5	/ / / /
Rear shock absorber upper nut	28	2.8	20.0	
Rear shock absorber lower nut	90	9.0	65.0	/ /
Wheel speed sensor bolt	11	1.1	8.0	/
Brake pipe flare nut	16	1.6	11.5	/
Parking brake cable clamp bolt	11	1.1	8.0	
Trailing arm bolt	73	7.3	53.0	
Rear axle nut	175	17.5	126.5	
Rear spindle bolt	88	8.8	64.0	

NOTE

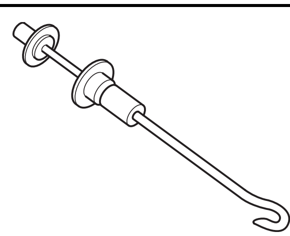
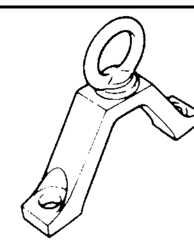
The specified tightening torque is also described in the following.
“Rear Suspension Construction”
“Rear Wheel Hub Components”

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

S7RS0B2308001

09942–15511 Sliding hammer 	09943–17912 Wheel hub remover 

Wheels and Tires

Precautions

Precaution for Emergency Flat Tire Repair Kit

S7RS0B2400001

WARNING

Flat tire repair sealant including in kit is harmful. Be sure to observe the following. Otherwise, your health may be ruined.

- **If swallowed, get medical attention immediately.**
- **Keep out of reach of children.**
- **Select place where there is good ventilation for this work.**
- **If it enters eye or contacts skin, wash thoroughly with water. If anything abnormal still remains, get medical attention immediately.**
- **Do not discard tire containing sealant as it is. Make sure to remove sealant from tire, referring to “Tire Repair for Emergency Repaired-Tire with Sealant”.**
- **Dispose of sealant as waste oil.**

⚠ CAUTION

- **When tire repaired with Emergency Flat Tire Repair Kit is brought in, remove flat tire repair sealant from tire and repair flat tire referring to “Tire Repair for Emergency Repaired-Tire with Sealant”.**
- **Sealant expiration date is printed on bottle label. if it expires, sealant should be replaced with a new one to ensure emergency flat tire repair.**

General Description

Tires Description

S7RS0B2401001

The tire is of tubeless type. The tire is designed to operate satisfactorily with loads up to the full rated load capacity when inflated to the recommended inflation pressures.
Correct tire pressures and driving habits have an important influence on tire life. Heavy cornering, excessively rapid acceleration, and unnecessary sharp braking increase tire wear.

Tire Placard

The “Tire Placard” is located on the left or right door lock pillar and should be referred to tire information.
The placard lists the maximum load, tire size and cold tire pressure where applicable.

NOTE

Whether rim size and/or maximum load are listed or not depends on regulations of each country.

Inflation of Tires

The pressure recommended for any model is carefully calculated to give a satisfactory ride, stability, steering, tread wear, tire life and resistance to bruises.
Tire pressure, with tires cold, (after vehicle has set for 3 hours or more, or driven less than one mile) should be checked monthly or before any extended trip. Set to the specifications on the “Tire Placard” located on the left door lock pillar.
It is normal for tire pressure to increase when the tires become hot during driving.
Do not bleed or reduce tire pressure after driving. Bleeding reduces the “Cold Inflation Pressure”.

Higher than recommended pressure can cause:

- Hard ride
- Tire bruising or carcass damage
- Rapid tread wear at center of tire

Unequal pressure on same axle can cause:

- Uneven braking
- Steering lead
- Reduced handling
- Swerve on acceleration

Lower than recommended pressure can cause:

- Tire squeal on turns
- Hard Steering
- Rapid and uneven wear on the edges of the tread
- Tire rim bruises and rupture
- Tire cord breakage
- High tire temperature
- Reduced handling
- High fuel consumption

Replacement Tires

When replacement is necessary, the original equipment type tire should be used. Refer to the Tire Placard. Replacement tires should be of the same size, load range and construction as those originally on the vehicle. Use of any other size or type tire may affect ride, handling, speedometer / odometer calibration, vehicle ground clearance and tire or snow chain clearance to the body and chassis.

It is recommended that new tires be installed in pairs on the same axle. If necessary to replace only one tire, it should be paired with the tire having the most tread, to equalize braking traction.

⚠ WARNING

Do not mix different types of tires on the same vehicle such as radial, bias and bias-belted tires except in emergencies, because handling may be seriously affected and may result in loss of control.

The metric term for tire inflation pressure is the kilo pascal (kPa). Tire pressures is usually printed in both kPa and kgf/cm^2 on the "Tire Placard".

Metric tire gauges are available from tool suppliers.

The chart, shown the table, converts commonly used inflation pressures from kPa to kgf/cm^2 and psi.

	kPa	kgf/cm^2	psi
Conversion: 1 psi = 6.895 kPa 1 kgf/cm^2 = 98.066 kPa	160	1.6	23
	180	1.8	26
	200	2.0	29
	220	2.2	32
	240	2.4	35
	260	2.6	38
	280	2.8	41
	300	3.0	44

Wheels Description

S7RS0B2401002

Wheel Maintenance

Wheel repairs that use welding, heating, or peening are not approved. All damaged wheels should be replaced.

Replacement Wheels

Wheels must be replaced if they are bent, dented, have excessive lateral or radial runout, air leak through welds, have elongated bolt holes, if lug wheel bolts won't stay tight, or if they are heavily rusted. Wheels with greater runout than shown in the following may cause objectional vibrations.

Replacement wheels must be equivalent to the original equipment wheels in load capacity, diameter, rim with offset and mounting configuration. A wheel of improper size or type may affect wheel and bearing life, brake cooling, speedometer / odometer calibration, vehicle ground clearance and tire clearance to body and chassis.

How to Measure Wheel Runout

To measure the wheel runout, it is necessary to use an accurate dial indicator. The tire may be on or off the wheel. The wheel should be installed to the wheel balancer of the like for proper measurement.

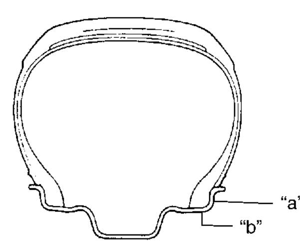
Take measurements of both lateral runout "a" and radial runout "b" at both inside and outside of the rim flange.

With the dial indicator set in place securely, turn the wheel one full revolution slowly and record every reading of the indicator.

When the measured runout exceeds the specification and correction by the balancer adjustment is impossible, replace the wheel. If the reading is affected by welding, paint or scratch, it should be ignored.

Lateral runout limit "a"
: 0.3 mm (0.012 in.)

Radial runout limit "b"
: 0.3 mm (0.012 in.)



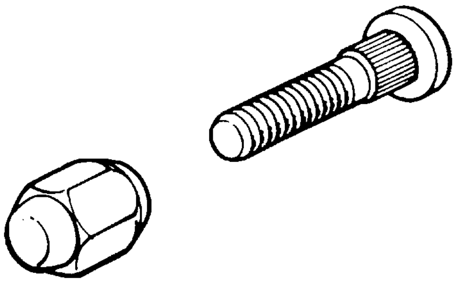
I4RS0A240001-01

Metric Lug Nuts and Wheel Studs

All models use metric lug nuts and wheel studs.

Metric lug nuts and wheel studs size
M12 x 1.25

If broken stud or nut are found, be sure to replace both stud and nut with new one.



I2RH01240003-01

Irregular and/or Premature Wear Description

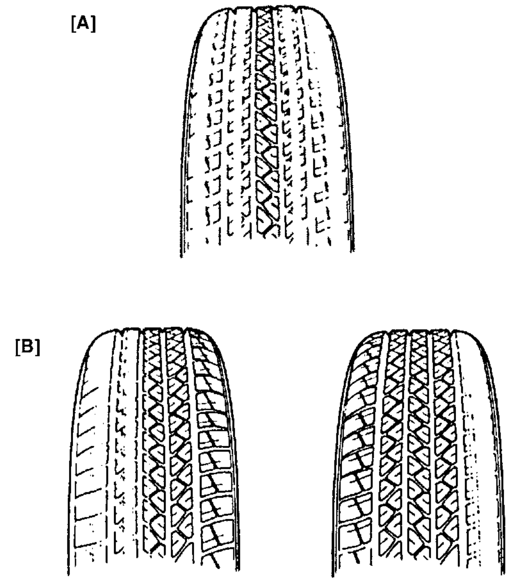
S7RS0B2401003

Irregular and premature wear has many causes. Some of them are as follows: incorrect inflation pressures, lack of tire rotation, driving habits, improper alignment.
If the following conditions are noted, tire rotation is necessary:

- Front tire wear is different from rear's.
- Uneven wear exists across tread of any tires.
- Both sides of front tire wears are not even.
- Both sides of rear tire wears are not even.
- There is cupping, flat spotting, etc.

A wheel alignment check is necessary if following conditions are noted:

- Both sides of front tire wears are not even.
- Wear is uneven across the tread of any front tire.
- Front tire treads have scuffed appearance with "feather" edges on one side of tread ribs or blocks.



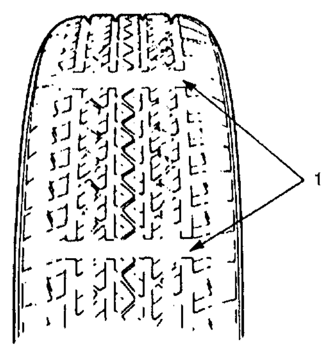
I3RH0A240002-01

[A]:	Hard Cornering, under inflation or lack of tire rotation
[B]:	Incorrect wheel alignment, tire construction not uniform or wheel heavy acceleration

Wear Indicators Description

S7RS0B2401004

Original equipment tires have built-in tread wear indicators (1) to show when they need replacement.
These indicators (1) will appear as 12 mm (0.47 in) wide bands when the tire tread depth becomes 1.6 mm (0.063 in).
When the indicators (1) appear in 3 or more grooves at 6 locations, tire replacement is recommended.



I2RH01240005-01

Radial Tire Waddle Description

S7RS0B2401005

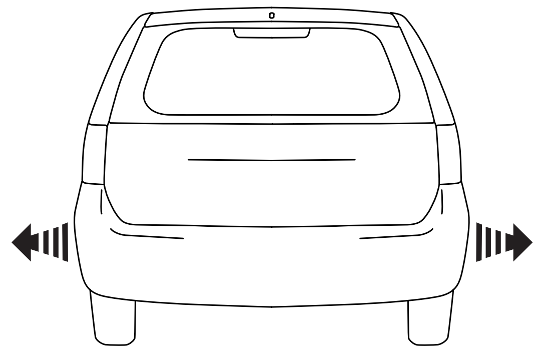
Waddle is side to side movement at the front and/or rear of the vehicle. It is caused by the steel belt not being straight within the tire. It is most noticeable at a low speed, 8 to 48 kph (5 to 30 mph).

It is possible to locate the faulty tire by road testing the vehicle. If it is on the rear, the rear end of the vehicle shakes from side to side or “waddles”. To the driver in the seat, it feels as though someone is pushing on the side of vehicle.

If the faulty tire is on the front, waddling is more visual. The front sheet metal appears to be moving back and forth and the driver feels as though he is at the pivot point in vehicle.

Waddle can be quickly diagnosed by using Tire Problem Detector (TPD) and following the equipment manufacture’s recommendations.

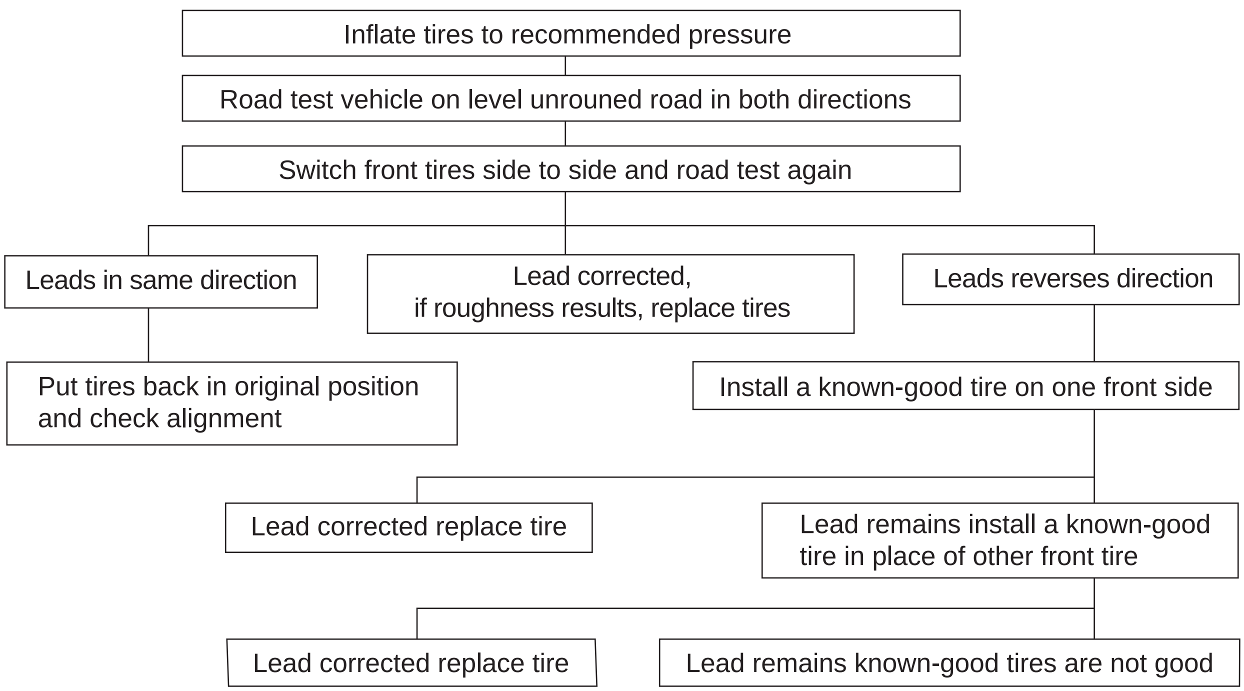
If TPD is not available, an alternative method of substituting known-good tire / wheel assemblies can be used as follows, although it takes a longer time.



I2RH01240006-01

1) Ride vehicle to determine whether the front or rear waddles.
2) Install tires and wheels that are known to be good (on similar vehicle) in place of those on waddling end of vehicle. If waddling end cannot be identified, substitute rear ones.
3) Road test again. If improvement is noted, reinstall originals one at a time till waddle causal tire is found. If no improvement is noted, install known-good tires in place of all four. Then reinstall originals in the same manner.

Equipment manufacture’s recommendations



I2RH01240007-01

Radial Tire Lead / Pull Description

S7RS0B2401006

"Lead / Pull" is the deviation of the vehicle from a straight path on a level road even with no pressure on the steering wheel.
Lead is usually caused by the following conditions.

- Improper tire and wheel alignment.
- Uneven brake assemblies.
- Tire construction.

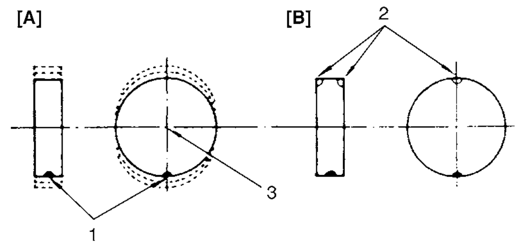
The way in which a tire is built can produce lead in a vehicle. An example of this is placement of the belt. Off center belts on radial tires can cause the tire to develop a side force while rolling straight down the road. If one side of the tire has a little larger diameter than the other, the tire will tend to roll to one side. This will develop a side force which can produce vehicle lead.
The procedure in the figure (Lead Diagnosis) should be used to make sure that wheel alignment is not mistaken for tire lead.

- Part of the lead diagnosis procedure is different from the proper tire rotation pattern currently in the owner and service manuals. If a medium to high mileage tire is moved to the other side of the vehicle, be sure to check that ride roughness has not developed.
- Rear tires will not cause lead.

Balancing Wheels Description

S7RS0B2401007

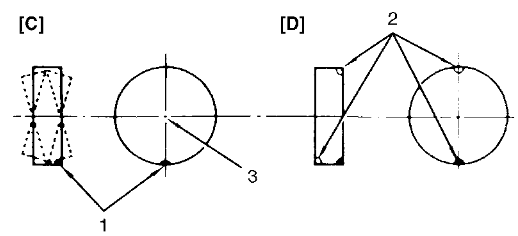
There are two types of wheel and tire balance: static and dynamic. Static balance, as shown in figure, is the equal distribution of weight around the wheel. Wheels that are statically unbalanced cause a bouncing action called tramp. This condition will eventually cause uneven tire wear.



I2RH01240008-01

1. Heavy spot wheel tramp	[A]: Before correction
2. Balance weights addition point	[B]: Corrective weights
3. C/L of spindle	

Dynamic balance, as shown in figure, is the equal distribution of weight on each side of the wheel centerline so that when the tire spins there is no tendency for the assembly to move from side to side. Wheels that are dynamically unbalanced may cause shimmy.



I2RH01240009-01

1. Heavy spot wheel shimmy	[C]: Before correction
2. Balance weights addition point	[D]: Corrective weights
3. C/L of spindle	

Repair Instructions

General Balance Procedures

S7RS0B2406001

Deposits of mud, etc. must be cleaned from inside of rim.

⚠ WARNING

Stones should be removed from the tread in order to avoid operator injury during spin balancing and to obtain good balance.

Each tire should be inspected for any damage, then balanced according to equipment manufacturer's recommendation.

Off-Vehicle Balancing

Most electronic off-vehicle balancers are more accurate than the on-vehicle spin balancers. They are easy to use and give a dynamic (two plane) balance. Although they do not correct for drum or disc unbalance as does on-vehicle spin balancing, this is overcome by their accuracy, usually to within 1/8 ounce.

On-Vehicle Balancing

On-vehicle balancing methods vary with equipment and tool manufacturers. Be sure to follow each manufacturer's instructions during balancing operation.

⚠ WARNING

Wheel spin should be limited to 55 km/h (35 mph) as indicated on speedometer.
This limit is necessary because speedometer only indicates one-half of actual wheel speed when one drive wheel is spinning and the other drive wheel is stopped.
Unless care is taken in limiting drive wheel spin, spinning wheel can reach excessive speeds. This can result in possible tire disintegration or differential failure, which could cause serious personal injury or extensive vehicle damage.

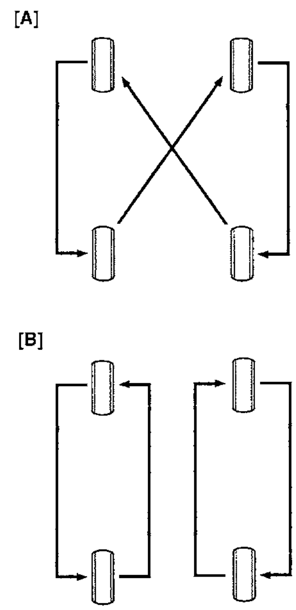
⚠ CAUTION

Using on-vehicle balancing method with ignition switch ON may set malfunction diagnostic trouble code (DTC) of ESP® and ABS even when system is in good condition. Never turn ignition switch ON while spinning wheel.

Tire Rotation

S7RS0B2406002

To equalize wear, rotate tires according to figure. Radial tires should be rotated periodically. Set tire pressure.



I6RS0C240002-01

[A]:	Rotation direction is not indicated.
[B]:	Rotation direction is indicated.

Wheel Removal and Installation

S7RS0B2406003

Removal

⚠ WARNING

Do not removal all of the wheel nuts at once, because all the wheels of this vehicle are mounted by the wheel nuts.
Leave a nut at least not to drop the wheel. Support the wheel and/or tire and then remove the nut(s) left with the wheel.

1) Loosen wheel nuts by approximately 180° (half a rotation).
2) Hoist vehicle.
3) Make sure that the vehicle will not fall off by trying to move vehicle body in both ways.
4) Remove wheel nut except one.
5) Support the wheel and/or tire not to drop the wheel and then remove the nut left with the wheel.

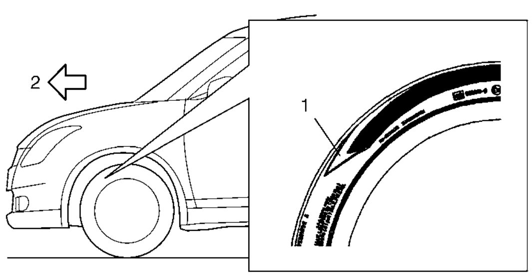
⚠ CAUTION

Never use heat to loosen tight wheel because the application of heat to wheel causes the wheel life shorter and the wheel bearing damage.

Installation

⚠ CAUTION

When installing wheel (with tire) which has arrow (1) indicating tire rotation direction on its side, make sure that arrow direction is same as actual tire rotation direction when vehicle is moving forward (2). Otherwise, water drainage performance and straight line vehicle stability will be affected.



I6RS0B240005-01

For installation, reverse removal procedure, noting the following.

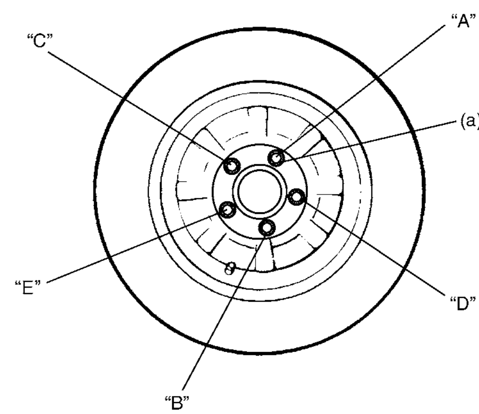
- Wheel nuts must be tightened in sequence and to specified torque to avoid bending wheel or brake disc.

NOTE

Before installing wheels, remove any build-up of corrosion on wheel mounting surface and brake disc mounting surface by scraping and wire brushing. Installing wheels without good metal-to-metal contact at mounting surfaces can cause wheel nuts to loosen, which can later allow a wheel to come off while vehicle is moving.

<u>Tightening order</u>
"A" – "B" – "C" – "D" – "E"

Tightening torque
Wheel nut (a): 85 N·m (8.5 kgf-m, 61.5 lb-ft)



I6RS0C240001-01

Tire Mounting and Dismounting

S7RS0B2406004

⚠ CAUTION

When installing tire which has arrow indicating tire rotation direction to wheel, make sure that this tire rotation direction is same as actual tire rotation direction when vehicle is moving forward. Otherwise, it is not possible to install wheel with tire to vehicle in specified direction.

Use a tire changing machine to mount or dismount tires. Follow equipment manufacturer's instructions. Do not use hand tools or tire irons alone to change tires as they may damage tire beads or wheel rim.
Rim bead seats should be cleaned with a wire brush or coarse steel wool to remove lubricants, old rubber and light rust. Before mounting or dismounting a tire, bead area should be well lubricated with approved tire lubricant.
After mounting, inflate to specified pressure shown on tire placard so that beads are completely seated.

⚠ WARNING

Do not stand over tire when inflating. Bead may break when bead snaps over rim's safety hump and cause serious personal injury.
Do not exceed 330 kpa (47.9 psi) pressure when inflating. If 330 kpa (47.9 psi) pressure will not seat beads, deflate, re-lubricate and reinflate.
Over inflation may cause bead to break and cause serious personal injury.

Install valve core and inflate to proper pressure.

Tire Repair

S7RS0B2406005

There are many different materials and techniques on the market to repair tires. As not all of these work on all types of tires, tire manufacturers have published detailed instructions on how and when to repair tires. These instructions can be obtained from each tire manufacturer.

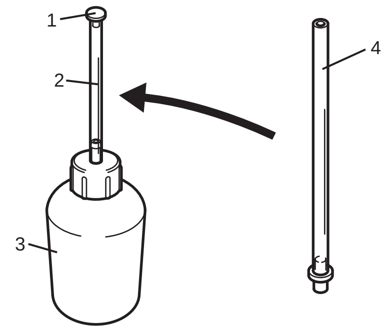
Tire Repair for Emergency Repaired-Tire with Sealant

S7RS0B2406006

⚠ WARNING

Be sure to observe "Precaution for Emergency Flat Tire Repair Kit". Otherwise, your health may be ruined.

1) Remove flat tire repair sealant from tire using plug (1), filler hose (2), sealant bottle (3) and extension hose (4) in kit as follows.
   a) Remove plug from filler hose of sealant bottle. Then connect extension hose to tip of filler hose.



I6RS0B240004-01

   b) Remove tire containing flat tire repair sealant from vehicle.
   c) Loosen valve core carefully to release air.

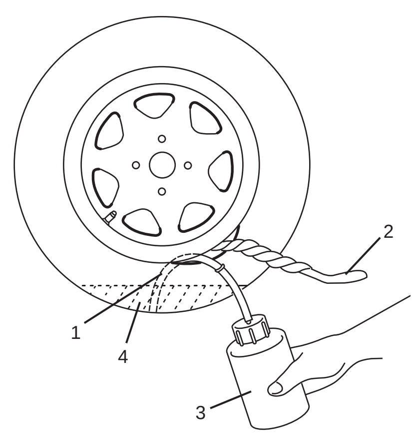
⚠ WARNING

Take care not to make sealant blast out from valve. Otherwise, your health may be ruined.

   d) Remove tire bead inside rim of wheel.
   e) Make a clearance by inserting a tire lever (2) between tire bead and rim, and then insert hose (1) thought clearance as shown in figure.
   f) Press the bottle and suck out sealant (4), using bottle (3) as a pump.

NOTE

To make sealant easy to suck up from tire, set bottle lower than sealant surface.



I6RS0C240003-01

   g) Change hose end position and repeat above step f) until sealant is not sucked out.
   h) Put cap on bottle so that collected sealant does not leak.

2) Check tire if it can be repaired, referring to “Tire Repair”. If it cannot be repaired, replace it with new one.
3) Replace valve core of flat tire with new one if tire is reused after repairing.

⚠ CAUTION

Be sure to use new valve core. Otherwise, air leak may occur due to sealant attached to valve core.

4) Install tire to rim of wheel, check that there is no air leakage and adjust it to specified pressure shown on tire placard.

Specifications

Wheels and Tires Specifications

S7RS0B2407001

Tire size (Standard)
: 195/50R16 87V

Wheel size (Standard)
: 16x 6 J

Tightening torque
Wheel nut: 85 N·m (8.5 kgf-m, 61.5 lb-ft)

NOTE

- **Tire inflation pressure should be checked when tires are cool.**
- **Specified tire inflation pressure should be found on tire placard or in owner’s manual which came with the vehicle.**

Tightening Torque Specifications

S7RS0B2407002

Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
Wheel nut	85	8.5	61.5	☞ / ☞

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

Section 3

Driveline / Axle

CONTENTS

3

Precautions

Precautions

Precautions for Driveline / Axle

S7RS0B3000001

Fastener Caution

Refer to “Fastener Caution in Section 00”.

Drive Shaft / Axle

General Description

Front Drive Shaft Construction

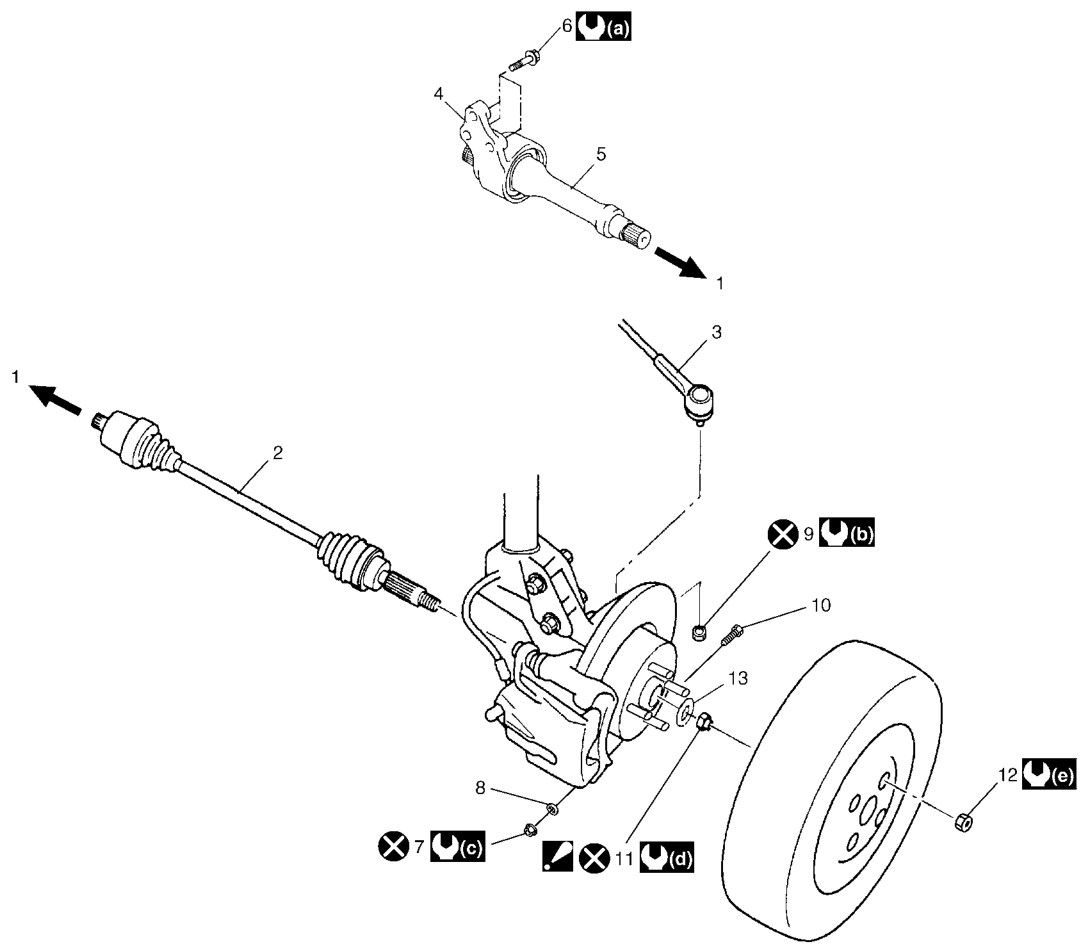
S7RS0B3101001

A constant velocity ball joint is used on the wheel side of both right and left side drive shaft assemblies. For A/T vehicle, a tripod type constant velocity joint is used on the differential side and center shaft side. For M/T vehicle, a double offset type constant velocity joint (DOJ) is used on the differential side and center shaft side. The drive shaft can slide through the tripod joint or the double offset joint (DOJ) in the extension/contraction direction.

Component Location

Front Drive Shaft Assembly Components Location

S7RS0B3103001



I6RS0C310002-03

1. To transaxle	8. Ball stud washer	(b) : 45 N·m (4.5 kgf-m, 32.5 lb-ft)
2. Drive shaft assembly	9. Tie-rod end nut	(c) : 60 N·m (6.0 kgf-m, 43.5 lb-ft)
3. Tie-rod end	10. Ball stud bolt	(d) : 200 N·m (20.0 kgf-m, 145.0 lb-ft)
4. Center bearing support	11. Drive shaft nut : After tightening nut, caulk nut securely.	(e) : 85 N·m (8.5 kgf-m, 61.5 lb-ft)
5. Center shaft	12. Wheel nut	: Do not reuse.
6. Center bearing support bolts	13. Drive shaft washer	
7. Ball stud nut	(a) : 55 N·m (5.5 kgf-m, 40.0 lb-ft)	

Diagnostic Information and Procedures

Front Drive Shaft Symptom Diagnosis

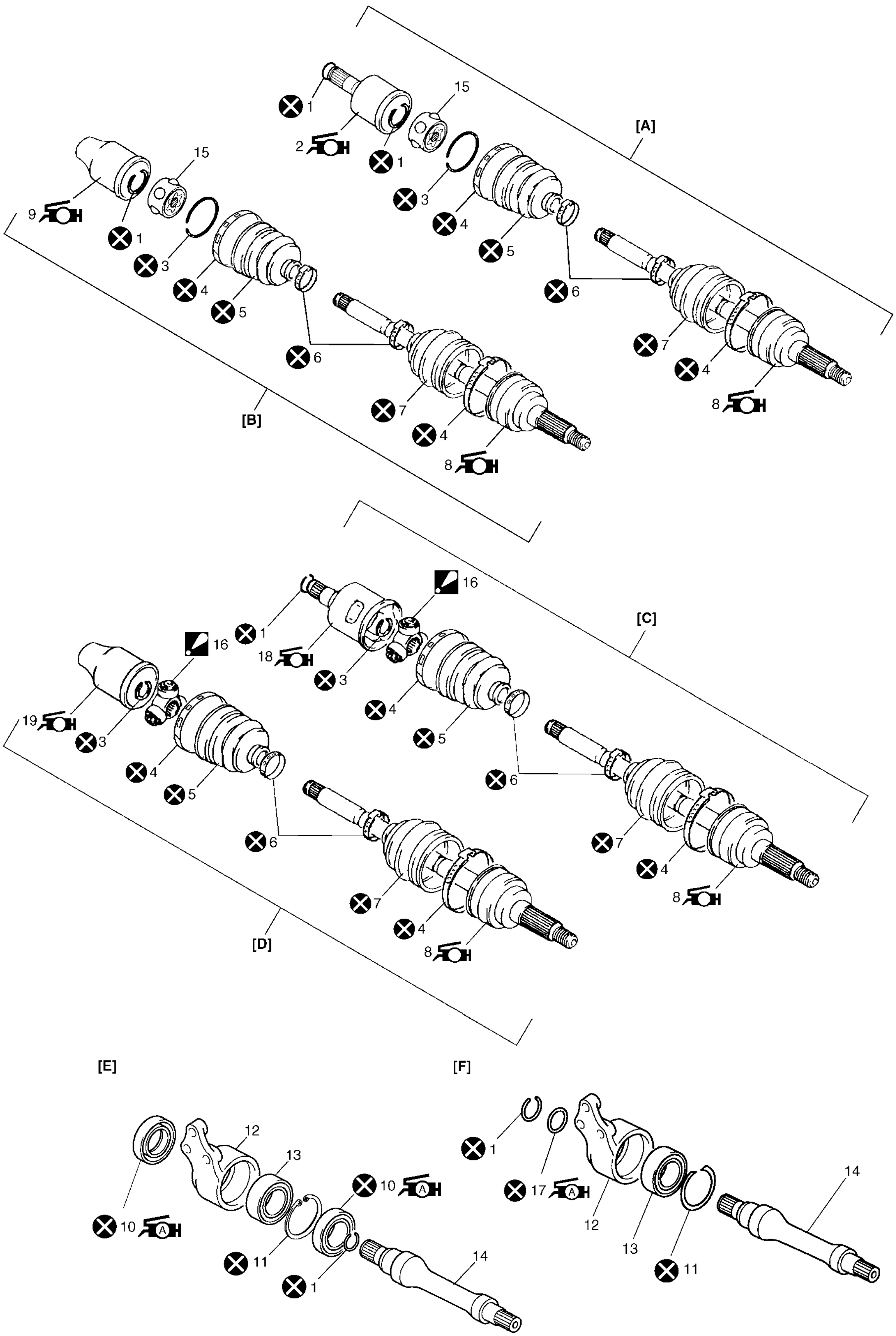
S7RS0B3104001

Condition	Possible cause	Correction / Reference Item
Abnormal noise	Worn or breakage of the drive shaft joint	*Replace.*
	Worn or breakage of the center bearing	*Replace.*

Repair Instructions

Front Drive Shaft Components

S7RS0B3106001



I6RS0C310003-02

[A]: Right side drive shaft assembly (M/T model)	8. Wheel side joint (Constant velocity ball joint) : Apply black grease included in spare part to joint.
[B]: Left side drive shaft assembly (M/T model)	9. Center shaft side joint (Constant velocity tripod joint) : Apply dark gray grease included in spare part to joint.
[C]: Right side drive shaft assembly (A/T model)	10. Oil seal : Apply grease 99000-25011 to oil seal lip.
[D]: Left side drive shaft assembly (A/T model)	11. Center bearing support circlip
[E]: Center shaft assembly (A/T model)	12. Center bearing support
[F]: Center shaft assembly (M/T model)	13. Center bearing
1. Circlip	14. Center shaft
2. Differential side joint (Constant velocity tripod joint) : Apply dark gray grease included in spare part to joint.	15. Cage
3. Snap ring	16. Tripod joint spider : Never disassemble.
4. Boot band (Large)	17. O-ring : Apply grease 99000-25011 to all round of O-ring.
5. Boot (Differential or center shaft side)	18. Differential side joint (Constant velocity tripod joint) : Apply dark gray grease included in spare part to joint.
6. Boot band (Small)	19. Center shaft side joint (Constant velocity tripod joint) : Apply dark gray grease included is spare part to joint.
7. Boot (Wheel side)	: Do not reuse.

Front Drive Shaft Assembly On-Vehicle Inspection

S7RS0B3106002

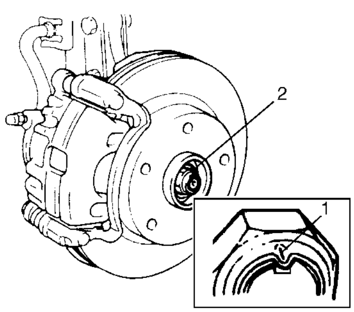
- Check boots for breakage or deterioration.
- Check wheel side joint for rattle or smooth rotation.
- Check differential side (or center shaft side) joint for smooth rotation.
  If any abnormality is found, replace.

Front Drive Shaft Assembly Removal and Installation

S7RS0B3106003

Removal

1) Hoist vehicle and remove wheel.
2) Undo caulking (1) and remove drive shaft nut (2).



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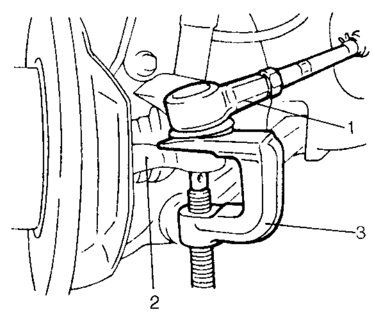
3) Drain transaxle oil.
4) Disconnect tie-rod end (1) from steering knuckle (2) using puller (3).



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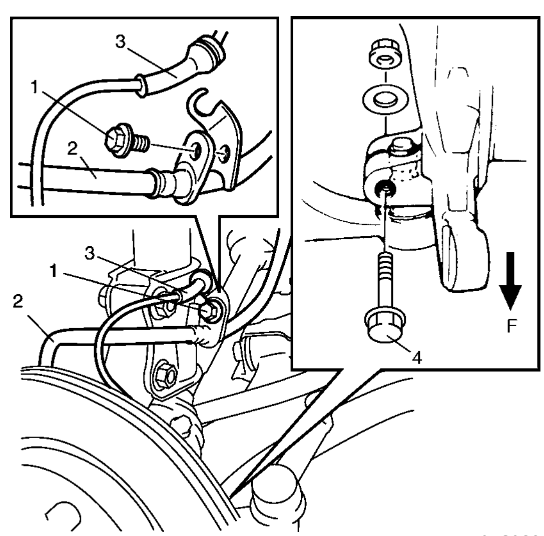
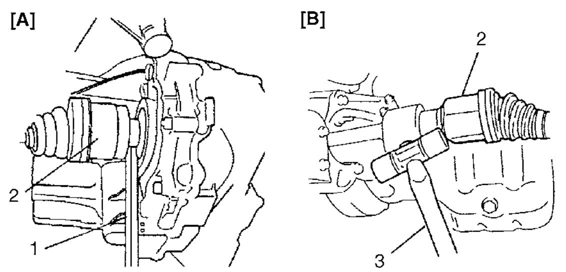
5) Remove stabilizer joint referring to “Front Suspension Frame, Stabilizer Bar and/or Bushings Removal and Installation in Section 2B”.
6) Remove brake hose mounting bolt (1) and break hose (2) from bracket and then detach wheel speed sensor harness (3) from strut bracket.
7) Remove suspension control arm ball joint bolt (4).



I6RS0C310005-01

F:	Vehicle front

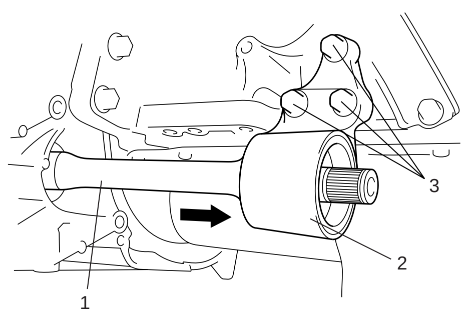
8) Disconnect front suspension control arm ball joint stud from steering knuckle.
9) Pull out drive shaft joint as follows.
   - For differential side
     Using tire lever (1), pull out drive shaft joint (2) so as to release snap ring fitting of joint spline at differential side.
   - For center shaft side
     Using plastic hammer (3), drive out drive shaft joint (2) so as to release snap ring fitting of joint spline at center shaft.



I6RS0C310006-01

[A]:	Differential side
[B]:	Center shaft side

10) Remove drive shaft assembly.
11) Remove center bearing support bolts (3) and remove center bearing support (2) with center shaft (1) from differential side gear.



I2RH01310007-01

Installation

⚠ CAUTION

- **Be careful not to damage oil seals and boots when installing drive shaft.**
- **Do not hit joint boot with hammer. Inserting joint only by hands is allowed.**
- **Make sure that differential side joint is inserted fully and its snap ring is seated as it was.**

Install drive shaft assembly by reversing removal procedure and noting the following points.

- Tighten each bolt and nut to the specified torque referring to “Front Drive Shaft Assembly Components Location”.
- Tighten brake hose mounting bolt to specified torque.

  Tightening torque
  Brake hose mounting bolt: 25 N·m (2.5 kgf-m, 18.0 lb-ft)

- Fill transaxle with oil as specified referring to “A/T Fluid Change in Section 5A” or “Manual Transaxle Oil Change in Section 5B”.
- Check toe setting referring to “Front Wheel Alignment Inspection and Adjustment in Section 2B” and adjust as required.

Front Drive Shaft Disassembly and Reassembly

S7RS0B3106004

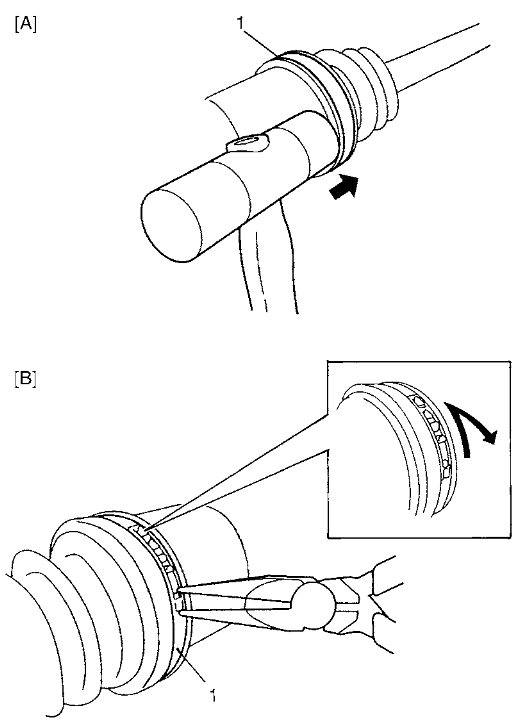
Disassembly

Tripod joint

⚠ CAUTION

- **Disassembly of wheel side joint is not allowed. If any noise or damage exists in it, replace it as assembly.**
- **Do not disassemble tripod joint spider. If any malcondition is found in it, replace it as differential side joint assembly.**

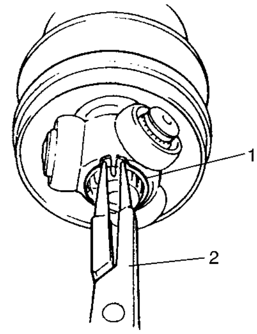
1) Remove differential side (or center shaft side) boot big band (1) as follows.
   - For boot big band without joint:
     Remove boot big band by tapping boot and band with plastic hammer. If it is hard to remove boot big band, cut it using a nipper or an iron saw with care not to damage joint housing.
   - For boot big band with joint:
     Draw hooks of boot big band together and remove band.



I4RH0A310004-01

[A]:	For boot big band without joint
[B]:	For boot big band with joint

2) Wipe off grease from shaft and take off snap ring (1) using snap ring pliers (2).

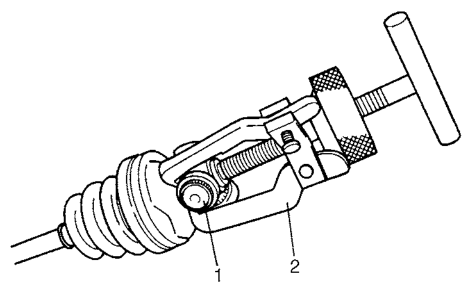


I5JB0A311008-01

3) Remove tripod joint spider (1) using 3 arms puller (2).

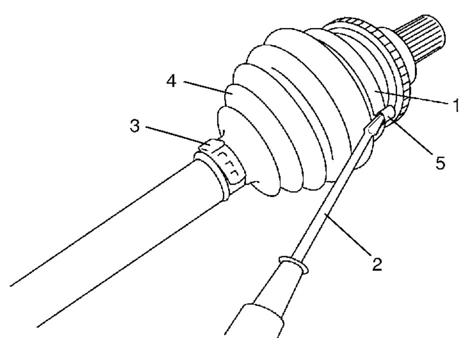
⚠ CAUTION

To prevent any problem caused by washing solution, do not wash tripod joint except its housing. Degreasing of tripod joint with cloth is allowed.



I3RH0A311004-01

4) Remove boot band as follows.
   a) Remove differential side (or center shaft side) boot small band, and then pull out differential side (or center shaft side) boot from shaft.
   b) Remove damper band, and then pull out damper through shaft, if equipped.
   c) Undo caulking (5) of wheel side boot big band (1) and small band (3) using flat end rod (2) or the like, then pull out wheel side boot (4) from shaft.



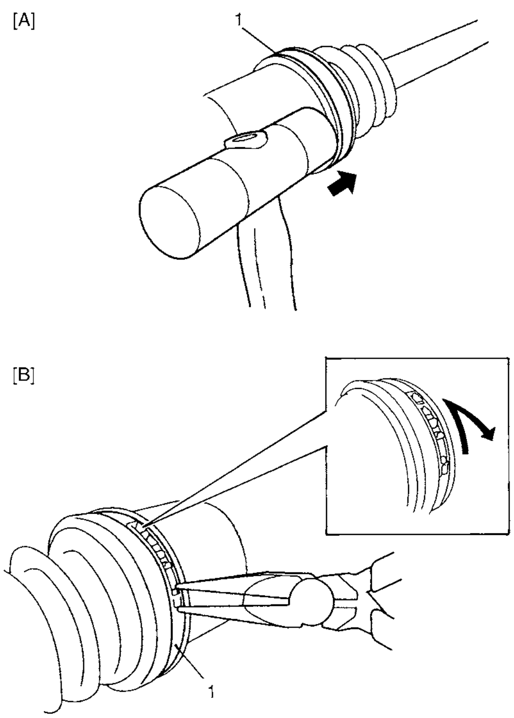
I4RS0A310006-01

DOJ

⚠ CAUTION

Disassembly of wheel side joint is not allowed. If any noise or damage exists in it, replace it as assembly.

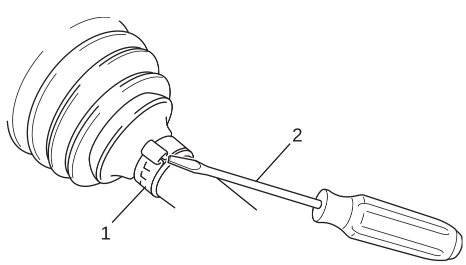
1) Remove differential side (or center shaft side) boot big band (1) as follows.
   - For boot big band without joint:
     Remove boot big band by tapping boot and band with plastic hammer. If it is hard to remove boot big band, cut it using a nipper or an iron saw with care not to damage joint housing.
   - For boot big band with joint:
     Draw hooks of boot big band together and remove band.



I4RH0A310004-01

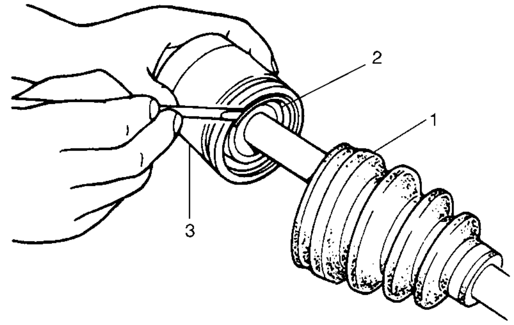
[A]:	For boot big band without joint
[B]:	For boot big band with joint

2) Remove differential side (or center shaft side) boot small band (1) using flat end rod (2) or the like.



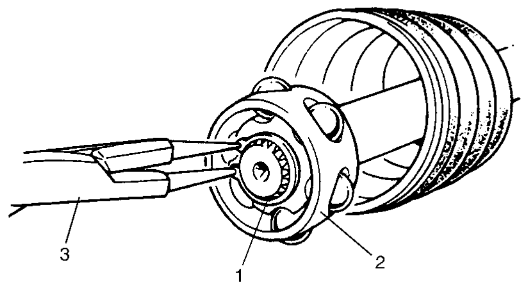
I5RS0B310005-01

3) Side boot (1) toward the center of shaft and remove snap ring (2) from outer race, and then take shaft out of outer race (3).



I2RH01310012-01

4) Wipe off grease and remove circlip (1) used to fix cage (2) by using snap ring pliers (3).



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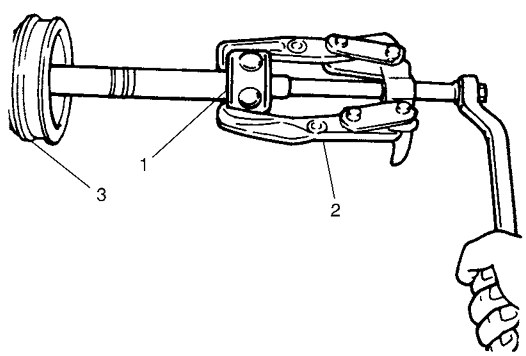
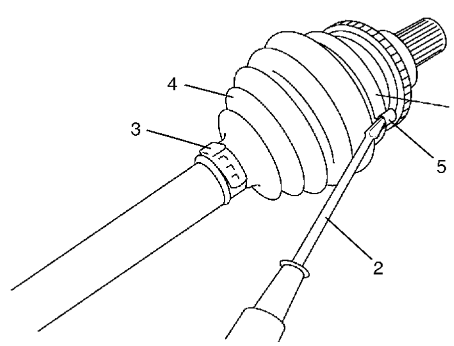
5) Draw away cage (1) by using bearing puller (2), and remove boot (3) from shaft.



I2RH01310014-01

6) Pull out differential side (or center shaft side) boot from shaft.
7) Undo caulking (5) of wheel side boot big band (1) and small band (3) using flat end rod (2) or the like, then pull out wheel side boot (4) from shaft.



I4RS0A310006-01

Reassembly

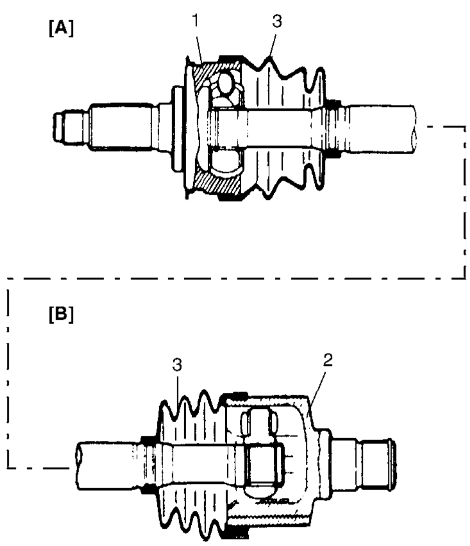
Tripod joint

Judging from abnormality noted before disassembly and what is found through visual check of component parts after disassembly, prepare replacing parts and proceed to reassembly.

Make sure that wheel side joint assembly (1) and tripod joint housing (2) are washed thoroughly and air dried. Replace boot(s) (3) with new one(s).

⚠ CAUTION

- **Do not wash boots in degreaser such as gasoline or kerosene. etc. Washing in degreaser causes deterioration of boot.**
- **To ensure full performance of joint as designed, be sure to distinguish between two types of grease in repair set and apply specified volume to respective joint referring to the followings for identification of the grease.**



I4RS0A310007-01

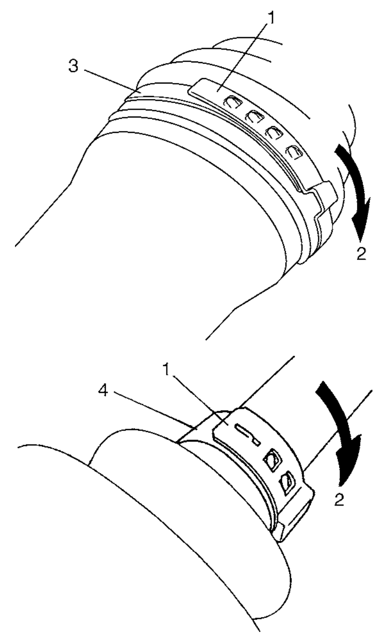
[A]:	Wheel side
[B]:	Differential side (or center shaft side)

1) Wash disassembled parts (except boots). After washing, dry parts completely by blowing air.
2) Clean boots with cloth.
3) Apply grease to wheel side joint. Use specified grease in tube in wheel side boot set as a spare parts.

   Grease color
   : Black

   Amount
   : 55 – 75 g (1.9 – 2.6 oz)

4) Install wheel side boot on shaft.
5) Fill up boot inside with specified grease.
6) Place new wheel side boot big band (3) and small band (4) onto boot putting band outer end (1) against forward rotation (2) as shown in figure.



I4RS0A310009-01

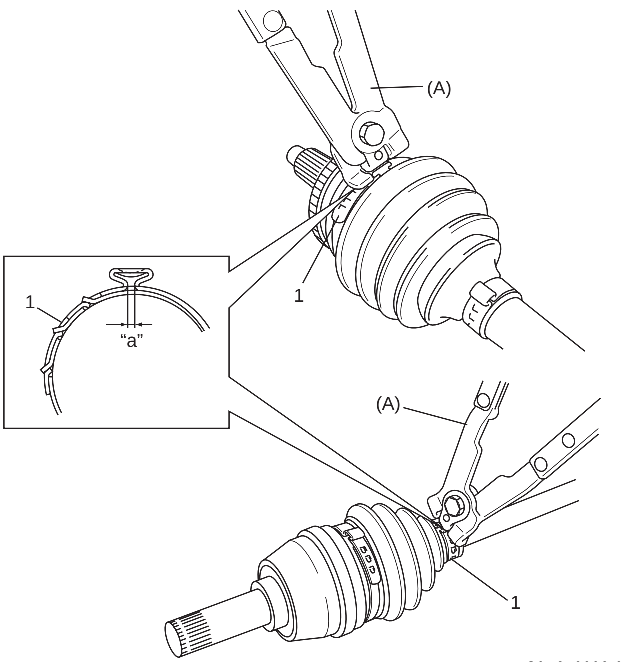
7) Fasten boot bands (1) securely using special tool as shown in figure.

<u>Distance “a”</u>
: 2.6 ± 1.4 mm (0.102 ± 55 in.)

⚠ CAUTION

Do not squeeze or distort boot when fastening it with bands.
Distorted boot caused by squeezing air may reduce its durability.

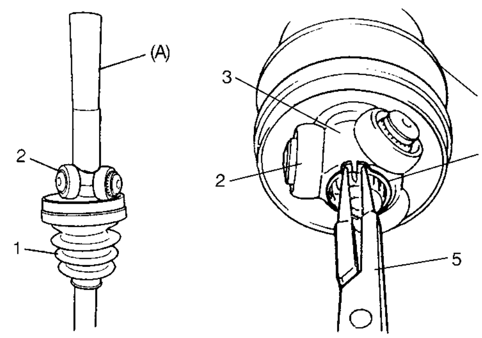
Special tool
(A): 09943–57010



I5RS0B310008-01

8) Set new differential side (or center shaft side) small band and new differential side (or center shaft side) boot (1) on shaft temporarily, and then apply grease to tripod joint (2). Use specified grease in tube included in spare parts.
9) Install tripod joint spider (3) on shaft using special tool with hammer, directing its chamfered spline toward wheel side, and then fasten it with new snap ring (4) using snap ring pliers (5).

Special tool
(A): 09925–98221



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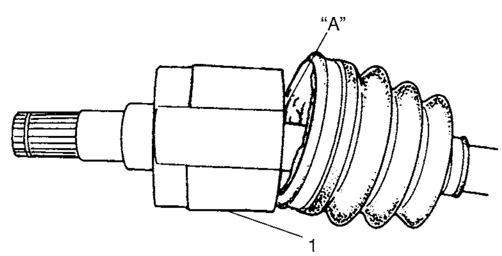
10) Apply grease (including in spare parts) to inside of tripod joint housing (1), joint it with tripod joint.

<u>Grease color</u>
“A”: Dark gray

<u>Amount</u>
“A”: 70 – 90 g (2.5 – 3.2 oz)



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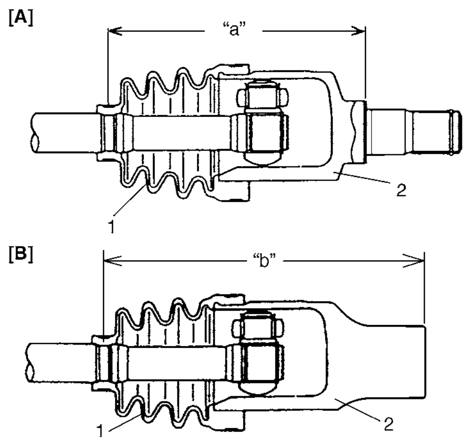
11) Fit boot (1) to grooves of shaft and housing (2) adjust length to specification below.
12) Insert screw driver into boot and allow air to enter boot so that air pressure in boot becomes the same as atmospheric pressure.

Drive shaft boot fixing position (distance between housing end and small boot band)
Left side drive shaft “a”: 153.9 mm (6.05 in.)
Right side drive shaft “b”: 178.0 mm (7.00 in.)



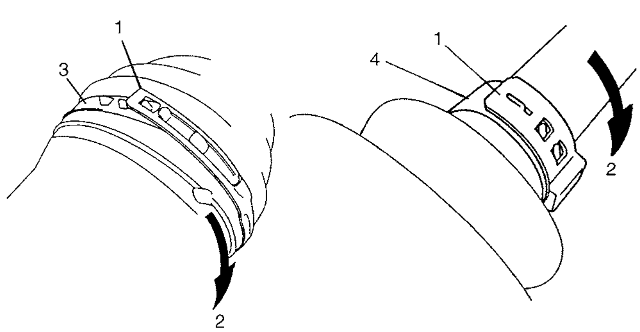
I4RS0B310004-01

[A]:	Drive shaft inserted into differential side
[B]:	Drive shaft inserted into center shaft side

⚠ CAUTION

- **Bend each boot band against forward rotation.**
- **Do not squeeze or distort boot when fastening it with bands. Distorted boot caused by squeezing air may reduce its durability.**

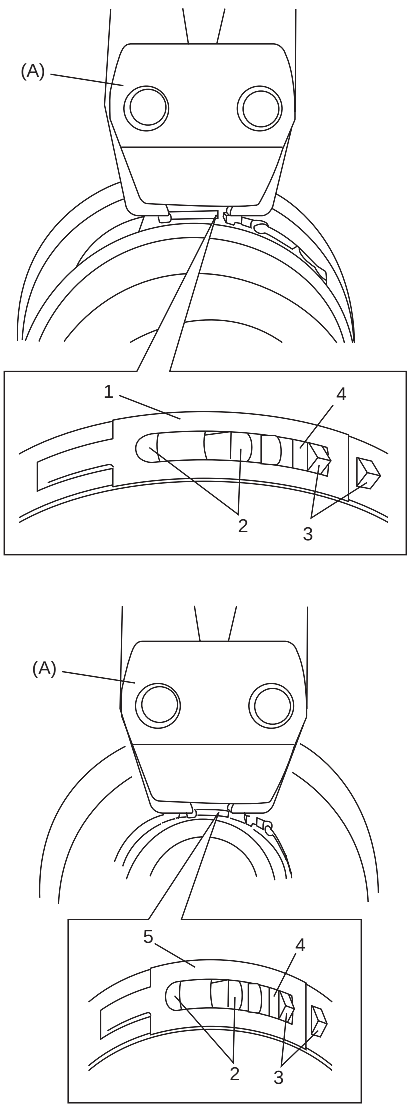
13) Place differential side (or center shaft side) boot new big band (3) and new small band (4) onto boot putting band outer end (1) against forward rotation (2) as shown in figure.



I5JB0A311006-01

14) Fasten differential side (or center shaft side) boot band.
   - For differential side (or center shaft side) boot big band (1) and small band (5).
     Fasten band by drawing hooks (2) with special tool and engage hooks (3) in slot and window (4).

Special tool
(A): 09943–57021



I6RS0B310005-02

DOJ

Judging from abnormality noted before disassembly and what is found through visual check of components parts after disassembly, prepare replacing parts and proceed to reassembly.
Make sure that wheel side joint assembly and DOJ housing are washed thoroughly and air dried.
Replace boot(s) with new one(s).

⚠ CAUTION

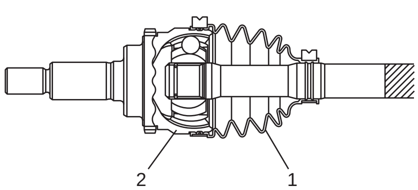
- **Do not wash boots in degreaser such as gasoline or kerosene. etc. Washing in degreaser causes deterioration of boot.**
- **To ensure full performance of joint as designed, be sure to distinguish between two types of grease in repair set and apply specified volume to respective joint referring to the followings for identification of the grease.**

1) Wash disassembled parts (except boots). After washing, dry parts completely by blowing air.
2) Clean boots with cloth.
3) Apply grease to wheel side joint. Use specified grease in tube in wheel side boot set as a spare parts.

Grease color
: Black

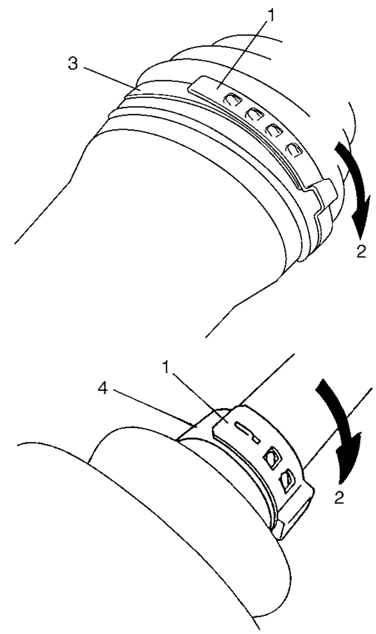
Amount
: 55 – 75 g (1.9 – 2.6 oz)

4) Install wheel side boot on shaft.
5) Fill up boot inside with specified grease.
6) Fit boot (1) to grooves of shaft and housing (2).
7) Insert screw driver into boot and allow air to enter boot so that air pressure in boot becomes the same as atmospheric pressure.



I5RS0B310007-01

8) Place new wheel side boot big band (3) and small band (4) onto boot putting band outer end (1) against forward rotation (2) as shown in figure.



I4RS0A310009-01

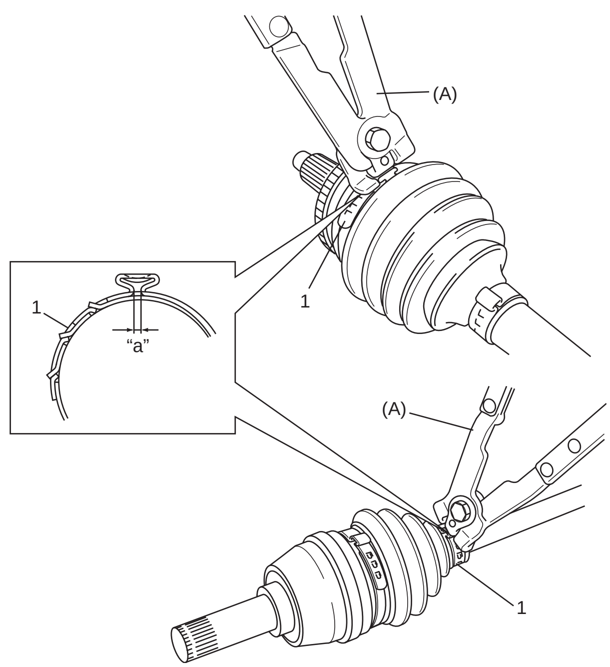
9) Fasten boot bands (1) using special tool as shown in figure.

Distance "a"
: 2.6 ± 1.4 mm (0.102 ± 0.055 in.)

⚠ CAUTION

Do not squeeze or distort boot when fastening it with bands.
Distorted boot caused by squeezing air may reduce its durability.

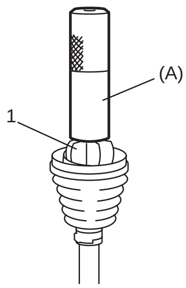
Special tool
(A): 09943–57010



I5RS0B310008-01

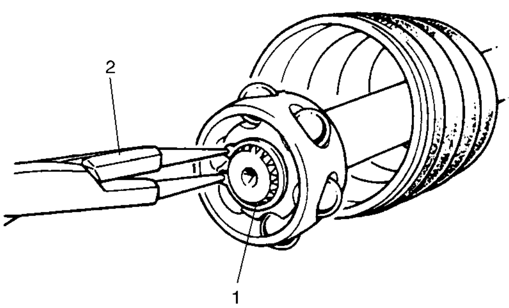
10) Set new differential side (or center shaft side) small band and new differential side (or center shaft side) boot on shaft temporarily.
11) Drive in the cage (1) by using special tool.

Special tool
(A): 09913–84510



I5RS0B310009-01

12) Install circlip (1) by using snap ring pliers (2).

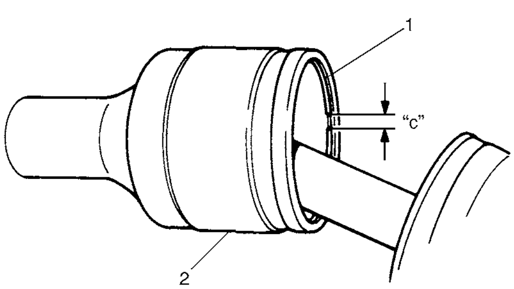


I5RS0B310010-01

13) Apply grease to entire surface of cage. Use specified grease in tube included in spare parts.
14) Insert cage into joint housing (2) and fit snap ring (1) into groove of joint housing (2).

⚠ CAUTION

Position opening of snap ring "c" so that it will not be lined up with a ball.

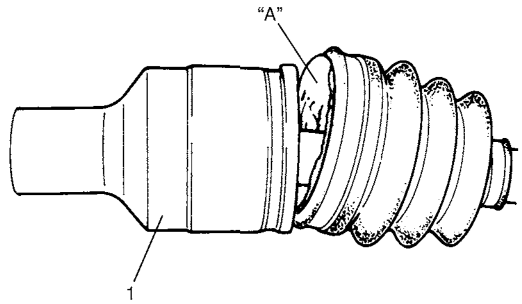


I2RH01310036-01

15) Apply grease (including in spare parts) to inside of joint housing (1).

Grease color
"A": Dark gray

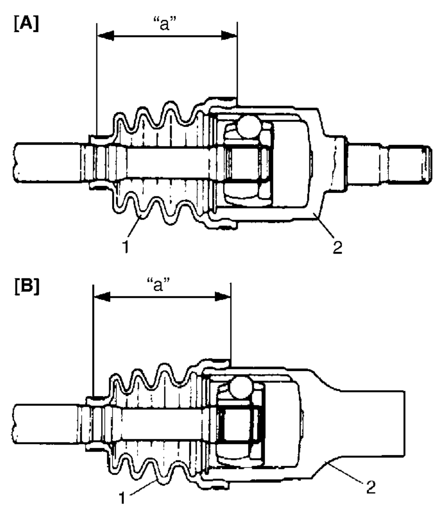
Amount
"A": 70 – 90 g (2.5 – 3.2 oz)



I5RS0B310011-02

16) Fit boot (1) to grooves of shaft and housing (2) adjust length to specification below.
17) Inset screw driver into boot and allow air to enter boot so that air pressure in boot becomes the same as atmospheric pressure.

Drive shaft boot fixing position (distance between boot end (housing side) and small boot band center)
Left side and right side drive shafts "a": 89.5 mm (3.52 in.)



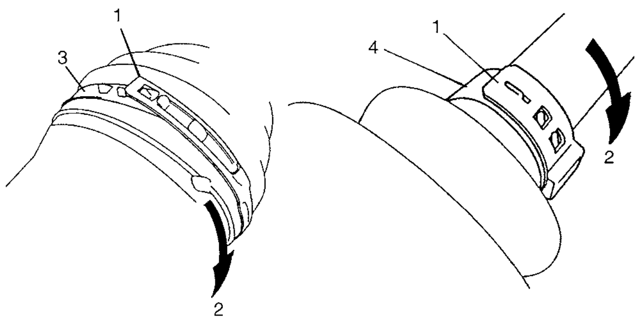
I5RS0B310012-01

[A]:	Drive shaft inserted into differential side
[B]:	Drive shaft inserted into center shaft side

⚠ CAUTION

- **Band each boot band against forward rotation.**
- **Do not squeeze or distort boot when fastening it with bands. Distorted boot caused by squeezing air may reduce its durability.**

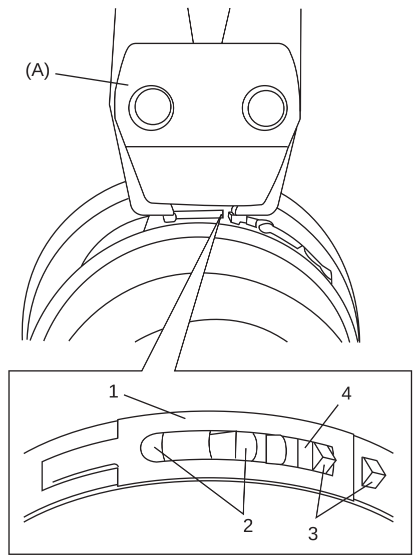
18) Place differential side boot (or center shaft side) new big band (3) and new small band (4) onto boot putting band outer end (1) against forward rotation (2) as shown in figure.



I5JB0A311006-01

19) Fasten differential side (or center shaft side) boot band.
    - For differential side (or center shaft side) boot big band
      Fasten band (1) by drawing hooks (2) with special tool and engage hooks (3) in slot and window (4).

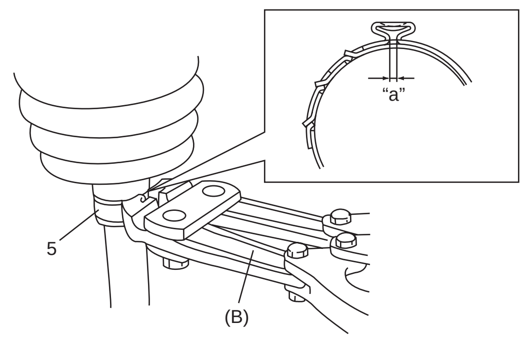
      Special tool
      (A): 09943–57021



    - For differential side (or center shaft side) boot small band
      Fasten band (5) using special tool as shown in figure.

      <u>Distance “a”</u>
      : 2.6 ± 1.4 mm (0.102 ± 0.055 in.)

      Special tool
      (B): 09943–57010



I5RS0B310013-01

Center Shaft and Center Bearing Support Disassembly and Reassembly

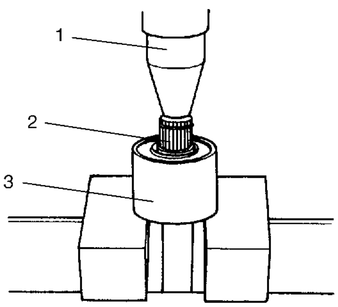
S7RS0B3106005

Disassembly

1) Remove snap ring and O-ring (M/T model) from center shaft.
2) Using hydraulic press (1), draw out center shaft (2) from center bearing.
3) Remove center bearing from bearing support as follows.

A/T model

a) Remove oil seals from center bearing support (3).

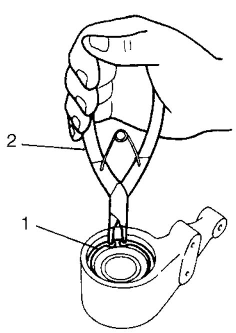


I3RM0A310012-01

b) Remove bearing support circlip (1) using snap ring pliers (2) and then remove center bearing from center bearing support.

M/T model

a) Remove bearing support circlip (1) using snap ring pliers (2) and then remove center bearing from center bearing support.

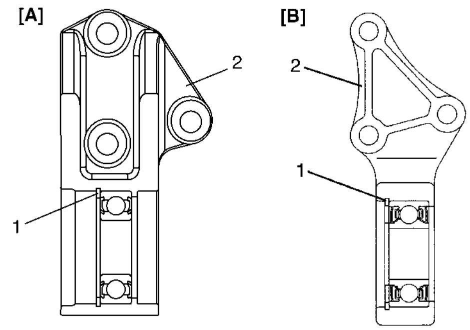


I6RS0B310006-03

Reassembly

Assemble center shaft by reversing disassembly procedure and noting the following points.

- When installing bearing support circlip (1), make sure that if fits in circlip groove in center bearing support (2) securely as shown.



I6RS0C310007-01

[A]: A/T model	[B]: M/T model

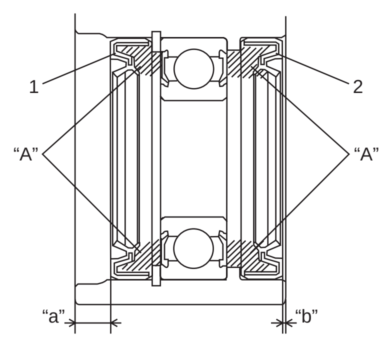
- For A/T model, when installing left oil seal (1) and right oil seal (2) using special tool, use care so that oil seals in proper direction and position as shown in figure.

Special tool
: 09925–15410

<u>Distance</u>
“a”: 7 – 8 mm (0.28 – 0.31 in.)
“b”: 0 – 1 mm (0 – 0.04 in.)

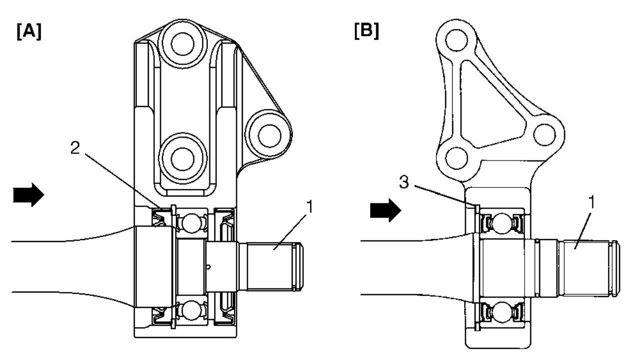
- For A/T model, be sure to apply grease to oil seal lip and bearing side space indicated in figure.

“A”: Grease 99000–25011 (SUZUKI Super Grease A)



I4RS0A310014-01

- Press-fit center shaft (1) from left oil seal (2) or circlip (3) side.



I6RS0C310008-02

[A]: A/T model	[B]: M/T model

- For M/T model, apply grease to O-ring and then install O-ring to center shaft.

Specifications

Tightening Torque Specifications

S7RS0B3107001

Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
Brake hose mounting bolt	25	2.5	18.0	☞

NOTE

The specified tightening torque is also described in the following.
“Front Drive Shaft Assembly Components Location”

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

Special Tools and Equipment

Recommended Service Material

S7RS0B3108001

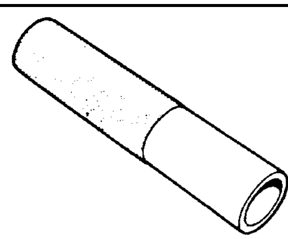
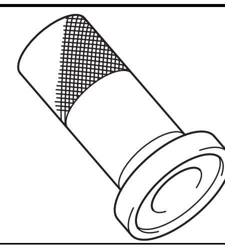
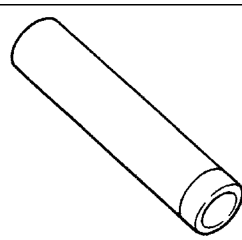
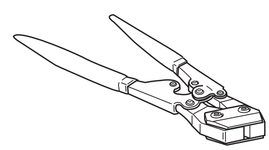
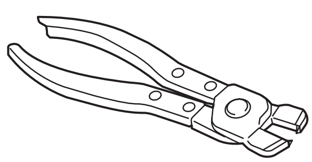
Material	SUZUKI recommended product or Specification		Note
Grease	SUZUKI Super Grease A	P/No.: 99000–25011	☞

NOTE

Required service material is also described in the following.
“Front Drive Shaft Components”

Special Tool

S7RS0B3108002

09913–84510 Bearing installer ☞ 	09925–15410 Oil seal installer ☞ 
09925–98221 Bearing installer ☞ 	09943–57010 Band compressor ☞ / ☞ / ☞ 
09943–57021 Pliers, Low-Profile Clamp ☞ / ☞ 	

Section 4

Brakes

CONTENTS

4

Precautions

Precautions

Precautions for Brakes

S7RS0B4000001

Suspension Caution
Refer to “Suspension Caution in Section 00”.

Wheels and Tires Caution
Refer to “Wheels and Tires Caution in Section 00”.

Brake Caution
Refer to “Brake Caution in Section 00”.

ESP® System Precautions
Refer to “Precaution for Vehicle Equipped with ESP® System in Section 00”.

General Precautions
Refer to “General Precautions in Section 00”.

Vehicle Lifting Points
Refer to “Vehicle Lifting Points in Section 0A”.

Fastener Caution
Refer to “Fastener Caution in Section 00”.

Fastener Information
Refer to “Fasteners Information in Section 0A”.

Brake Control System and Diagnosis

Precautions

Precautions on Brake

S7RS0B4100001

Air Bag Warning

Refer to “Air Bag System Service Warning in Section 00”.

Brakes Diagnosis Note

Refer to “Brakes Diagnosis Note”.

General Description

Brakes Construction

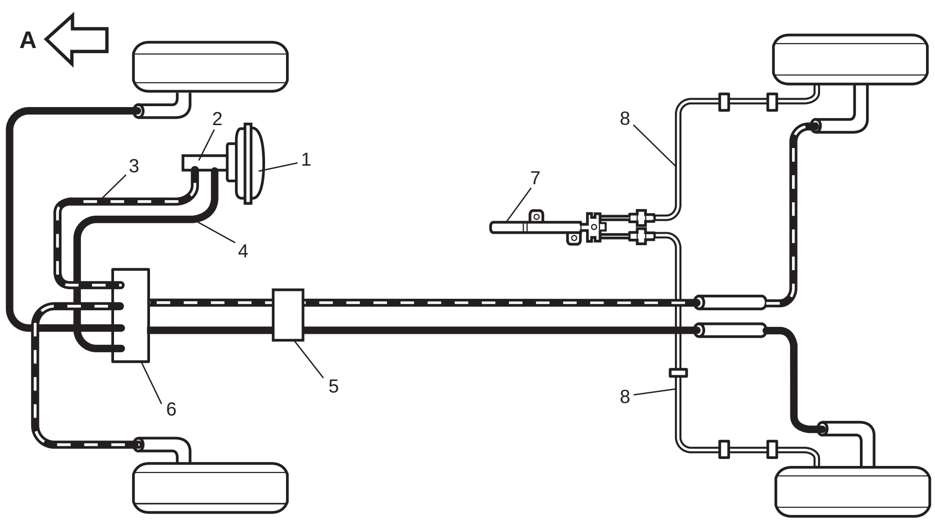
S7RS0B4101001

When the foot brake pedal is depressed, hydraulic pressure is developed in the master cylinder to actuate pistons (two in front and two in rear).

The master cylinder is a tandem master cylinder. Brake pipes are connected to the master cylinder and they make two independent circuits. One connects front right & rear left brakes and the other connects front left & rear right brakes.

In this brake system, the disc brake type is used for the front wheel brake and the rear wheel brake.

The parking brake system is mechanical. It applies brake force to only rear wheels by means of the cable and mechanical linkage system. The same brake shoes or pads are used for both parking and foot brakes.



I6RS0C410001-01

1. Brake booster	4. Primary side	7. Parking brake lever
2. Master cylinder	5. 4 way joint	8. Parking brake cable
3. Secondary side	6. ABS or ESP® hydraulic unit / control module assembly	A: Forward

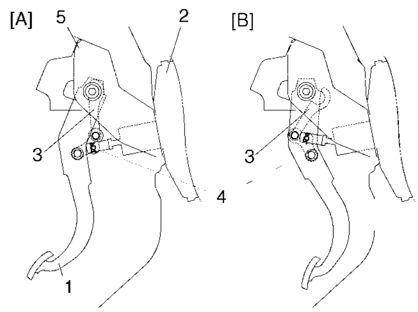
Brake Pedal Foot Protection System Construction

S7RS0B4101004

Should a front crash occur and the engine push the dash panel toward the interior side, the brake pedal bracket is also pushed toward the interior side. In this case, the brake pedal lever comes off from the brake pedal, thereby preventing the brake pedal from moving rearward.

⚠ CAUTION

Never disassemble brake pedal assembly. Disassemble will spoil its original function. If faulty condition is found, replace it with new one.

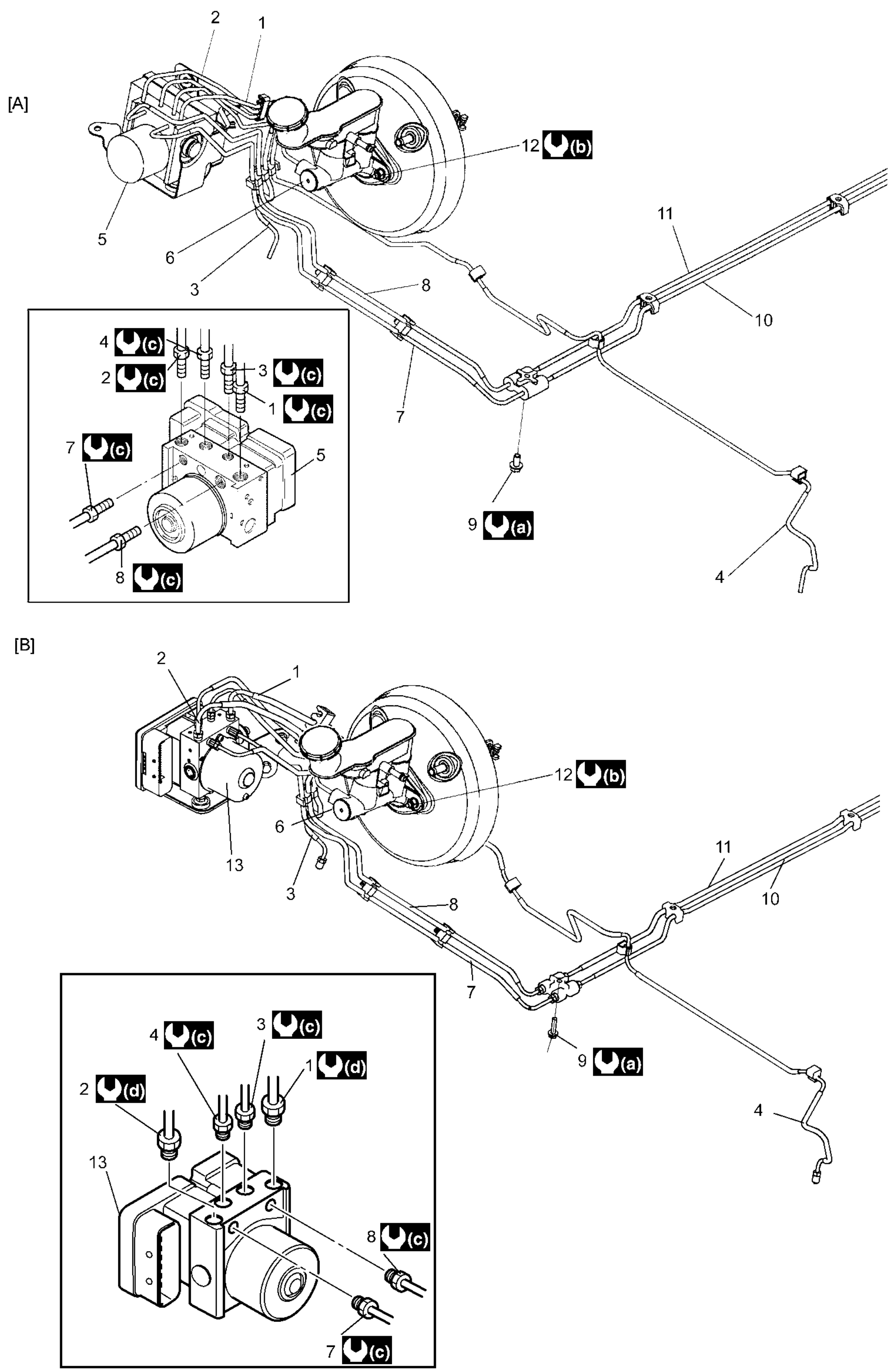


I6RW0C410001-02

[A]: Before crash	2. Brake booster	5. Brake pedal bracket
[B]: After crash	3. Brake pedal lever	
1. Brake pedal	4. Booster push clevis rod	

Front Brake Hose / Pipe Construction

S7RS0B4101002

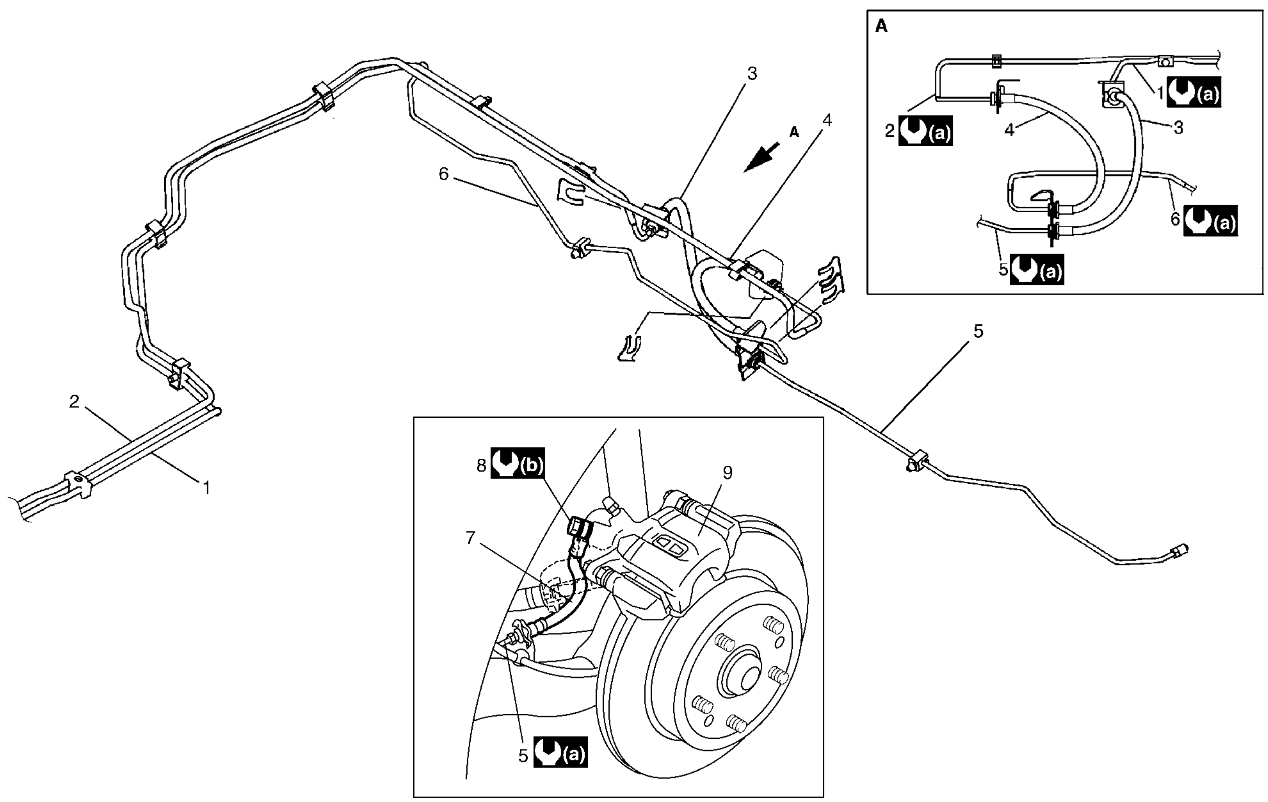


I7RS0B410003-01

[A]:	ABS model	6.	Master cylinder	13.	ESP® hydraulic unit
[B]:	ESP® model	7.	From hydraulic unit to 4-way joint right	(a) :	11 N·m (11.0 kgf-m, 8.0 lb-ft)
1.	From master cylinder primary to hydraulic unit	8.	From hydraulic unit to 4-way joint left	(b) :	15 N·m (1.5 kgf-m, 11.0 lb-ft)
2.	From master cylinder secondary to hydraulic unit	9.	4-way joint	(c) :	16 N·m (1.6 kgf-m, 11.5 lb-ft)
3.	From hydraulic unit to right front brake	10.	4-way joint to left rear brake hose	(d) :	19 N·m (1.9 kgf-m, 14.0 lb-ft)
4.	From hydraulic unit to left front brake	11.	4-way joint to right rear brake hose		
5.	ABS hydraulic unit	12.	Master cylinder fixing nut		

Rear Brake Hose / Pipe Construction

S7RS0B4101003



I6RS0C410003-01

A:	View A	4.	Right rear brake hose	8.	Flexible hose joint bolt
1.	To left rear brake hose	5.	Left rear brake hose to left brake	9.	Caliper
2.	To right rear brake hose	6.	Right rear brake hose to right brake	(a) :	16 N·m (1.6 kgf-m, 12.0 lb-ft)
3.	Left rear brake hose	7.	Brake flexible hose	(b) :	23 N·m (2.3 kgf-m, 17.0 lb-ft)

Diagnostic Information and Procedures

Brakes Diagnosis Note

S7RS0B4104001

Road Testing Brakes

Brakes should be tested on dry, clean, smooth and reasonably level roadway which is not crowned. Road test brakes by making brake applications with both light and heavy pedal forces at various speeds to determine if the vehicle stops evenly and effectively. Also drive vehicle to see if it leads to one side or the other without brake application. If it does, check the tire pressure, front wheel alignment and front suspension attachments for looseness. See diagnosis table for other causes.

Brake Fluid Leaks

Check the master cylinder fluid levels. While a slight drop in reservoir level does result from normal lining wear, an abnormally low level indicates a leak in the system. In such a case, check the entire brake system for leakage. If even a slight evidence of leakage is noted, the cause should be corrected or defective parts should be replaced.

Substandard or Contaminated Brake Fluid

Improper brake fluid, mineral oil or water in the fluid may cause the brake fluid to boil or the rubber components in the hydraulic system to deteriorate.

If deterioration of rubber is evident, disassemble all hydraulic parts and wash with alcohol. Dry these parts with compressed air before assembly to keep alcohol out of the system. Replace all rubber parts in the system, including hoses. Also, when working on the brake mechanisms, check for fluid on the linings.
If excessive fluid is found, replace the pads.

If master cylinder piston seals are satisfactory, check for leakage or excessive heat conditions. If leakage is not found, drain fluid, flush with brake fluid, refill and bleed system.
The system must be flushed if there is any doubt as to the grade of fluid in the system or if fluid has been used which contained parts that have been subjected to contaminated fluid.

Brakes Symptom Diagnosis

S7RS0B4104002

Condition	Possible cause	Correction / Reference Item
Not enough braking force	Brake oil leakage from brake lines	*Locate leaking point and repair.*
	Brake disc or brake pad stained with oil	*Clean or replace.*
	Overheated brakes	*Determine cause and repair.*
	Badly worn brake pad	*Replace.*
	Malfunctioning caliper assembly	*Repair or replace.*
	Malfunctioning brake booster	*Check system and replace assembly.*
	Malfunctioning brake master cylinder	*Check system and replace as necessary.*
	Air in system	*Bleed system.*
	Malfunctioning ABS (ESP®).	*Check system and replace as necessary.*
Brake pull (Brakes not working in unison)	Brake pad and disc are wet with water or stained with oil in some brakes	*Clean or replace.*
	Disc is out of round in some brakes	*Replace.*
	Tires are inflated unequally	*Inflate equally.*
	Disturbed front wheel alignment	*Adjust as prescribed.*
	Unmatched tires on same axle	*Tires with approximately the same amount of tread should be used on the same axle.*
	Restricted brake pipes or hoses	*Check for soft hoses and damaged lines. Replace with new hoses and new double-walled steel brake tubing.*
	Malfunctioning caliper assembly	*Caliper should slide. Check for stuck or sluggish pistons and proper lubrication of caliper slide pin.*
	Loose suspension parts	*Check all suspension mountings.*
	Loose calipers	*Check and torque bolts to specifications.*
Noise (High pitched squeak without brake applied)	Contact wear indicator to brake disc	*Replace brake pads.*
	Worn brake pad	*Replace brake pads.*
Excessive pedal travel (Pedal stroke too large)	Partial brake system failure	*Check brake systems and repair as necessary.*
	Brake fluid leaking	*Repair the leaking point and bleed air.*
	Air in system (soft / spongy pedal)	*Bleed system.*
Brake locked	Malfunctioning ABS (ESP®)	*Check system referring to "ABS Check in Section 4E" or "Electronic Stability Program System Check in Section 4F".*
Dragging brakes (A very light drag is present in all brakes immediately after pedal is released.)	Master cylinder pistons not returning correctly	*Replace master cylinder.*
	Restricted brake pipes or hoses	*Check for soft hoses or damaged pipes and replace with new hoses and/or new brake piping.*
	Incorrect parking brake adjustment on rear brakes	*Check and adjust to correct specifications.*
	Weakened or broken return springs in rear brakes.	*Replace.*
	Sluggish parking brake cables or linkage	*Repair or replace.*
	Brake caliper piston sticking	*Repair as necessary.*
	Badly worn piston seal in caliper	*Replace piston seal.*
	Improper brake pedal free height	*Check brake pedal free height.*

Condition	Possible cause	Correction / Reference Item
Pedal pulsation (Pedal pulsates when depressed for braking)	Damaged or loose wheel bearings	*Replace wheel bearings.*
	Distorted steering knuckle or rear wheel spindle	*Replace knuckle or rear wheel spindle.*
	Excessive disc lateral runout	*Check per instructions. If not within specifications, replace or machine disc.*
	Parallelism between brake pad and disc not within specifications	*Check per instructions. If not within specifications, replace or machine disc.*
	Brake caliper piston sticking	*Repair as necessary.*
Braking noise	Worn or distorted brake pad	*Replace pads.*
	Loose front wheel bearings	*Replace wheel bearings.*
	Distorted backing plates or loose mounting bolts	*Replace or retighten securing bolts.*
	Contact wear indicator to brake disc	*Replace brake pad.*
Brake warning light lights after engine start	Parking brake applied	*Release parking brake and check that brake warning light turns off.*
	Insufficient amount of brake fluid	*Investigate leaky point, correct it and add brake fluid.*
	Brake fluid leaking	*Investigate leaky point, correct it and add brake fluid.*
	Brake warning light circuit faulty	*Repair circuit.*
	Malfunctioning EBD system	*Check system referring to “EBD Warning Light (Brake Warning Light) Comes ON Steady in Section 4E”.*
Brake warning light turns on when brake is applied	Brake fluid leaking	*Investigate leaky point, correct it and add brake fluid.*
	Insufficient amount of brake fluid	*Investigate leaky point, correct it and add brake fluid.*
Brake warning light fails to turn on even when parking brake is applied	Brake warning light circuit faulty	*Replace bulb or repair circuit.*
ABS warning light or ESP® warning light turns on after engine start	Malfunctioning ABS (ESP®)	*Check system referring to “ABS Check in Section 4E” or “Electronic Stability Program System Check in Section 4F”.*
ABS warning light or ESP® warning light turns on when brake is applied	Malfunctioning ABS (ESP®)	*Check system referring to “ABS Check in Section 4E” or “Electronic Stability Program System Check in Section 4F”.*
ABS warning light or ESP® warning light does not turn on for 2 sec. after ignition switch has turned ON	Bulb burnt out	*Replace bulb.*
	Malfunctioning ABS (ESP®)	*Check system referring to “ABS Check in Section 4E” or “Electronic Stability Program System Check in Section 4F”.*
ABS warning light flashes	New ABS hydraulic unit / control module assembly installed.	*Perform “ABS Hydraulic Unit Operation Check in Section 4E”.*

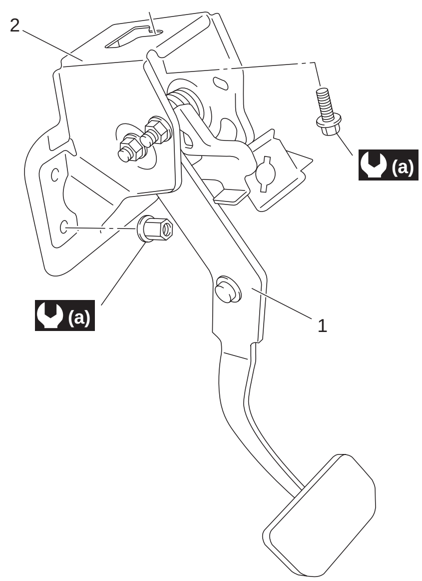
Repair Instructions

Brake Pedal Components

S7RS0B4106019

⚠ CAUTION

Never disassemble brake pedalassembly. Disassemble will spoil its originalfunction. If faulty condition is found, replaceit with new one.



I7RS0B410002-01

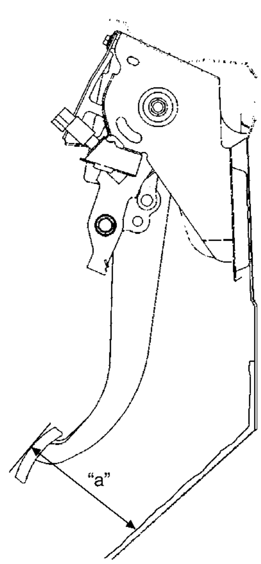
1. Brake pedal	(a) : 13 N·m (1,3 kgf-m, 9.5 lb-ft)
2. Brake pedal bracket	

Brake Pedal Free Height Inspection

S7RS0B4106001

1) Check brake pedal free height. If it is not within specification, check and adjust following item 2) and 6).

<u>Brake pedal free height “a” from carpet</u>
130 – 150 mm (5.1 – 5.9 in.)



I6RS0C410004-02

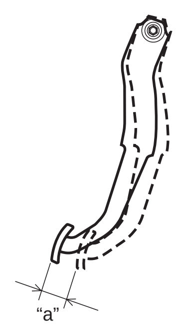
2) Check measurement between booster mounting surface and center of clevis pin hole. When booster push rod clevis has been reinstalled, it is important that the measurement is adjusted (refer to “Brake Booster Inspection and Adjustment”).
3) Check stop light switch position. Adjust it if it is out of specification.
4) Check pedal for dent.
5) Check brake booster for installation.
6) Check brake booster push rod for length.

Brake Pedal Play Inspection

S7RS0B4106002

Pedal play should be within the following specification. If out of specification, check stop light switch for proper installation position and adjust if necessary.
Also check pedal shaft bolt and booster clevis pin installation for looseness and replace if defective.

<u>Brake pedal play “a”</u>
: 1 – 8 mm (0.04 – 0.31 in.)



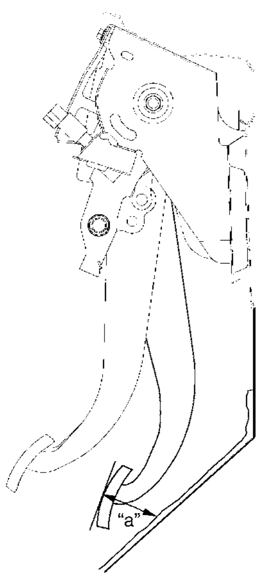
I3RH0A410010-01

Excessive Pedal Travel Inspection

S7RS0B4106003

1) Start engine.
2) Depress brake pedal a few times.
3) With brake pedal depressed with approximately 300 N (30 kg, 66 lbs) load, measure brake pedal to wall (dash panel silencer) clearance “a”. If clearance “a” is less than specification, the most possible cause is air in lines. Should clearance “a” remain less than specification even after bleeding of system, other possible infrequent cause is booster push rod length out of adjustment.
   - Bleed brake system. Refer to “Air Bleeding of Brake System”.

<u>Brake arm pedal to wall clearance “a”</u>
When pedal depressed at 300 N (30 kg, 66 lbs): over 75 mm (2.95 in.)

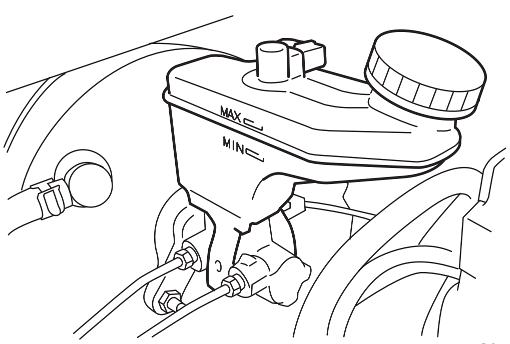


I6RS0C410005-02

Brake Fluid Level Inspection

S7RS0B4106004

1) Check master cylinder, reservoir and reservoir hose (if equipped) for crack, damage and brake fluid leakage. If any faulty condition exists, correct or replace.
2) Check that brake fluid level is between MAX and MIN marks on reservoir.



I4RS0B410006-01

NOTE

Be sure to use particular brake fluid either as indicated on reservoir cap of that vehicle or recommended in owner’s manual which comes along with that vehicle. Use of any other fluid is strictly prohibited.
Fluid level should be between MIN and MAX lines marked on reservoir.
When brake warning lamp lights sometimes during driving, replenish fluid to MAX level.
When fluid decreases quickly, inspect brake system for leakage. Correct leaky points and then refill to specified level.

⚠ CAUTION

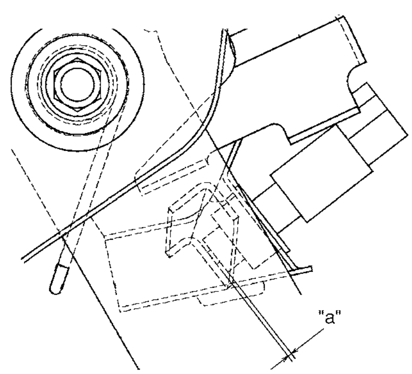
Do not use shock absorber fluid or any other fluid which contains mineral oil. Do not use a container which has been used for mineral oil or a container which is wet from water.
Mineral oil will cause swelling and distortion of rubber parts in hydraulic brake system and water mixed into brake fluid will lower fluid boiling point. Keep all fluid containers capped to prevent contamination.

Stop Light Switch Adjustment

S7RS0B4106005

Adjustment should be made as follows. Pull up brake pedal toward you and while holding it there, adjust switch position so that clearance between end of thread and brake pedal is as specified. Then lock it by turning clockwise.

<u>Clearance between brake pedal and stop light switch</u>
“a”: 1.2 – 2.2 mm (0.05 – 0.08 in.)



I4RS0A410007-01

Air Bleeding of Brake System

S7RS0B4106006

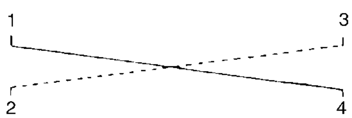
⚠ **CAUTION**

Brake fluid is extremely damaging to paint. If fluid should accidentally touch painted surface, immediately wipe fluid from paint and clean painted surface.

Bleeding operation is necessary to remove air whenever it entered hydraulic brake system.
Hydraulic lines of brake system are based on the diagonal split system. When a brake pipe or hose was disconnected at the wheel, bleeding operation must be performed at both ends of the line of the removed pipe or hose. When any joint part of the master cylinder of other joint part between the master cylinder and each brake (wheel) was removed, the hydraulic brake system must be bled at all 4 wheel brakes.

NOTE

Perform bleeding operation starting with rear brake caliper farthest from master cylinder and then at front caliper of the same brake line. Do the same on the other brake line.

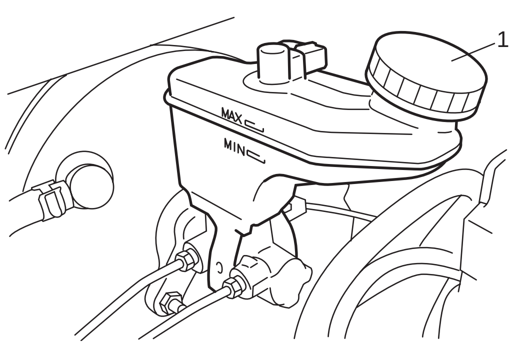


I6RS0C410007-01

1. Right front brake caliper	3. Right rear brake caliper
2. Left front brake caliper	4. Left rear brake caliper

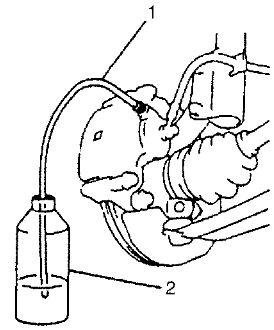
1) Fill master cylinder reservoir with brake fluid and keep at least one-half full of fluid during bleeding operation.

<u>**Brake fluid**</u>
: Refer to reservoir cap (1)



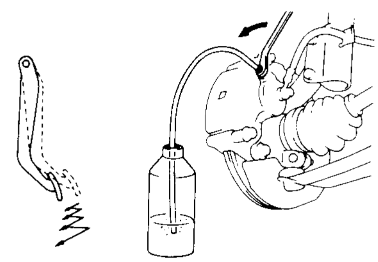
I6RS0C410009-01

2) Remove bleeder plug cap. Attach a vinyl tube (1) to bleeder plug, and insert the other end into container (2).



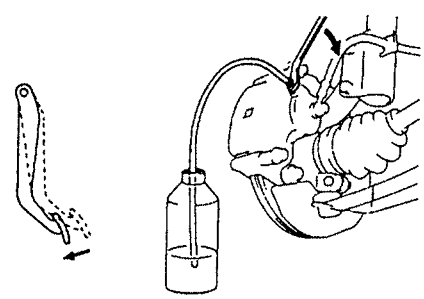
I2RH01410015-01

3) Depress brake pedal several times, and then while holding it depressed, loosen bleeder plug about one-third to one-half turn.
4) When fluid pressure in cylinder is almost depleted, retighten bleeder plug.
5) Repeat this operation until there are no more air bubbles in hydraulic line.



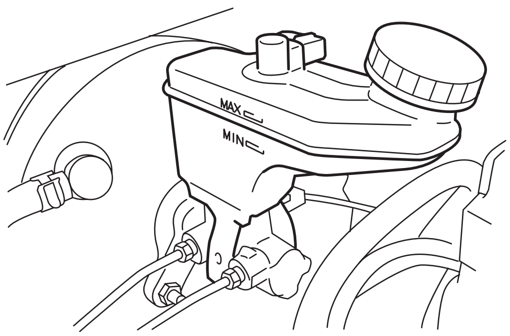
I2RH01410016-01

6) When bubbles stop, depress and hold brake pedal and tighten bleeder plug referring to “Front Disc Brake Components in Section 4B” and “Rear Disc Brake Components in Section 4C”.



I2RH01410017-01

7) Then attach bleeder plug cap.
8) After completing bleeding operation, apply fluid pressure to pipe line and check for leakage.
9) Replenish fluid into reservoir up to specified level.



I4RS0B410006-01

10) Check brake pedal for sponginess. If found spongy, repeat entire procedure of bleeding.

Front Brake Hose / Pipe Removal and Installation

S7RS0B4106007

"Front Brake Hose / Pipe Construction"

⚠ CAUTION

Do not allow brake fluid to get on painted surfaces. Painted surfaces will be damaged by brake fluid, flush it with water immediately if any fluid is spilled.

Removal

1) Raise and support vehicle properly. Remove tire and wheel.

NOTE

This operation is not necessary when removing pipes connecting master cylinder.

2) Clean dirt and foreign material from both flexible hose end and pipe end fittings.
3) Drain brake fluid in reservoir.
4) Remove brake flexible hose or pipe.

Installation

Reverse brake flexible hose removal procedure, noting the following.

- Make sure that steering wheel is in straight-forward position and flexible hose has not twist or kink.
- Check to make sure that flexible hose doesn't contact any part of suspension, both in extreme right and extreme left turn conditions. If it does at any point, remove and correct. Fill and maintain brake fluid level in reservoir.
- Bleed brake system. Refer to "Air Bleeding of Brake System".
- Perform brake test and check installed part for fluid leakage.

Rear Brake Hose / Pipe Removal and Installation

S7RS0B4106008

⚠ CAUTION

Do not allow brake fluid to get on painted surfaces. Painted surfaces will be damaged by brake fluid, flush it with water immediately if any fluid is spilled.

Removal

1) Raise and support vehicle properly. Remove tire and wheel.
2) Clean dirt and foreign material from both flexible hose end and pipe end fittings.
3) Drain brake fluid in reservoir.
4) Remove brake flexible hose or pipe.

Installation

Reverse brake flexible hose removal procedure, noting the following.

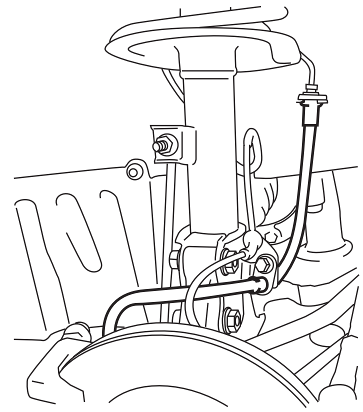
- Fill and maintain brake fluid level in reservoir.
- Bleed brake system. Refer to "Air Bleeding of Brake System".
- Perform brake test and check each installed part for fluid leakage.
- Never reuse protector nut once removed. Be sure to use a new one.
- Install clamps properly referring to the figure and tighten bolts.
- When installing hose, make sure that it has no twist or kink.

Brake Hose and Pipe Inspection

S7RS0B4106009

Hose

The brake hose assembly should be checked for road hazard damage, for cracks and chafing of outer cover, for leaks and blisters. A light and mirror may be needed for an adequate inspection. If any above conditions are observed on brake hose, it is necessary to replace it.



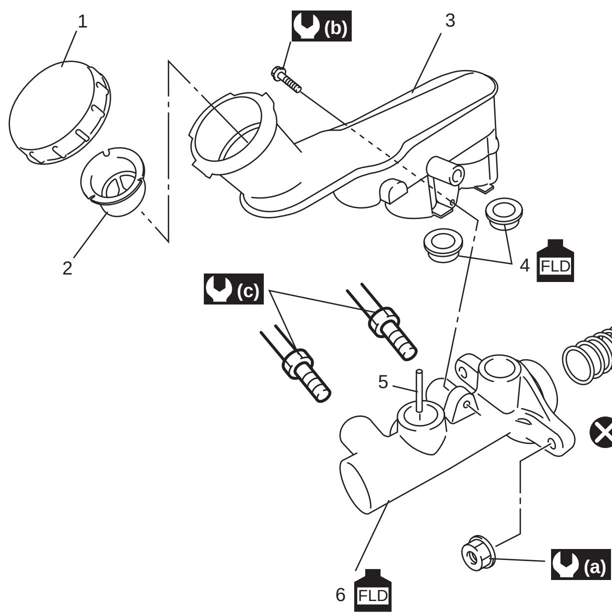
I4RS0B410009-01

Pipe

Inspect the pipe for damage, cracks, dents and corrosion. If any defect is found, replace it.

Master Cylinder Components

S7RS0B4106010



I7RS0B410004-01

1. Reservoir cap	7. Master cylinder piston set	13. Circlip
2. Filter	FLD 8. Primary piston assembly : Apply brake fluid.	(a) : 2.5 N·m (0.25 kgf-m, 2.0 lb-ft)
3. Reservoir	FLD 9. Secondary piston assembly : Apply brake fluid.	(b) : 15 N·m (1.5 kgf-m, 11.0 lb-ft)
FLD 4. Grommet : Apply brake fluid.	10. Cup	(c) : 16 N.m (1.6 kgf-m, 12.0 lb-ft) (flare nut for M10) 19 N.m (1.9 kgf-m, 14.0 lb-ft) (flare nut for M12)
FLD 5. Secondary piston stopper pin : Apply brake fluid.	11. Piston guide	: Do not reuse.
FLD 6. Master cylinder body : Apply brake fluid to inside of cylinder.	12. O-ring	

Master Cylinder Assembly Removal and Installation

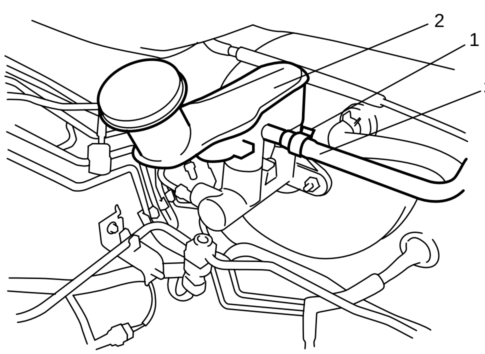
S7RS0B4106011

⚠ CAUTION

Do not allow brake fluid to get on painted surfaces. Painted surfaces will be damaged by brake fluid, flush it with water immediately if any fluid is spilled.

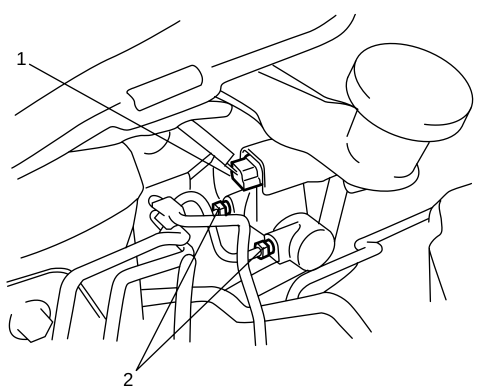
Removal

1) Clean outside of master cylinder.
2) Drain brake fluid in reservoir.
3) Remove clutch reservoir hose clamp (1) and disconnect clutch reservoir hose (3) from reservoir (2) (M/T model).



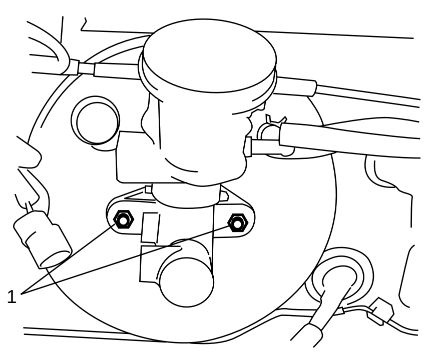
I4RS0A410026-01

4) Disconnect fluid level switch coupler (1) on reservoir.
5) Disconnect brake pipes (2) connected to master cylinder.



I4RS0A410013-01

6) Remove master cylinder fixing nuts (1).



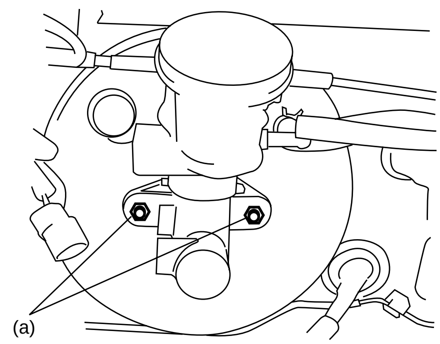
I4RS0A410014-01

7) Remove master cylinder and master cylinder seal.

Installation

1) Install new master cylinder seal.
2) Apply small amount of silicon grease (included in spare parts) to piston rod.
3) Install master cylinder to booster and tighten master cylinder fixing nuts (a) to specified torque.

Tightening torque
Master cylinder fixing nut (a): 15 N·m (1.5 kgf-m, 11.0 lb-ft)

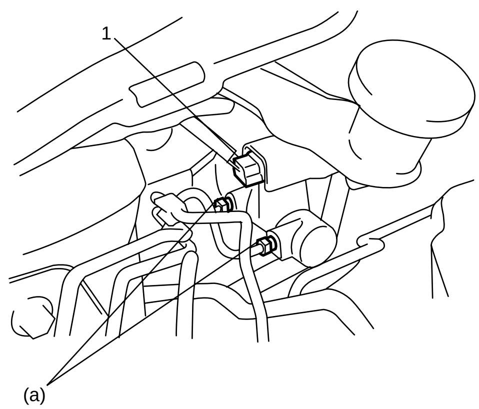


I4RS0A410015-01

4) Connect brake pipe to master cylinder and tighten flare nuts (a) to specified torque.

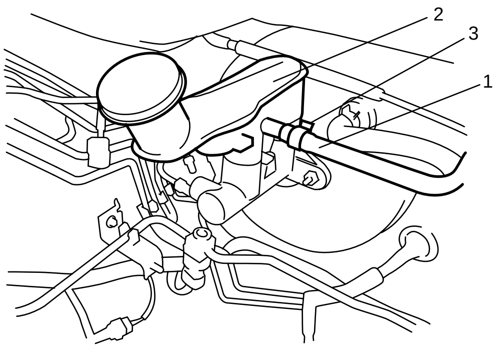
Tightening torque
Brake pipe flare nut for M10 (a): 16 N·m (1.6 kgf-m, 11.5 lb-ft)
Brake pipe flare nut for M12 (a): 19 N·m (1.9 kgf-m, 14.0 lb-ft)

5) Connect fluid level switch connector (1) of reservoir.



I4RS0A410016-01

6) Connect clutch reservoir hose (1) to reservoir (2) and install reservoir hose clamp (3) (M/T model).



I4RS0A410023-01

7) Fill reservoir with specified brake fluid up to its MAX mark.
8) After completing the work, bleed air from brake and clutch system referring to “Air Bleeding of Brake System” and “Air Bleeding of Clutch System in Section 5C” (M/T model).
9) Check each installed parts for fluid leakage
10) Check brake pedal for play referring to “Brake Pedal Play Inspection”.
11) Perform brake test and check fluid leakage.

Master Cylinder Reservoir Removal and Installation

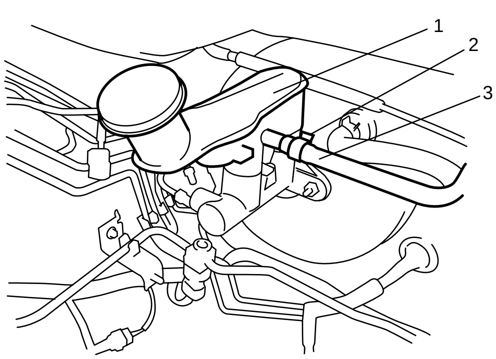
S7RS0B4106020

⚠ CAUTION

Brake fluid is extremely damaging to paint. Do not allow brake fluid to get on painted surfaces.

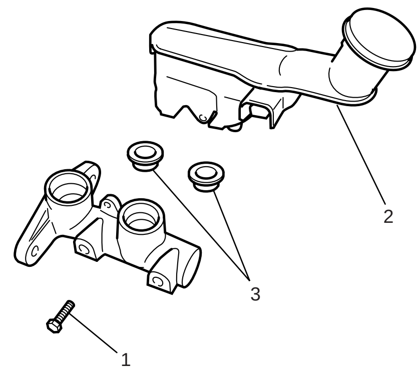
Removal

1) Remove windshield wiper referring to “Windshield Wiper Removal and Installation in Section 9D”.
2) Remove cowl top panel referring to “Cowl Top Components in Section 9K”.
3) Disconnect fluid level switch coupler on reservoir.
4) Clean outside of reservoir.
5) Take out fluid with syringe or such.
6) Disconnect clutch reservoir hose clamp (2) and hose (3) from reservoir (1) (M/T model).



I4RS0A410010-01

7) Remove reservoir bolt (1).
8) Remove reservoir (2) and grommets (3).

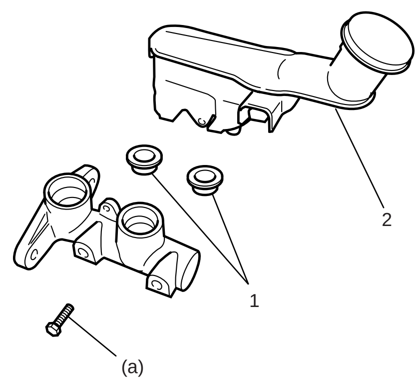


I4RS0A410011-01

Installation

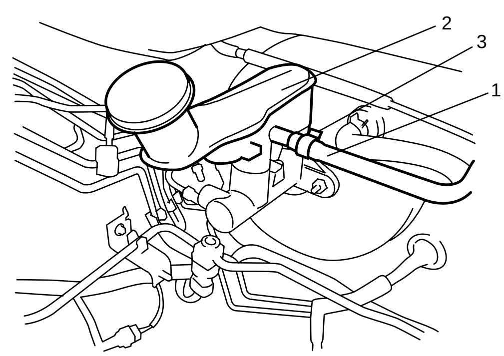
1) When using new grommets, lubricate them with the same fluid as the one to fill reservoir with. Then press-fit grommets (1) to reservoir (2). Grommets must be seated in place.
2) Install reservoir (2) to master cylinder with bolt (a).

Tightening torque
Reservoir bolt (a): 2.5 N·m (0.25 kgf-m, 2.0 lb-ft)



I4RS0A410012-01

3) Connect fluid level switch coupler on reservoir.
4) Connect clutch reservoir hose (1) to reservoir (2) (M/T model).
5) Install clutch reservoir hose clamp (3) (M/T model).



I4RS0A410023-01

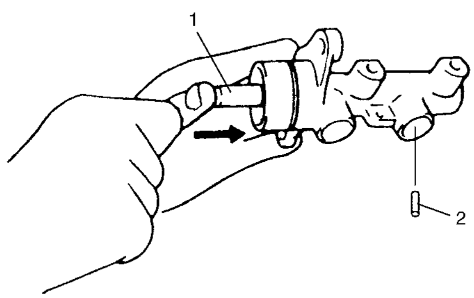
6) Fill reservoir with specified fluid.
7) After completing the work, bleed air from brake and clutch system referring to “Air Bleeding of Brake System” and “Air Bleeding of Clutch System in Section 5C” (M/T model).
8) Install cowl top panel referring to “Cowl Top Components in Section 9K”.
9) Install windshield wiper referring to “Windshield Wiper Removal and Installation in Section 9D”.
10) Perform brake test and check each installed part for fluid leakage.

Master Cylinder Assembly Disassembly and Assembly

S7RS0B4106013

Disassembly

1) Push in primary piston (1) to remove secondary piston stopper pin (2) from master cylinder as shown.

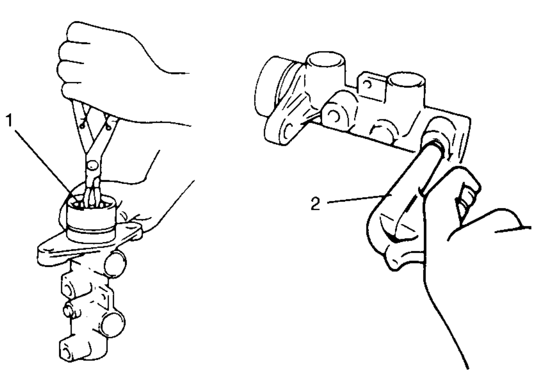


I2RH01410025-01

2) Remove circlip (1).
3) Remove piston guide and primary piston. Then remove secondary piston by blowing compressed air (2) into hole. Be cautions during removal as secondary piston jumps out.

⚠ WARNING

Do not apply too highly compressed air which will cause piston to jump out of cylinder. Place a cloth to prevent piston from damage. It should be taken out gradually with moderately compressed air. Do not place your fingers in front of piston when using compressed air.



I4RS0A410017-01

Assembly

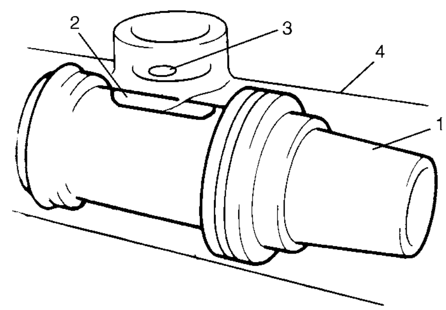
⚠ CAUTION

- **Never use any mineral oil such as kerosene oil and gasoline when washing and assembling parts.**
- **Check inside of cylinder wall, pistons and cup seals are free from any foreign objects such as dust and dirt and use case not to cause any damage with a tool during assembly.**
- **Do not drop parts. Do not use any part which has been dropped.**

1) Apply brake fluid to inside of cylinder and contact surface of piston assembly (new piston cups, new O-ring and piston guide).
2) Install secondary return spring and secondary piston (1) into cylinder body (4).

NOTE

Align oblong hole in secondary piston (2) with stopper pin hole (3) in master cylinder body (4) when installing it.



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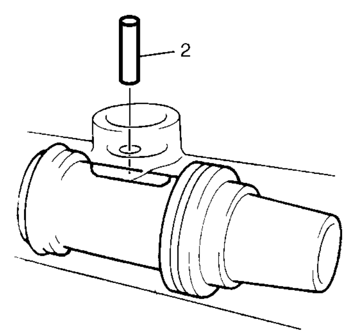
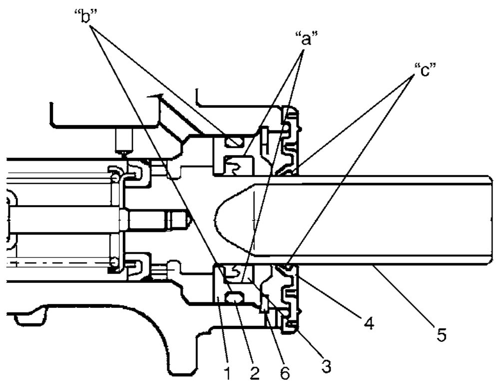
3) Install primary piston assembly into cylinder body.
4) Install piston stopper pin (2) with pistons pushed in all the way and install it.



I4RS0A410018-01

5) Apply small amount of rubber grease (included in spare parts) to mating surface of “a” (piston cup (3) and piston guide (1)) and “b” piston guide (1) and O-ring (2)).
6) Apply small amount of silicon grease (included in spare parts) to mating surfaces of “c” (rod seal (4) and primary piston (5)).
7) Install piston guide (1) and circlip (6).



I4RS0A410024-01

Master Cylinder Assembly Inspection

S7RS0B4106014

Inspect all disassembled parts for wear or damage, and replace parts if necessary.

NOTE

- **Wash disassembled parts with brake fluid.**
- **Do not reuse inner parts and rubber parts.**

Inspect master cylinder bore for scoring or corrosion. It is best to replace corroded cylinder. Corrosion can be identified as pits or excessive roughness.

NOTE

Polishing bore of master cylinder with cast aluminium body with anything abrasive is prohibited, as damage to cylinder bore may occur.

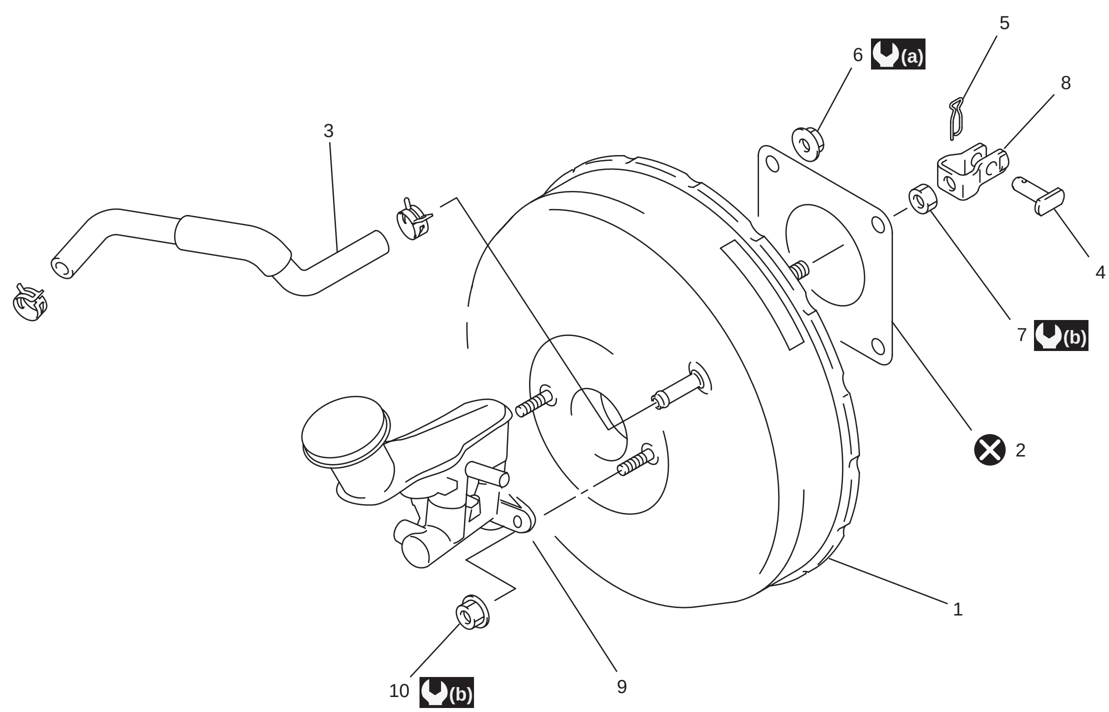
Rinse cylinder in clean brake fluid. Shake excess rinsing fluid from cylinder. Do not use a cloth to dry cylinder, as lint from cloth cannot be kept from cylinder bore surfaces.

Brake Booster Components

S7RS0B4106015

⚠ **CAUTION**

Never disassemble brake booster. Disassembly will spoil its original function. If faulty condition is found, replace it with new one.



I6RS0C410010-01

1. Booster assembly	5. Clip	9. Brake master cylinder	⊗ : Do not reuse.
2. Gasket	6. Booster nut	10. Master cylinder fixing nut	
3. Brake vacuum hose	7. Clevis pin lock nut	(a) : Tighten 13 N·m (1.3 kgf-m, 9.5 lb-ft) by the specified procedure.	
4. Clevis pin	8. Push rod clevis	(b) : 15 N·m (1.5 kgf-m, 11.0 lb-ft)	

Booster Operation Inspection

S7RS0B4106016

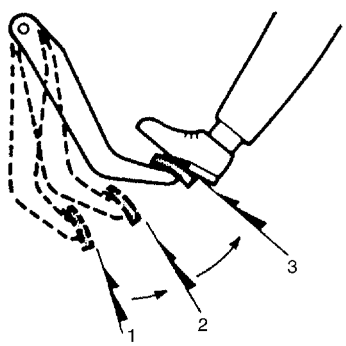
There are two ways to perform this inspection, with and without a tester. Ordinarily, it is possible to roughly determine its condition without using a tester.

NOTE

For this check, make sure that no air is in hydraulic line.

Check Air Tightness

1) Start engine.
2) Stop engine after running for 1 to 2 minutes.
3) Depress brake pedal several times with the same load as in ordinary braking and observe pedal travel. If pedal goes down deep the first time but its travel decreases as it is depressed the second and more times, air tightness is obtained.



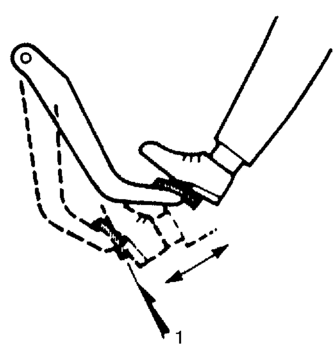
I2RH01410005-01

1. 1st	2. 2nd	3. 3rd

4) If pedal travel doesn't change, air tightness isn't obtained.

NOTE

If defective, inspect vacuum lines and sealing parts, and replace any faulty part. When this has been done, repeat the entire test.

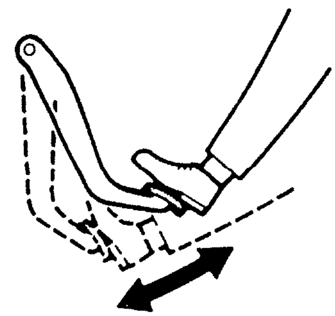


I2RH01410006-01

1. 1st, 2nd, 3rd

Check Operation

1) With engine stopped, depress brake pedal several times with the same load and make sure that pedal travel doesn't change.



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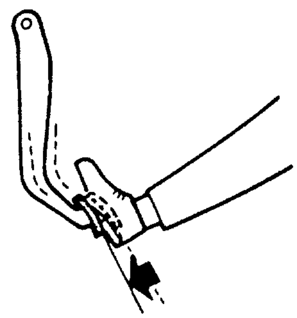
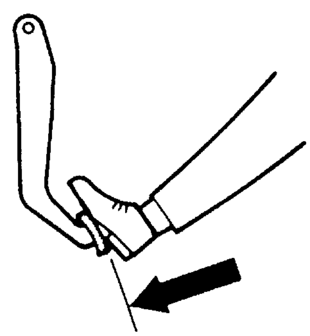
2) Start engine while depressing brake pedal. If pedal travel increases a little, operation is satisfactory. But no change in pedal travel indicates malfunction.



I2RH01410008-01

Check Air Tightness Under Load

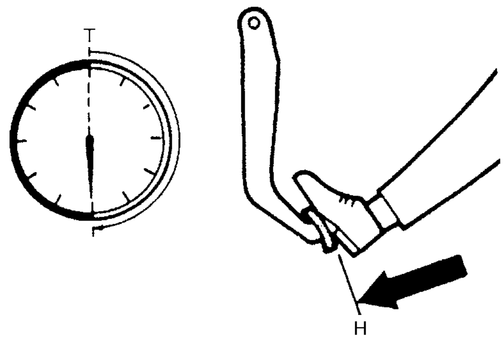
1) With engine running, depress brake pedal. Then stop engine while holding brake pedal depressed.



I2RH01410009-01

H: Hold

2) Hold brake pedal depressed for 30 seconds. If pedal height does not change, condition is good. But it isn't if pedal rises.



I2RH01410010-01

H:	Hold
T:	30 seconds

Brake Booster Removal and Installation

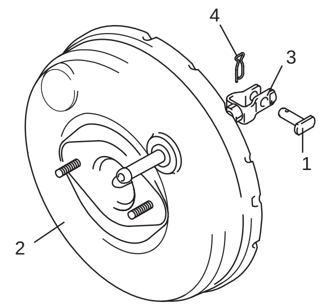
S7RS0B4106017

Removal

1) Recover refrigerant from A/C system by using recovery and recycling equipment referring to "Operation Procedure for Refrigerant Charge in Section 7B" or "Operation Procedure for Refrigerant Charge in Section 7B".
2) Remove master cylinder assembly from booster referring to "Master Cylinder Assembly Removal and Installation".
3) Remove cowl top cover and cowl top panel referring to "Cowl Top Components in Section 9K".
4) Remove suction hose referring to "Major Components of A/C System in Section 7B" or "Major Components of A/C System in Section 7B".
5) Disconnect vacuum hose from booster referring to "Brake Booster Components".
6) Remove push rod clevis pin and booster mounting nuts and then remove booster.

Installation

1) Loosen brake pedal bracket mounting bolt.
2) Install booster (2) to dash panel. Then connect push rod clevis (3) to pedal arm with clevis pin (1) and clip (4).



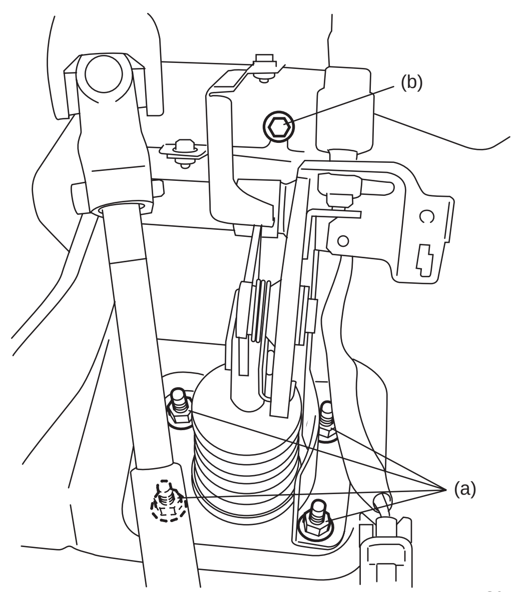
I6RS0C410006-02

3) Tighten booster mounting nuts (a) to specified torque.

   Tightening torque
   Booster mounting nut (a): 13 N·m (1.3 kgf-m, 9.5 lb-ft)

4) Tighten brake pedal bracket mounting bolt to specified torque.

   Tightening torque
   Brake pedal bracket mounting bolt (b): 13 N·m (1.3 kgf-m, 9.5 lb-ft)



I4RS0B410021-02

5) Install suction hose referring to "Major Components of A/C System in Section 7B" or "Major Components of A/C System in Section 7B".
6) Install cowl top panel and cowl top cover referring to "Cowl Top Components in Section 9K".
7) Install master cylinder assembly to booster referring to "Master Cylinder Assembly Removal and Installation".
8) Fill reservoir with specified fluid.
9) Bleed air from brake system.

10) Check pedal height and play referring to "Brake Pedal Free Height Inspection" and "Brake Pedal Play Inspection".
11) Check each installed part for fluid leakage and perform brake test.
12) Evacuate and charge refrigerant by referring to "Evacuating of A/C System" and "Procedure of Charging" under "Operation Procedure for Refrigerant Charge in Section 7B" or "Operation Procedure for Refrigerant Charge in Section 7B".

Brake Booster Inspection and Adjustment

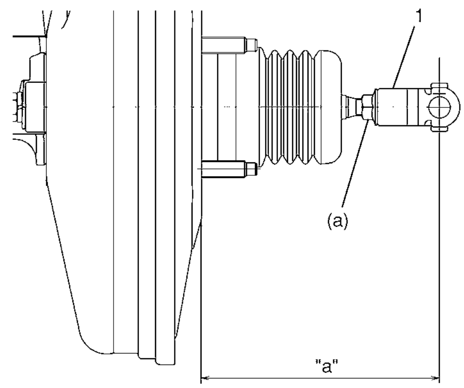
S7RS0B4106018

Installation Position of Push Rod

If push rod clevis (1) has been removed, adjust distance between booster installation surface (without including packing) and the center of clevis pin hole to standard value "a" and tighten nut (a) to specified torque.

Distance "a" between center of booster clevis pin hole and booster surface
Standard:
114.5 – 115.5 mm (4.51 – 4.54 in.)

Tightening torque
Clevis lock nut (a): 15 N·m (1.5 kgf-m, 11.0 lb-ft)



I4RS0A410022-01

Specifications

Tightening Torque Specifications

S7RS0B4107001

Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
Master cylinder fixing nut	15	1.5	11.0	☞
Brake pipe flare nut for M10	16	1.6	11.5	☞
Brake pipe flare nut for M12	19	1.9	14.0	☞
Reservoir bolt	2.5	0.25	2.0	☞
Booster mounting nut	13	1.3	9.5	☞
Brake pedal bracket mounting bolt	13	1.3	9.5	☞
Clevis lock nut	15	1.5	11.0	☞

NOTE

The specified tightening torque is also described in the following.
"Front Brake Hose / Pipe Construction"
"Rear Brake Hose / Pipe Construction"
"Brake Pedal Components"
"Master Cylinder Components"
"Brake Booster Components"

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

Special Tools and Equipment

Recommended Service Material

S7RS0B4108001

NOTE

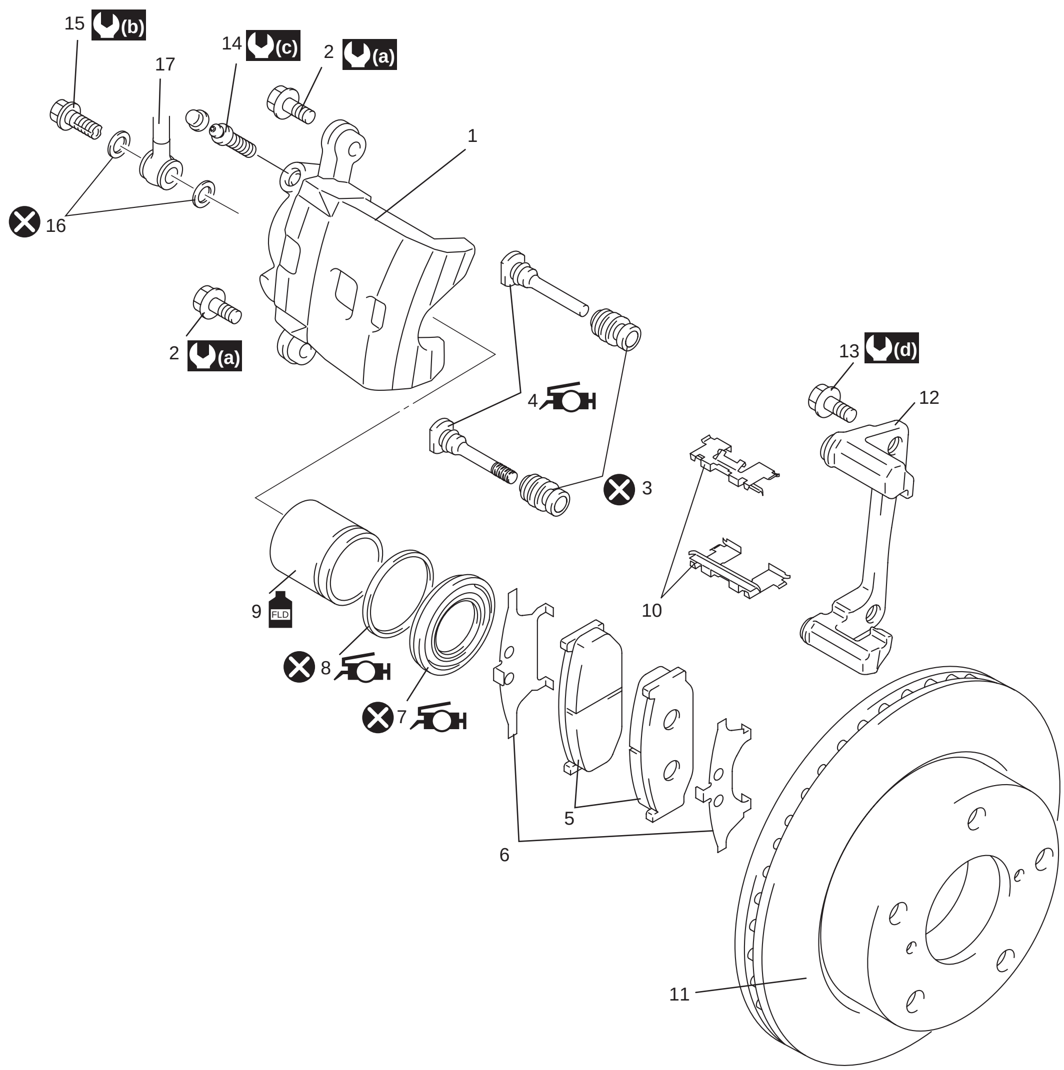
Required service material is also described in the following.
"Master Cylinder Components"

Front Brakes

Repair Instructions

Front Disc Brake Components

S7RS0B4206001



I6RS0C420005-02

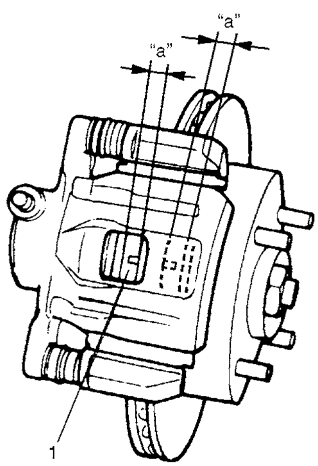
1. Caliper	9. Disk brake piston : Apply brake fluid to contact surface of cylinder.	17. Brake flexible hose
2. Caliper pin bolt	10. Pad spring	(a) : 26 N·m (2.6 kgf-m, 19.0 lb-ft)
3. Boot	11. Brake disc	(b) : 23 N·m (2.3 kgf-m, 17.0 lb-ft)
4. Slide pin : Apply rubber grease (included in slide pin boot set).	12. Brake caliper carrier	(c) : 8 N·m (0.8 kgf-m, 6.0 lb-ft)
5. Brake pad	13. Caliper carrier bolt	(d) : 85 N·m (8.5 kgf-m, 61.5 lb-ft)
6. Shim : Apply small amount of pad grease (include in pad repair kit).	14. Bleeder plug	: Do not reuse.
7. Cylinder boot : Apply small amount of rubber grease included in piston seal set.	15. Flexible hose joint bolt	
8. Piston seal : Apply small amount of rubber grease included in piston seal set.	16. Hose washer	

Front Disc Brake Pad On-Vehicle Inspection

S7RS0B4206002

Inspect pad linings (1) periodically according to maintenance schedule whenever wheels are removed (for tire rotation or other reason). Take a look through each end (or hole) of caliper and check lining thickness of outside and inside pads.
If lining is worn and its thickness (“a” in figure) is less than limit, all pads must be replaced at the same time.

<u>Front brake pad thickness “a” (lining thickness)</u>
Standard: 10 mm (0.40 in.)
Limit: 2 mm (0.08 in.)



I2RH01420001-01

Front Disc Brake Pad Removal and Installation

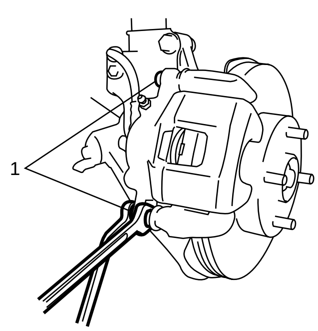
S7RS0B4206003

NOTE

When replacing brake pad, replace it on the right and left.

Removal

1) Loosen wheel nuts, lifted vehicle and remove wheels referring to “Wheel Removal and Installation in Section 2D”.
2) Remove caliper pin bolts (1).



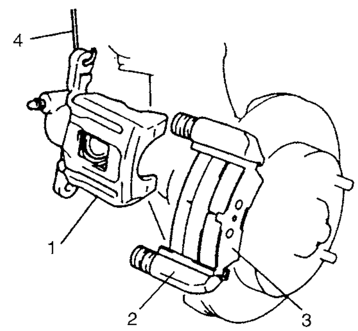
I2RH01420003-01

3) Remove caliper (1) from caliper carrier (2).

NOTE

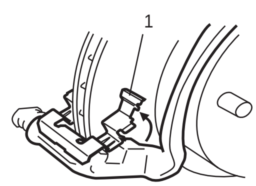
Hang removed caliper (1) with a wire hook (4) or the like so as to prevent brake hose from bending and twisting excessively or being pulled.
Don’t operate brake pedal with brake pads removed.

4) Remove brake pads (3).



I2RH01420004-01

5) Remove brake pad spring (1) as shown in figure.



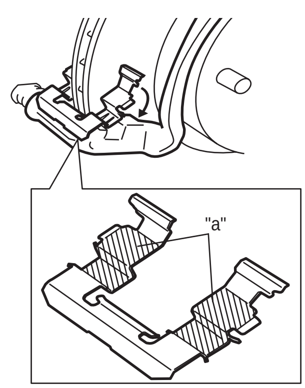
I7RW01420014-01

Installation

⚠ WARNING

Do not apply grease on pad lining surface.

1) Apply small amount of pad grease “a” (included in spare parts) to pad spring and set brake pad spring as shown in figure.

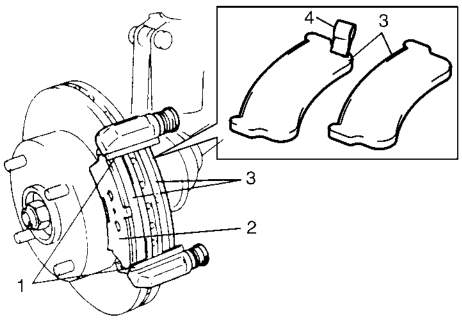


I7RW01420011-01

2) Set brake pad springs (1), shim (2) and install brake pads (3).

NOTE

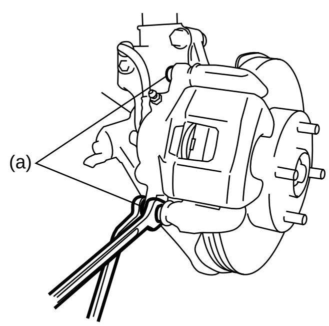
Install right side brake pad with wear indicator (4) to vehicle center side.



I6RS0C420002-01

3) Install caliper and tighten caliper pin bolts (a) to specified torque.

Tightening torque
Caliper pin bolt (a): 26 N·m (2.6 kgf-m, 19.0 lb-ft)



I4RS0A420002-01

4) Install wheel and lower lift.
5) Tighten wheel nuts to specified torque.

Tightening torque
Wheel nut (a): 85 N·m (8.5 kgf-m, 61.5 lb-ft)

6) After completion of installation, check for brake effectiveness.

Front Disc Brake Pad Inspection

S7RS0B4206004

Check pad lining for wear. When wear exceeds limit, replace with new one.

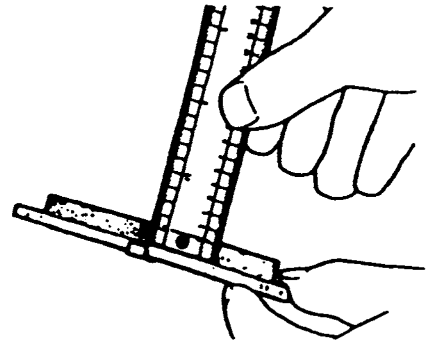
⚠ CAUTION

Never polish pad lining with sandpaper. If lining is polished with sandpaper, hard particles of sandpaper will be deposited in lining and may damage disc. When pad lining requires correction, replace it with a new one.

Front brake pad thickness (lining thickness)
Standard: 10 mm (0.40 in.)
Limit: 2 mm (0.08 in.)

NOTE

When pads are removed, visually inspect caliper for brake fluid leak. Correct leaky point, if any.



I2RH01420005-01

Front Disc Brake Caliper Removal and Installation

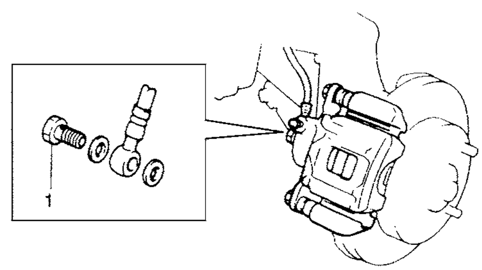
S7RS0B4206005

Removal

1) Hoist vehicle and remove wheel.
2) Loosen flexible hose joint bolt (1) a little at caliper.

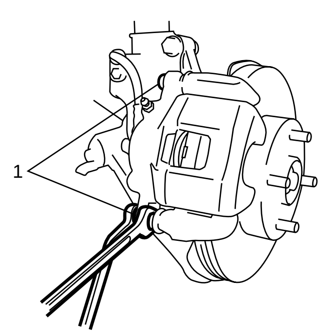
⚠ CAUTION

Be careful not to twist flexible hose while loosening the bolt.



I6RS0C420003-01

3) Remove caliper pin bolts (1).



I2RH01420010-01

4) Remove caliper from caliper carrier.
5) Disconnect flexible hose from caliper using care not to twist it. As this will allow brake fluid to flow out of flexible hose, have a container ready beforehand.

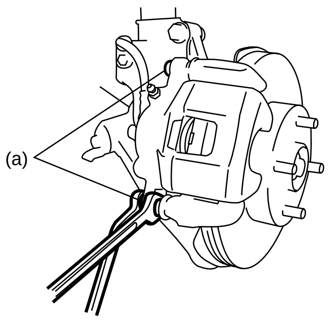
Installation

1) Torque caliper pin bolts (a) to specification.

NOTE

- **Make sure that boots are fit into groove securely.**
- **If brake pads are replaced, use new caliper pin bolts included in repair kit. (if included)**

Tightening torque
Caliper pin bolt (a): 26 N·m (2.6 kgf-m, 19.0 lb-ft)



I4RS0A420003-01

2) Connect caliper to flexible hose.
3) Torque flexible hose joint bolt to specification.

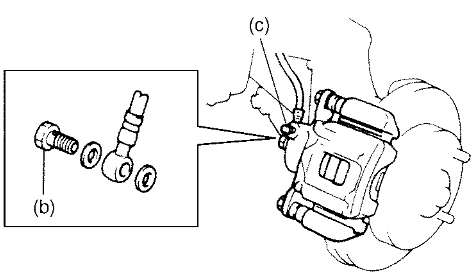
Tightening torque
Flexible hose joint bolt (b): 23 N·m (2.3 kgf-m, 17.0 lb-ft)

⚠ WARNING

Make sure that flexible hose is not twisted when tightening joint bolt. If it is twisted, reconnect it using care not to twist it.

4) Tighten bleeder plug to specified torque.

Tightening torque
Bleeder plug (c): 8.0 N·m (0.8 kgf-m, 6.0 lb-ft)



I6RS0C420004-01

5) Lower hoist and torque wheel nuts to specifications.

Tightening torque
Wheel nut: 85 N·m (8.5 kgf-m, 61.5 lb-ft)

6) After completing installation, fill reservoir with brake fluid and bleed air from brake system referring to "Air Bleeding of Brake System in Section 4A".
7) Check each installed part for fluid leakage.
8) Perform brake test and check fluid leakage.

Front Disc Brake Caliper Disassembly and Assembly

S7RS0B4206006

Disassembly

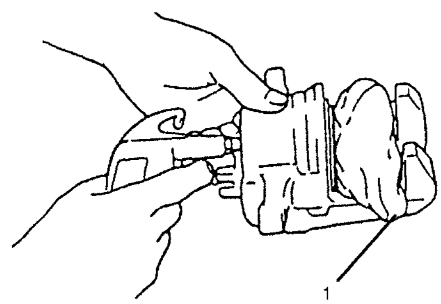
⚠ CAUTION

- **Clean around caliper with brake fluid before disassembly.**
- **Be careful not to damage inside (bore side) of cylinder.**

1) Remove piston with air blown into flexible hose bolt installation hole.

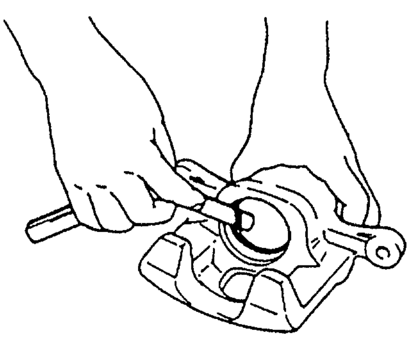
⚠ WARNING

Do not apply too highly compressed air which will cause piston to jump out of cylinder. Place a cloth (1) to prevent piston from damage. It should be taken out gradually with moderately compressed air. Do not place your fingers in front of piston when using compressed air.



I2RH01420011-01

2) Remove cylinder boot.
3) Remove piston seal using a thin blade like a thickness gauge, etc.



I2RH01420013-01

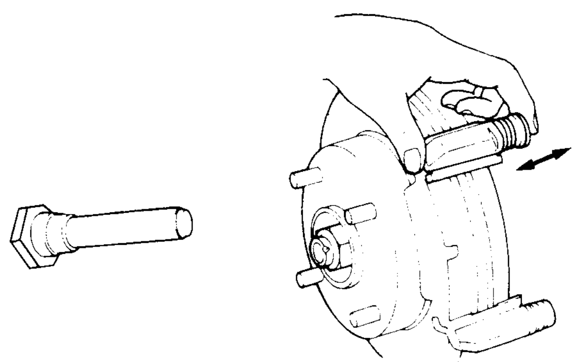
4) Remove bleeder plug and cap from caliper.

Assembly

Assemble parts in reverse order of disassembly, observing the following instructions.

⚠ CAUTION

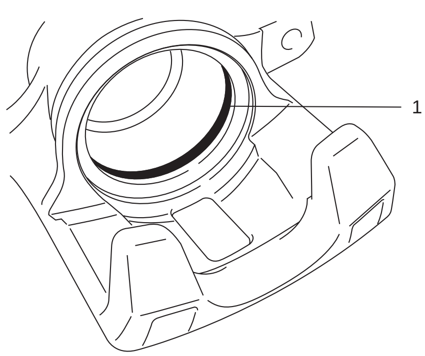
- **Wash each part cleanly before installation in the same fluid as the one used in master cylinder reservoir.**
- **Never use other fluid or thinner.**
- **Before installing piston seal or cylinder boot to cylinder, apply brake fluid to them.**
- **Install a new piston seal into groove in cylinder securely making sure that it is not twisted.**
- **Before installing caliper to carrier, check for slid pin smooth movement in thrust direction.**
- **After reassembling brake lines, bleed air from them.**



I2RH01420016-01

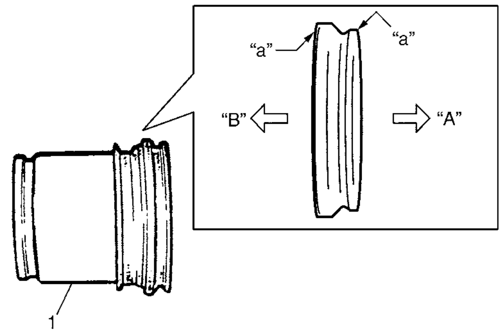
- Install piston seal, boot and piston to caliper referring to the following instructions.

1) Replace with a new piston seal (1) at every overhaul. After applying rubber grease (included in repair kit) or brake fluid, fit piston seal (1) into groove in cylinder taking care not to twist it.



I2RH01420017-01

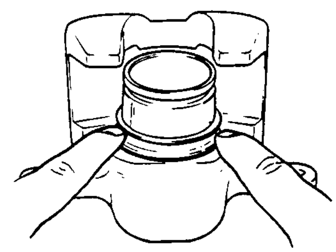
2) Before inserting piston (1) into cylinder, apply rubber grease (included in repair kit) or brake fluid to new boot "a" and install it onto piston as shown.



I4RS0A420006-01

"A":	1 grooved side directed cylinder side
"B":	2 grooved side directed pad side

3) Fit boot as it is in figure into boot groove in cylinder with fingers.

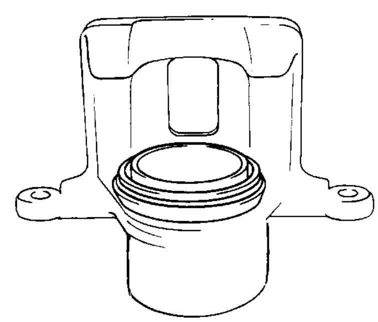


I2RH01420019-01

4) Insert piston into cylinder by hand and fit boot in boot groove in piston.

NOTE

Check that boot is fitted in boot groove securely all around piston and cylinder.



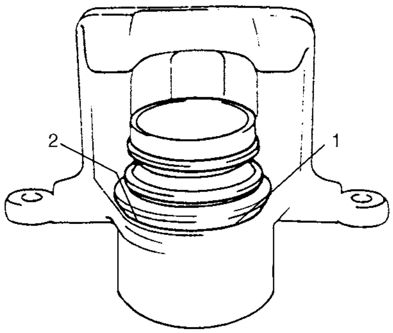
I2RH01420020-01

5) To confirm that boot is fitted in its groove in cylinder properly, pull piston out of cylinder a little but do not take it all out.

NOTE

Boot's face (1) should be at the same level from cylinder's face (2) all around.

6) Insert piston into cylinder by hand.



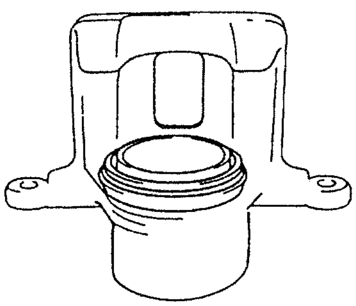
I4RS0A420004-01

Front Disc Brake Caliper Inspection

S7RS0B4206007

Pin Boot and Cylinder Boot

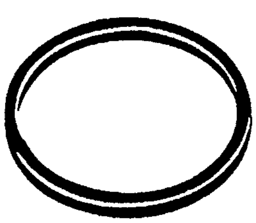
Check boots for breakage, crack and damage.
If defective, replace.



I2RH01420014-01

Piston Seal

Excessive or uneven wear of pad lining may indicate unsmooth return of piston.
In such case, replace rubber seal.



I2RH01420015-01

Front Brake Disc Removal and Installation

S7RS0B4206008

⚠ CAUTION

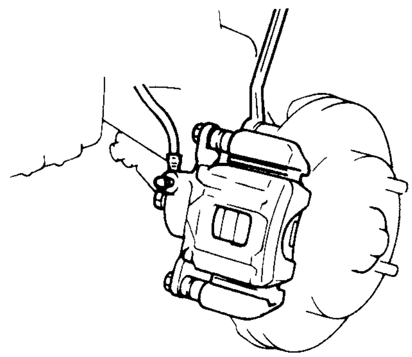
During removal, be careful not to damage brake flexible hose and not to depress brake pedal.

Removal

1) Hoist vehicle and remove wheel.
2) Remove caliper assembly by removing caliper carrier bolts (2 pcs).

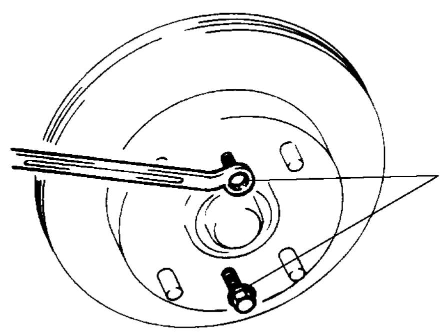
NOTE

Hang removed caliper with a wire hook or the like so as to prevent brake hose from bending and twisting excessively or being pulled.



I2RH01420024-01

3) Pull brake disc off by using 8 mm bolts (1) (2 pcs).

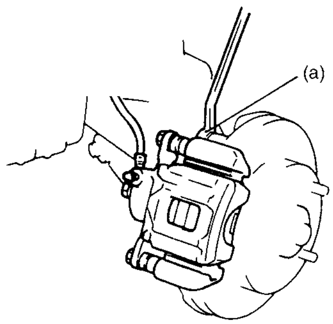


I2RH01420025-01

Installation

1) Install disc to wheel hub.
2) Install caliper assembly to steering knuckle.
3) Torque caliper carrier bolts to specification.

Tightening torque
Caliper carrier bolt (a): 85 N·m (8.5 kgf-m, 61.5 lb-ft)



I2RH01420028-01

4) Torque front wheel nuts to specification.

Tightening torque
Wheel nut (b): 85 N·m (8.5 kgf-m, 61.5 lb-ft)

5) Upon completion of installation, perform brake test.

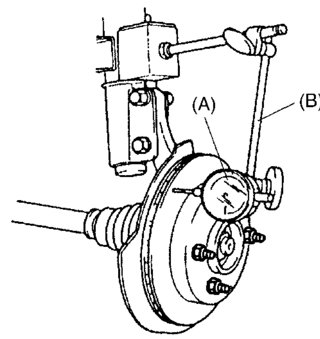
Front Brake Disc Inspection

S7RS0B4206009

- Install wheel nuts to hub bolts and fasten to fix the brake disc.
  Using magnetic stand and with dial gauge positioned at about 10 mm (0.39 in.) inward from periphery of disc, measure deflection of disc.
  If limit value is exceeded, replace correct or replace.

Front brake disc deflection
Limit: 0.10 mm (0.004 in.) max.

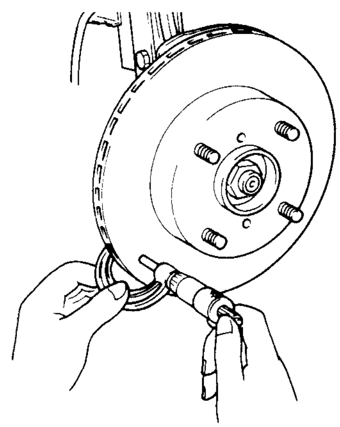
Special tool
(A): 09900–20607
(B): 09900–20701



I2RH01420026-01

- Using micrometer, measure thickness of brake disc.
  If it is less than limit, replace brake disc.

Front brake disc thickness
Standard: 20.0 mm (0.79 in.)
Limit: 18.0 mm (0.71 in.)



I2RH01420027-01

Specifications

Tightening Torque Specifications

S7RS0B4207001

Fastening part	Tightening torque			Note
	N⋅m	kgf-m	lb-ft	
Caliper pin bolt	26	2.6	19.0	☞ / ☞
Wheel nut	85	8.5	61.5	☞ / ☞ / ☞
Flexible hose joint bolt	23	2.3	17.0	☞
Bleeder plug	8.0	0.8	6.0	☞
Caliper carrier bolt	85	8.5	61.5	☞

NOTE

The specified tightening torque is also described in the following.
"Front Disc Brake Components"

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

Special Tools and Equipment

Recommended Service Material

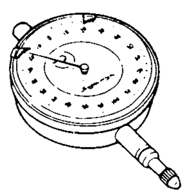
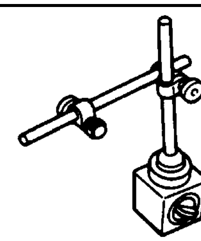
S7RS0B4208001

NOTE

Required service material is also described in the following.
"Front Disc Brake Components"

Special Tool

S7RS0B4208002

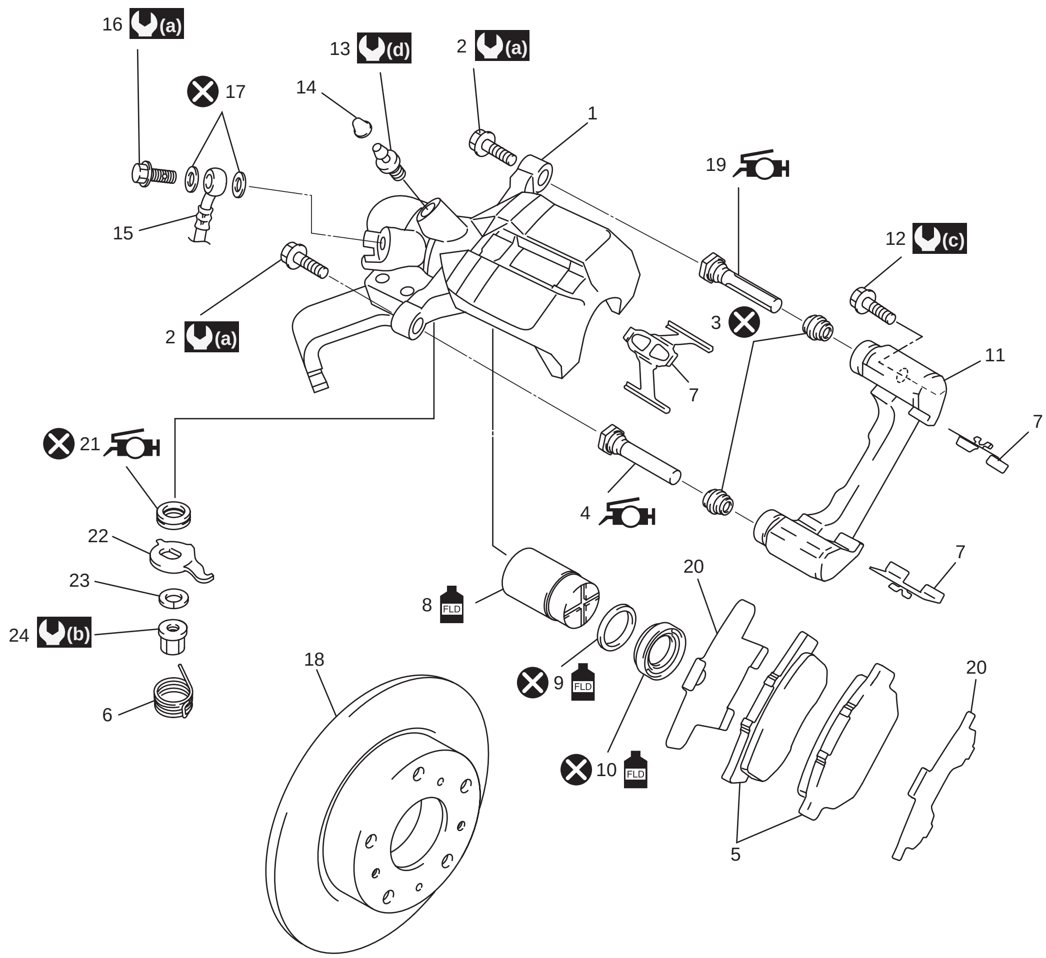
09900–20607 Dial gauge ☞ 	09900–20701 Magnetic stand ☞ 

Rear Brakes

Repair Instructions

Rear Disc Brake Components

S7RS0B4306001



I7RS0B430001-01

1. Caliper	11. Brake caliper carrier	21. Shaft cover : Apply rubber grease.
2. Caliper pin bolt	12. Caliper carrier bolt	22. Lever
3. Boot	13. Rear caliper bleeder plug	23. Washer
4. No.1 slide pin : Apply rubber grease.	14. Bleeder plug cap	24. Parking nut
5. Brake pad	15. Brake flexible hose	(a) : 23 N·m (2.3 kgf-m, 17.0 lb-ft)
6. Return spring	16. Flexible hose joint bolt	(b) : 27 N·m (2.7 kgf-m, 19.5 lb-ft)
7. Pad spring	17. Hose washer	(c) : 60 N·m (6.0 kgf-m, 43.5 lb-ft)
FLD 8. Disk brake piston : Apply brake fluid to contact surface of cylinder.	18. Brake disc	(d) : 9 N·m (0.9 kgf-m, 6.5 lb-ft)
FLD 9. Piston seal : Apply small amount of brake fluid to all around part of piston seal.	19. No.2 slide pin : Apply rubber grease.	: Do not reuse.
FLD 10. Cylinder boot : Apply small amount of brake fluid.	20. Pad shim	

Rear Disc Brake Pad Removal and Installation

S7RS0B4306002

NOTE

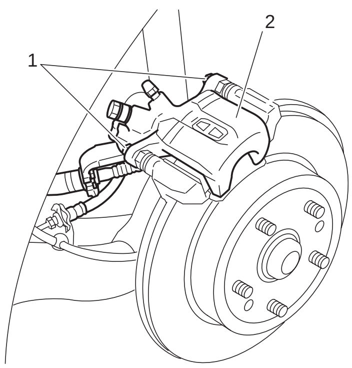
When replacing brake pad, replace it on the right and left.

Removal

1) Hoist vehicle and remove wheel.
2) Release parking brake lever.
3) Remove caliper pin bolts (1).
4) Remove caliper (2) from caliper carrier.

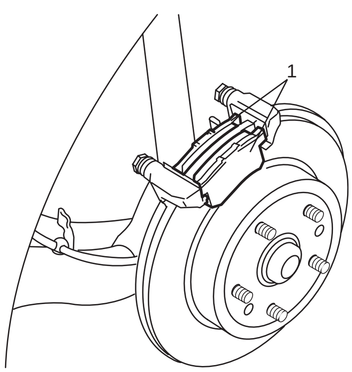
NOTE

Hang removed caliper (2) with a wire hook or the like so as to prevent brake hose from bending and twisting excessively or being pulled.
Don't operate brake pedal with brake pads removed.



I6RS0C430002-01

5) Remove brake pads (1) and pad springs.

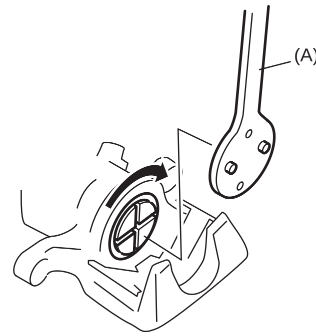


I6RS0C430003-01

Installation

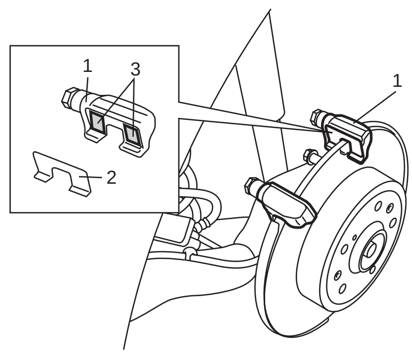
1) Turn brake caliper piston clockwise to obtain clearance between brake disc and pads.

Special tool
(A): 09945–16060



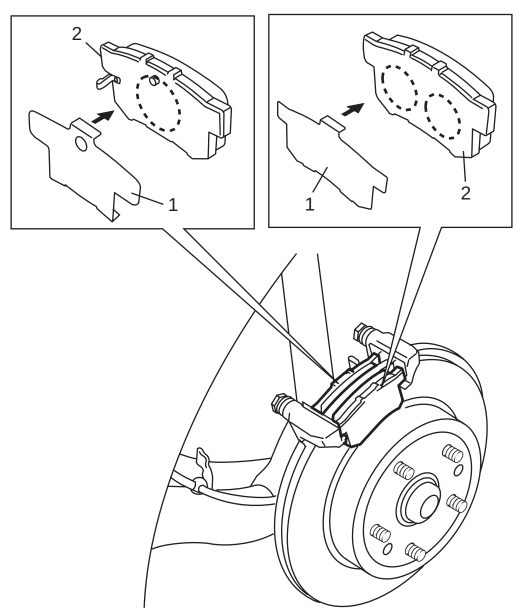
I6RS0B431004-01

2) Clean (and degrease) pad spring installation face (3) of caliper carrier (1).
3) Attach pad springs (2) to caliper carrier (1).



I6RS0B431005-03

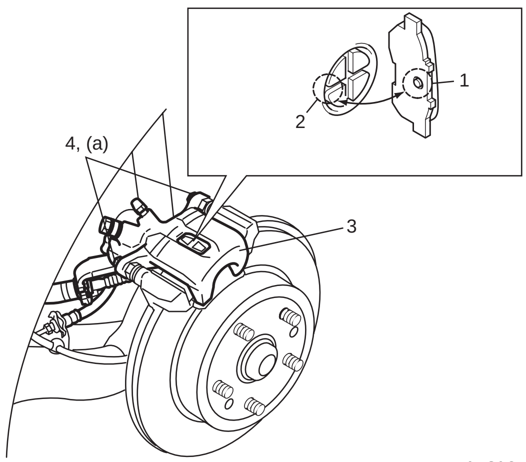
4) Before installing brake pad shims (1), apply small amount of grease (included in spare parts) to mating surfaces of brake pad and pad shim.
5) Set pad shims (1) to brake pads (2).



I6RS0C430004-01

6) With lug (1) of brake pad matched with dent (2) of brake piston, install caliper (3) to caliper carrier.
7) Tighten caliper pin bolts (4) to specified torque.

Tighting torque
Caliper pin bolt (a): 23 N·m (2.3 kgf-m, 17 lb-ft)



I6RS0C430005-01

8) Tighten wheel bolts temporarily and lower lift.
9) Tighten wheel nuts to specified torque.

Tightening torque
Wheel bolt: 85 N·m (8.5 kgf-m, 61.5 lb-ft)

10) After completion of installation, check for brake effectiveness.

Rear Disc Brake Caliper Removal and Installation

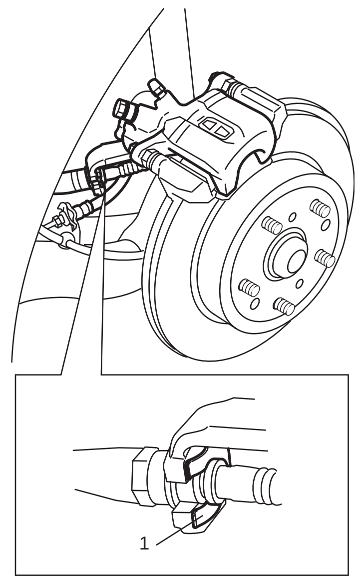
S7RS0B4306003

⚠ CAUTION

Do not allow brake fluid to get on painted surfaces. Painted surfaces will be damaged by brake fluid, flush it with water immediately if any fluid is spilled.

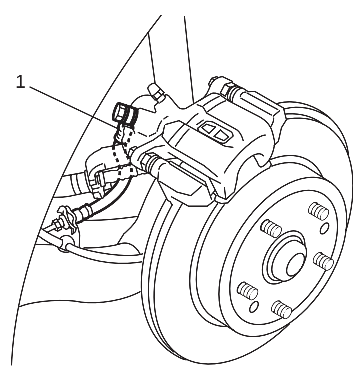
Removal

1) Hoist vehicle and remove rear wheel.
2) Release parking brake lever.
3) Remove clip (1).



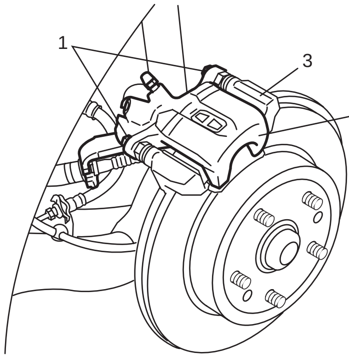
I6RS0C430006-01

4) Disconnect flexible hose (1) from caliper.



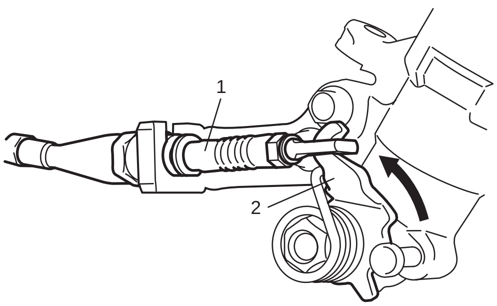
I6RS0C430007-01

5) Remove caliper pin bolts (1).
6) Remove caliper (2) from brake caliper carrier (3).



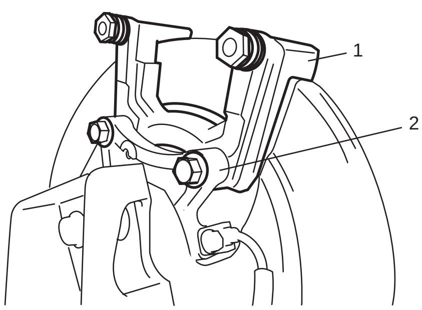
I6RS0C430008-01

7) Disconnect parking brake cable (1) from lever (2) while rotating lever in direction of arrow.



I6RS0B431011-01

8) Remove brake pads, slide pins and slide pin boots from brake caliper carrier.
9) Remove brake caliper carrier (1) from spindle (2).

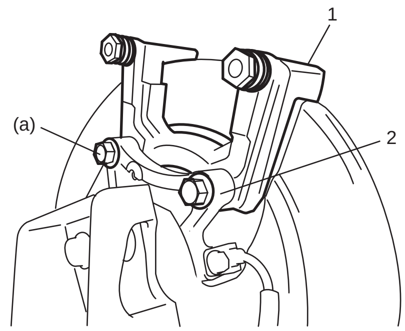


I6RS0B431012-01

Installation

1) Install brake caliper carrier (1) to spindle (2).

Tightening torque
Brake caliper carrier bolt (a): 60 N·m (6.0 kgf-m, 43.5 lb-ft)

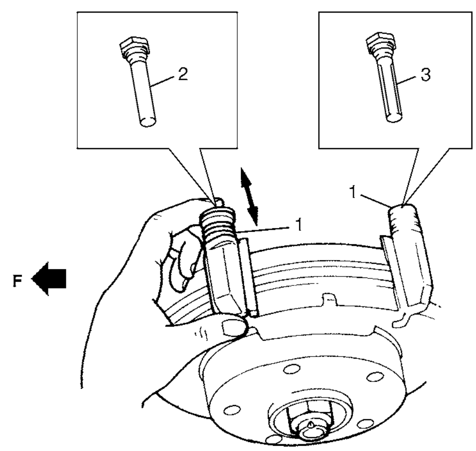


I6RS0B431023-01

2) Install new slide pin boots (1) to brake caliper carrier.
3) Apply rubber grease to slide pins, then install slide pin to front side and slide pin to rear side of brake caliper carrier.

NOTE

Be sure not to install wrongly because the shape of slide pins are different as below.



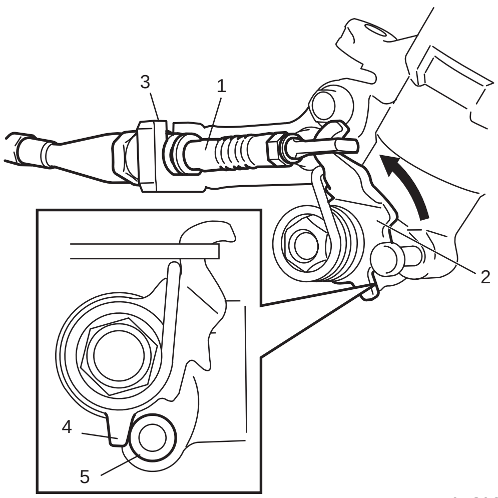
I6RS0C430009-02

F: Vehicle front

4) Pass parking brake cable (1) through bracket (3) of caliper.
5) Hang parking brake cable on lever (2) as follows.

NOTE

Make sure that lever (4) contacts pin (5).



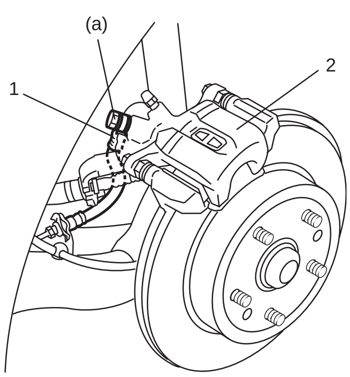
I6RS0C430010-01

6) Install brake pads and caliper referring to "Rear Disc Brake Pad Removal and Installation".
7) Connect flexible hose (1) with new washers to caliper (2).

⚠ WARNING

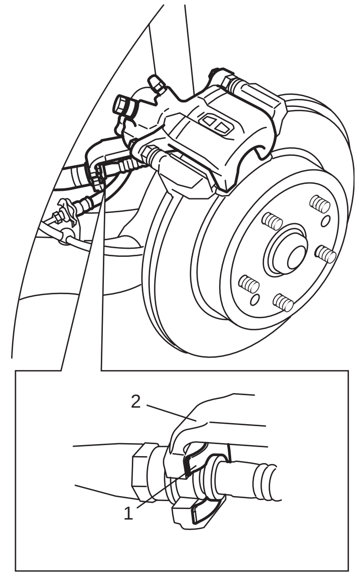
Make sure that flexible hose is not twisted when tightening joint bolt. If it is twisted, reconnect it using care not to twist it.

Tightening torque
Flexible hose joint bolt (a): 23 N·m (2.3 kgf-m, 17.0 lb-ft)



I6RS0C430011-01

8) Install brake cable clip (1) securely to bracket (2).



I6RS0C430012-01

9) After reassembling brake lines, bleed air from them referring to "Air Bleeding of Brake System in Section 4A".
10) Check to make sure that system is free from fluid leakage.
11) Start engine and then depress brake pedal with about 300 N (30 kg, 66 lbs) load 3 times or more so as to obtain proper disc to pad clearance.
12) Check to make sure that parking brake lever stroke is as specified. Refer to "Parking Brake Inspection and Adjustment in Section 4D".
13) Tighten wheel nuts to specified torque.

Tightening torque
Wheel bolt: 85 N·m (8.5 kgf-m, 61.5 lb-ft)

14) Remove vehicle from hoist and perform brake test (foot brake and parking brake).

Rear Disc Brake Pad Inspection

S7RS0B4306004

Check pad lining for wear. When wear exceeds limit, replace with new one.

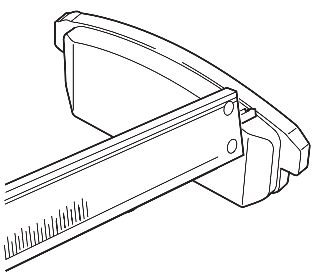
⚠ CAUTION

Never polish pad lining with sandpaper. If lining is polished with sandpaper, hard particles of sandpaper will be deposited in lining and may damage disc. When pad lining requires correction, replace it with a new one.

Rear brake pad thickness (lining thickness)
Standard: 9.0 mm (0.354 in.)
Limit: 1.0 mm (0.039 in.)

NOTE

When pads are removed, visually inspect caliper for brake fluid leak. Correct leaky point, if any.



I6RS0B431034-01

Rear Disc Brake Caliper Disassembly and Assembly

S7RS0B4306005

Disassembly

⚠ CAUTION

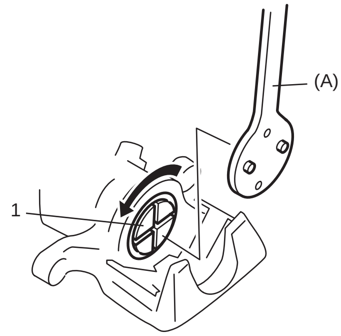
Clean around caliper with brake fluid before disassembly.

1) Remove disc brake piston (1) by turning piston counterclockwise with special tool.

⚠ CAUTION

Be careful not to damage inside (bore side) of cylinder.

Special tool
(A): 09945–16060

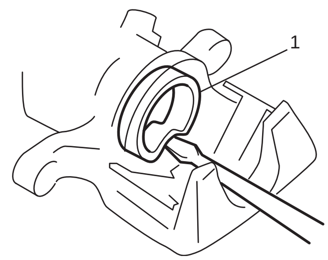


I6RS0B431013-01

2) Remove cylinder boot and piston seal (1).

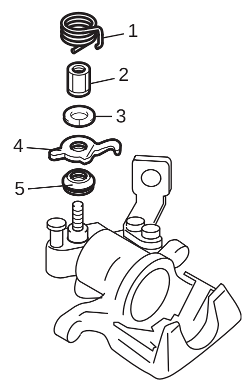
⚠ CAUTION

Be careful not to damage inside (bore side) of cylinder.



I6RS0B431014-01

3) Remove bleeder plug and cap from caliper.
4) Remove return spring (1), parking nut (2), washer (3), lever (4) and shaft cover (5).



I6RS0B431015-01

Assembly

⚠ CAUTION

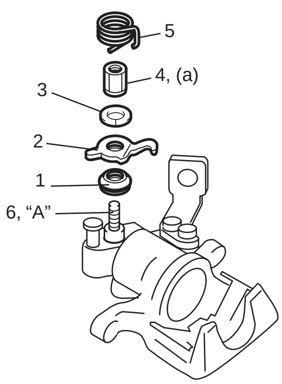
- **Wash each part cleanly before installation in the same fluid as the one used in master cylinder reservoir.**
- **Never use other fluid or thinner.**
- **Before installing caliper to brake caliper carrier, install slide pins with grease applied into carrier hole and check for its smooth movement in thrust direction.**
- **Before installing piston seal to cylinder, apply fluid to them.**
- **Install a piston seal into groove in cylinder securely making sure that it is not twisted.**

1) Apply thread lock cement to shaft thread (6) of caliper.

   "A": Thread lock cement 99000–32110 (Thread Lock Cement Super 1322)

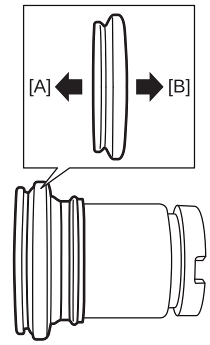
2) Apply grease to inside of new shaft cover (1).
3) Install new shaft cover, lever (2), washer (3), parking nut (4) and return spring (5) to caliper.

   Tightening torque
   Parking nut (a): 27 N·m (2.7 kgf-m, 19.5 lb-ft)



I6RS0C430016-01

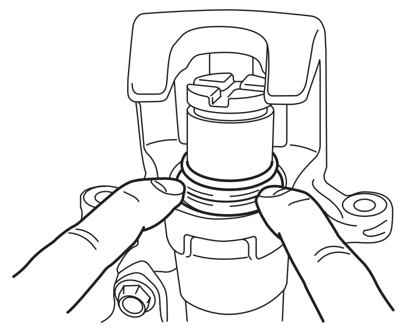
4) Install bleeder plug and cap to caliper.
5) Install new piston seal to caliper.
6) Before inserting piston (2) into cylinder, install boot (1) onto piston as shown.



I6RS0B431017-01

[A]:	Cylinder side
[B]:	Brake pad side

7) Fit boot as it is in figure into boot groove in cylinder with fingers.



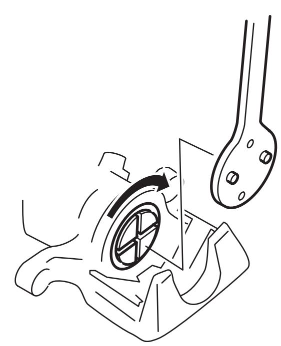
I6RS0B431033-01

8) Turn brake caliper piston clockwise to obtain clearance between brake disc and pads.

NOTE

Check that boot is fitted in boot groove securely all around piston.

Special tool
(A): 09945–16060



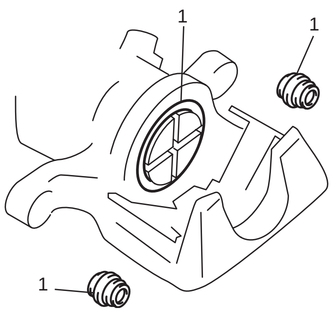
I6RS0B431018-01

Rear Disc Brake Caliper Inspection

S7RS0B4306006

Pin Boot and Cylinder Boot

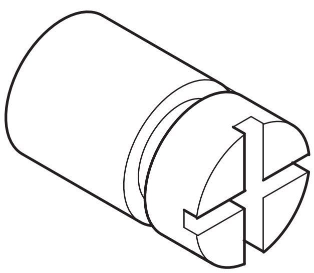
Check boots (1) for breakage, crack and damage.
If defective, replace.



I6RS0B431019-01

Disc Brake Piston

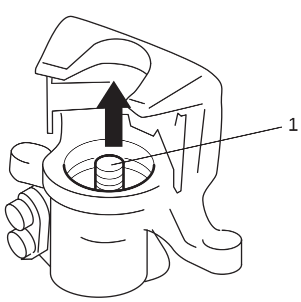
Check all around piston for rust, corrosion and any other damage.
If it is found faulty, replace.



I6RS0B431020-01

Caliper

Push in adjusting bolt (1) by hand and move lever to check that adjusting bolt (1) moves smoothly in the arrow direction.
Also, check adjusting bolt (1) for any damage. If it is found faulty, replace.



I6RS0B431021-01

Slide Pin

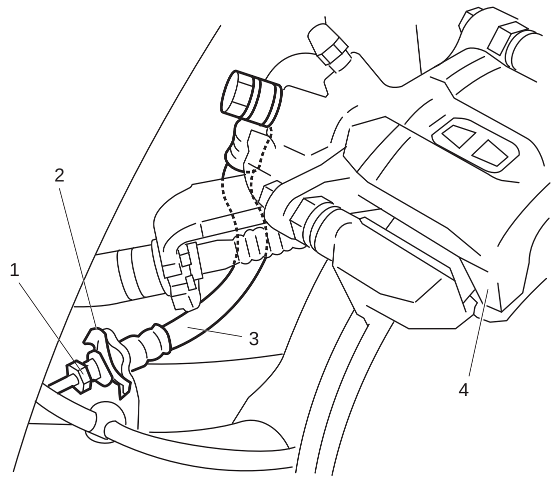
Check guide pin for smooth movement.
If it is found faulty, correct or replace.
Apply rubber grease to guide pin outer surface. Rubber grease should be the one whose viscosity is less affected by such low temperature as –40 °C (–40 °F).

Rear Flexible Hose Removal and Installation

S7RS0B4306007

Removal

1) Hoist vehicle and remove tire and wheel.
2) Remove caliper (4) assembly referring to “Rear Disc Brake Caliper Disassembly and Assembly”.
3) Loosen brake pipe flare nut (1) using by flare nut wrench.
4) Remove clip (2).
5) Remove brake flexible hose (3) from brake pipe.



I6RS0C430013-01

Installation

Install reverse order of removal nothing the following.

- Tighten brake pipe flare nut to specified torque.

Tightening torque
Brake pipe flare nut (a): 16 N·m (1.6 kgf-m, 12.0 lb-ft)

Rear Brake Disc Removal and Installation

S7RS0B4306008

Removal

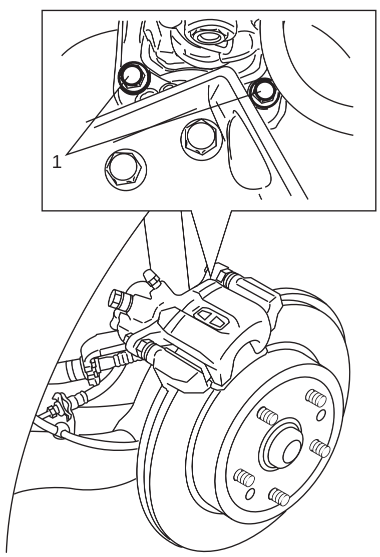
1) Hoist vehicle and remove wheel.
2) Remove caliper assembly by removing caliper carrier bolts (1) (2 pcs).

⚠ CAUTION

During removal, be careful not to damage brake flexible hose and not to depress brake pedal.

NOTE

Hang removed caliper with a wire hook or the like so as to prevent brake hose from bending and twisting excessively or being pulled.
Don't operate brake pedal with brake pads removed.



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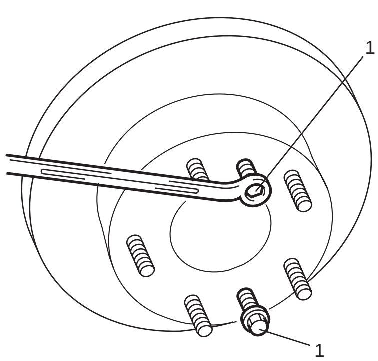
3) Pull brake disc off by using 8 mm bolts (1) (2 pcs).



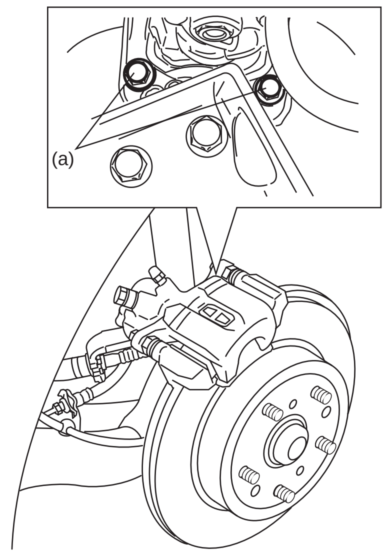
I6RS0C430017-01

Installation

Install in reverse order of removal nothing the following.

- Tighten brake disc screws and caliper carrier bolts to specified torque.

  Tightening torque
  Caliper carrier bolt (a): 60 N·m (6.0 kgf-m, 43.5 lb-ft)



I6RS0C430015-01

- Tighten wheel nuts to specified torque.

  Tightening torque
  Wheel bolt: 85 N·m (8.5 kgf-m, 61.5 lb-ft)

- Upon completion of installation, perform brake test.

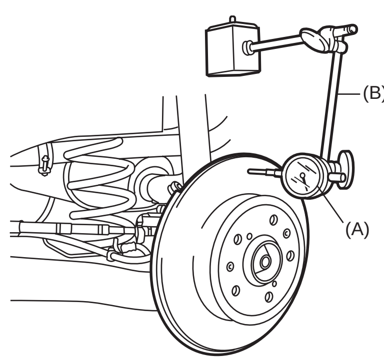
Rear Brake Disc Inspection

S7RS0B4306009

- Using magnetic stand and with dial gauge positioned at about 10 mm (0.39 in.) inward from periphery of disc, measure deflection of disc.
  If limit value is exceeded, replace correct or replace.

Rear brake disc deflection
Limit: 0.10 mm (0.004 in.) max.

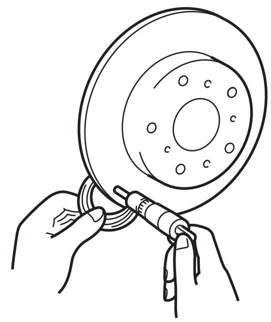
Special tool
(A): 09900–20607
(B): 09900–20701



I6RS0B431031-01

- Using micrometer, measure thickness of brake disc. If limit value is exceeded, replace brake disc.

Rear brake disc thickness
Standard: 9 mm (0.354 in.)
Limit: 8 mm (0.315 in.)



I6RS0B431032-01

Specifications

Tightening Torque Specifications

S7RS0B4307001

Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
Caliper pin bolt	23	2.3	17	☞
Wheel bolt	85	8.5	61.5	☞ / ☞ / ☞
Brake caliper carrier bolt	60	6.0	43.5	☞
Flexible hose joint bolt	23	2.3	17.0	☞
Parking nut	27	2.7	19.5	☞
Brake pipe flare nut	16	1.6	12.0	☞
Caliper carrier bolt	60	6.0	43.5	☞

NOTE

The specified tightening torque is also described in the following.
“Rear Disc Brake Components”

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

Special Tools and Equipment

Recommended Service Material

S7RS0B4308001

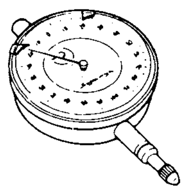
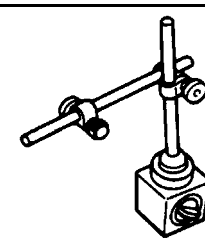
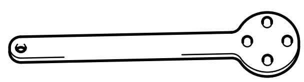
Material	SUZUKI recommended product or Specification		Note
Thread lock cement	Thread Lock Cement Super 1322	P/No.: 99000–32110	☞

NOTE

Required service material is also described in the following.
“Rear Disc Brake Components”

Special Tool

S7RS0B4308002

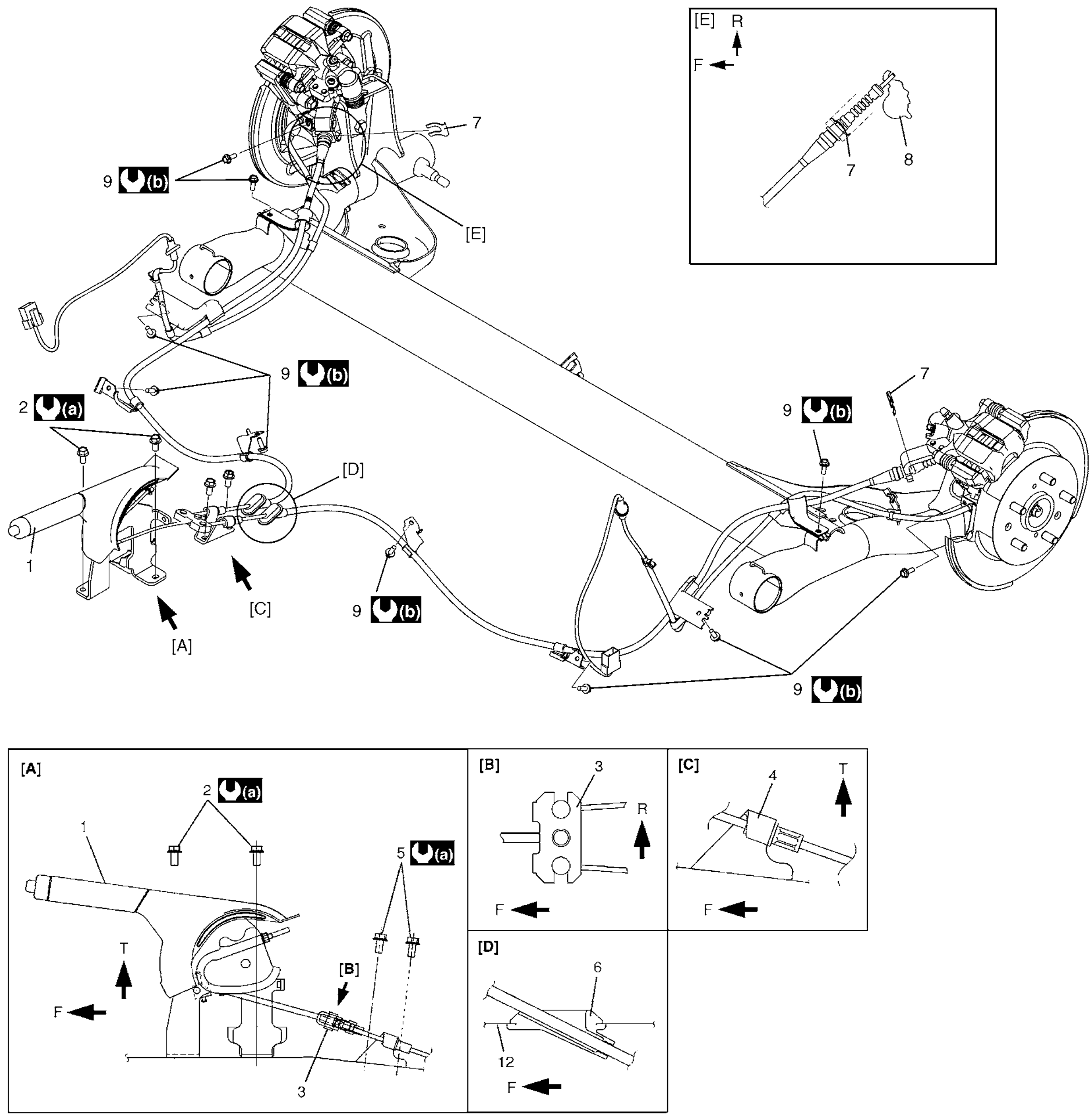
09900–20607 Dial gauge ☞ 	09900–20701 Magnetic stand ☞ 
09945–16060 Piston installer handle ☞ / ☞ / ☞ 	

Parking Brake

General Description

Parking Brake Cable Construction

S7RS0B4401001



I6RS0B440001-01

T: Top side	3. Equalizer	8. Lever	[C]: View [C]
F: Front side	4. Parking cable bracket	9. Parking cable clamp bolt	[D]: View [D]
R: Right side	5. Parking cable bracket bolt	10. Vehicle body	(a) : 25 N·m (2.5 kgf-m, 18.0 lb-ft)
1. Parking brake lever assembly	6. Grommet	[A]: View [A]	(b) : 11 N·m (1.1 kgf-m, 8.0 lb-ft)
2. Parking brake lever bolt	7. E-ring	[B]: View [B]	

Repair Instructions

Parking Brake Inspection and Adjustment

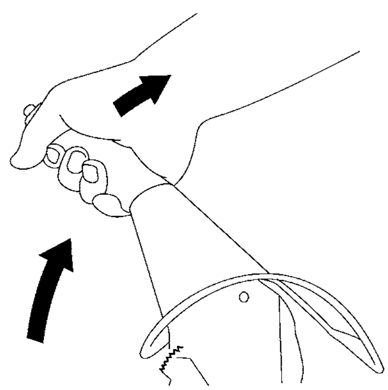
S7RS0B4406001

Inspection

Hold center of parking brake lever grip and pull it up with 200 N (20 kg, 44 lbs) force.
With parking brake lever pulled up as shown, count ratchet notches. There should be 4 to 9 notches.
Also, check if both right and left rear wheels are locked firmly.
To count number of notches easily, listen to click sounds that ratchet makes while pulling parking brake lever without pressing its button.
One click sound corresponds to one notch.
If number of notches is out of specification, adjust cable referring to adjustment procedure so as to obtain specified parking brake stroke.

NOTE

Check tooth tip of each notch for damage or wear.
If any damage or wear is found, replace parking brake lever.



I4RS0B440002-01

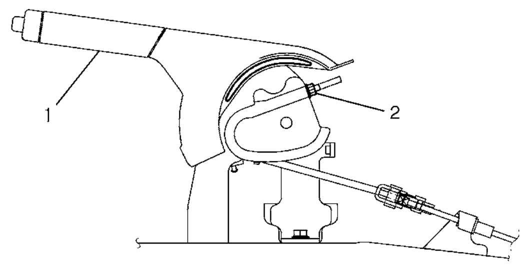
Adjustment

NOTE

Make sure for the following conditions before cable adjustment.

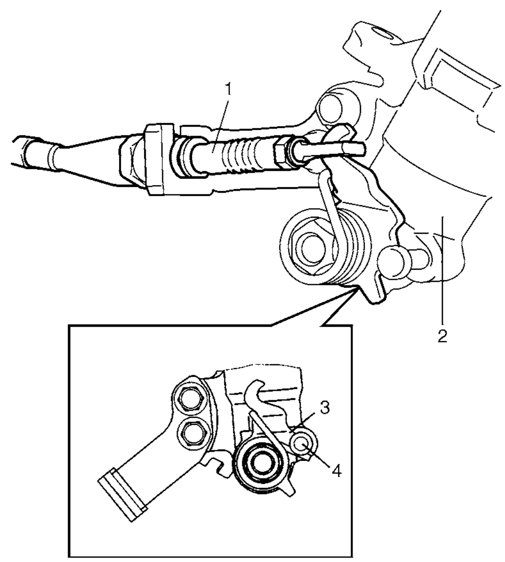
- **No air is trapped in brake system.**
- **Brake pedal travel is proper.**
- **Start engine and then brake pedal has been depressed at least 3 times with about 160 N (16.0 kg, 35.3 lbs) load.**
- **Parking brake lever (1) has been pulled up a few times with about 200 N (20 kg, 44 lbs) load.**
  If parking brake cable is replaced with new one, pull up parking brake lever a few times with about 500 N·m (50 kg, 110 lbs) force.

1) Release parking brake lever (1).
2) Loosen parking brake lever adjust nut (2) fully.



I4RS0A440003-01

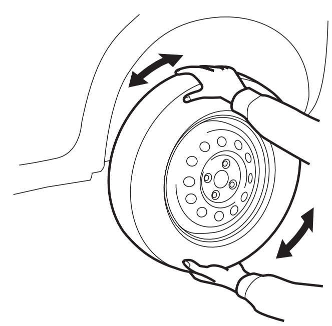
3) Make sure that lever (3) contacts pin (4).



I6RS0C440001-01

1. Parking brake cable	2. Brake caliper

4) Pull up parking brake lever 1 notch.
5) Rotate rear wheel by hand and fasten parking lever adjust nut until dragging rear wheel lightly.



I6RS0C440002-01

6) Release parking brake lever and then make sure that there is no drag in rear wheel.
   If there is, repeats go to step 2).
7) Make sure that the number of notch is between 4 and 9 when operating parking brake lever.
8) If the number of notch is not between 4 and 9, replace parking brake cable and/or inspect rear brake caliper.

   Parking brake stroke
   When lever is pulled up at 200 N (20kg, 44lbs) : 4 to 9 notches

Parking Brake Cable Removal and Installation

S7RS0B4406002

Removal

NOTE

When it is necessary to remove both right and left parking brake cables, repeat below steps 2) and 5) on right and left wheels.

1) Hoist vehicle.
2) Remove wheel.
3) Disconnect parking brake cable from equalizer (parking brake lever) and clamps.
4) Disconnect parking brake cable from lever referring to “Rear Disc Brake Caliper Removal and Installation in Section 4C”.
5) Remove parking brake cable and parking cable bracket.

Installation

Install it by reversing removal procedure, noting the following points.

- Install clamps properly referring to “Parking Brake Cable Construction”.
- Tighten bolts and nuts to specified torque referring to “Parking Brake Cable Construction”.

  Tightening torque
  Parking brake lever bolt: 25 N·m (2.5 kgf-m, 18.0 lb-ft)
  Parking cable clamp bolt: 11 N·m (1.1 kgf-m, 8.0 lb-ft)
  Parking cable bracket bolt: 25 N·m (2.5 kgf-m, 18.0 lb-ft)

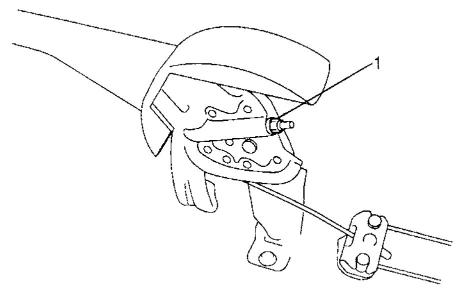
- Adjust parking brake cable. Refer to “Parking Brake Inspection and Adjustment”.
- Check brake disc for dragging and brake system for proper performance. Brake test should be performed.

Parking Brake Lever Removal and Installation

S7RS0B4406003

Removal

1) Remove console box.
2) Block vehicle wheels and release parking brake lever.
3) Disconnect lead wire of parking brake switch at coupler.
4) Loosen parking brake cable adjusting nut (1).

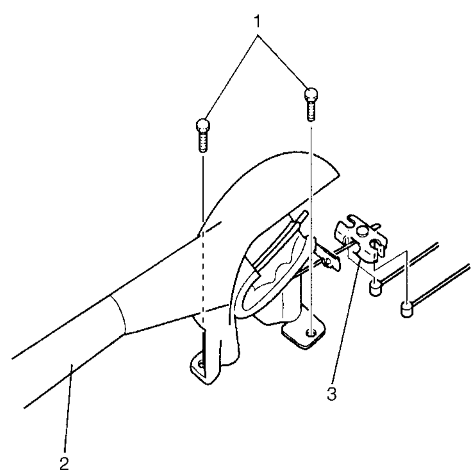


I4RS0A440004-01

5) Remove parking brake lever bolts (1) and then remove parking brake lever assembly (2) with equalizer (3).

NOTE

Don’t disassemble parking brake lever switch. It must be removed and installed as a complete switch assembly.

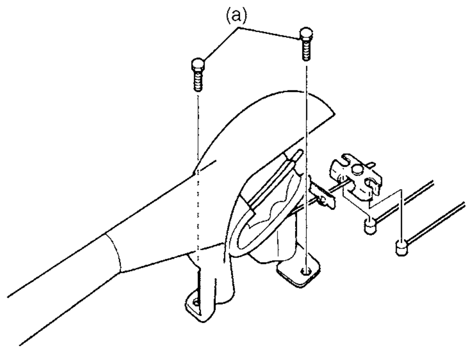


I4RS0A440005-01

Installation

1) Install in reverse order of removal procedure. Check equalizer inclined angle.

Tightening torque
Parking brake lever bolt (a): 25 N·m (2.5 kgf-m, 18.0 lb-ft)



I4RS0A440006-01

2) After all parts are installed, parking brake lever needs to be adjusted. Refer to “Parking Brake Inspection and Adjustment”.
3) Check brake drum or disc for dragging and brake system for proper performance. After removing vehicle from hoist, brake test should be performed.

Specifications

Tightening Torque Specifications

S7RS0B4407001

Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
Parking brake lever bolt	25	2.5	18.0	☞ / ☞
Parking cable clamp bolt	11	1.1	8.0	☞
Parking cable bracket bolt	25	2.5	18.0	☞

NOTE

The specified tightening torque is also described in the following.
“Parking Brake Cable Construction”

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

ABS

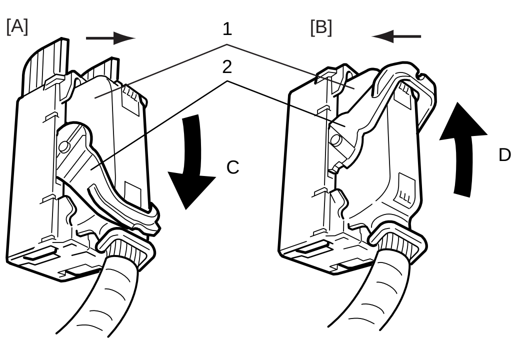
Precautions

Precautions in Diagnosing Troubles

S7RS0B4500001

To ensure that the trouble diagnosis is done accurately and smoothly, observe the following and follow "ABS Check".

- Diagnostic information stored in ABS control module memory can be cleared as well as checked by using SUZUKI scan tool. Before using scan tool, read its Operator's (Instruction) Manual carefully to have good understanding as to what functions are available and how to use it.
- If the vehicles was operated in any of the following ways, ABS warning light may light momentarily but this does not indicate anything abnormal in ABS.
  - The vehicle was driven with parking brake pulled.
  - The vehicle was driven with brake dragging.
  - The vehicle was stuck in mud, sand, etc.
  - Wheel spin occurred while driving.
  - Wheel(s) was rotated while the vehicle was jacked up.
- Be sure to read "Precautions for Electrical Circuit Service in Section 00" before inspection and observe what is written there.
- Be sure to use the trouble diagnosis procedure as described in "ABS Check". Failure to follow it may result in incorrect diagnosis. (Some other diagnosis trouble code may be stored by mistake in the memory of ABS control module during inspection.)
- When disconnecting ABS control module connector (1), pull down lock lever (2) of connector.
  When connecting, set the connector on ABS control module assembly and pull up the lock lever (2) until it locks.



I4RH01450001-01

[A]: Disconnect	C: Pull down to disconnect
[B]: Connect	D: Pull up to connect

- Communication of ECM, BCM, ABS control module, keyless start control module (if equipped), and combination meter is established by CAN (Controller Area Network).
  Therefore, be sure to read "Precautions for Installing Mobile Communication Equipment in Section 00" before inspection and handle CAN communication line.

Precautions in On-Vehicle Service

S7RS0B4500002

When connector is connected to ABS control module assembly, do not disconnect connectors of sensors with ignition switch ON. Otherwise, DTC will be set in ABS control module.

Precautions in Hydraulic Unit Operation Check

S7RS0B4500003

ABS hydraulic unit / control module assembly function is checked by correct wheel lock / release condition when brake pressure is pressurized / depressurized using SUZUKI scan tool. The hydraulic unit operation check referring to "ABS Hydraulic Unit Operation Check" should be performed to confirm the correct brake pipe connection in the following cases.

- ABS hydraulic unit / control module assembly was replaced.
- Brake pipe and/or hose ware replaced.

General Description

ABS Description

S7RS0B4501001

The ABS (Antilock Brake System) controls the fluid pressure applied to the wheel cylinder of each brake from the master cylinder so that each wheel is not locked even when hard braking is applied.
This ABS has also the following function.
While braking is applied, but before ABS control becomes effective, braking force is distributed between the front and rear so as to prevent the rear wheels from being locked too early for better stability of the vehicle.
The main component parts of this ABS include the following parts in addition to those of the conventional brake system.

- Wheel speed sensor which senses revolution speed of each wheel and outputs its signal.
- ABS warning light which lights to inform abnormality when system fails to operate properly.
- ABS hydraulic unit / control module assembly is incorporated ABS control module, ABS hydraulic unit (actuator assembly), solenoid valve power supply driver (transistor), solenoid valve driver (transistor), pump motor driver (transistor).
  – ABS control module which sends operation signal to ABS hydraulic unit to control fluid pressure applied to each wheel cylinder based on signal from each wheel speed sensor so as to prevent wheel from locking.
  – ABS hydraulic unit which operates according to signal from ABS control module to control fluid pressure applied to wheel cylinder of each 4 wheels.
  – Solenoid valve power supply driver (transistor) which supplies power to solenoid valve in ABS hydraulic unit.
  – Solenoid valve driver (transistor) which controls each solenoid valves in ABS hydraulic unit.
  – Pump motor driver (transistor) which supplies power to pump motor in ABS hydraulic unit.

This ABS is equipped with Electronic Brake force Distribution (EBD) system that controls a fluid pressure of rear wheels to best condition, which is the same function as that of proportioning valve, by the signal from wheel sensor independently of change of load due to load capacity and so on. And if the EBD system fails to operate properly, the brake warning light lights to inform abnormality.

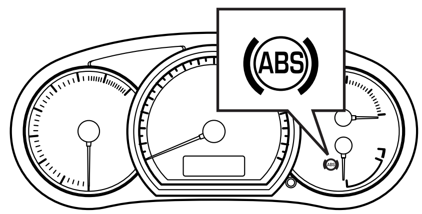
ABS Hydraulic Unit / Control Module Assembly Description

S7RS0B4501002

ABS control module is a component of ABS hydraulic unit / control module assembly and has the following functions.

Self-Diagnosis Function

ABS control module diagnoses conditions of the system component parts (whether or not there is any abnormality) all the time and indicates the results (warning of abnormality occurrence and DTC) through the ABS warning light as described.



I4RS0A450001-01

- When ignition switch is turned ON, ABS warning light lights for 2 seconds to check its circuit.
- When no abnormality has been detected (the system is in good condition), ABS warning light turns OFF after 2 seconds.
- When an abnormality in the system is detected, ABS warning light lights and the area where that abnormality lies is stored in the memory of EEPROM in ABS control module.

CAN Communication System Description

S7RS0B4501003

Refer to “CAN Communication System Description in Section 1A” for CAN communication system description.
ABS communicates control data with each control module as follows.

ABS Transmission Data

				ECM	Combination meter
ABS control module	Transmit	DATA	Torque request	○	
			Wheel speed signal (front right)	○	
			Wheel speed signal (front left)	○	
			Wheel speed signal (rear right)	○	
			Wheel speed signal (rear left)	○	
			ABS active	○	
			ABS indication on		○
			EBD indication on		○

I6RS0C450001-01

ABS Reception Data

			ECM
ABS control module	DATA Receive	Brake pedal switch signal	○

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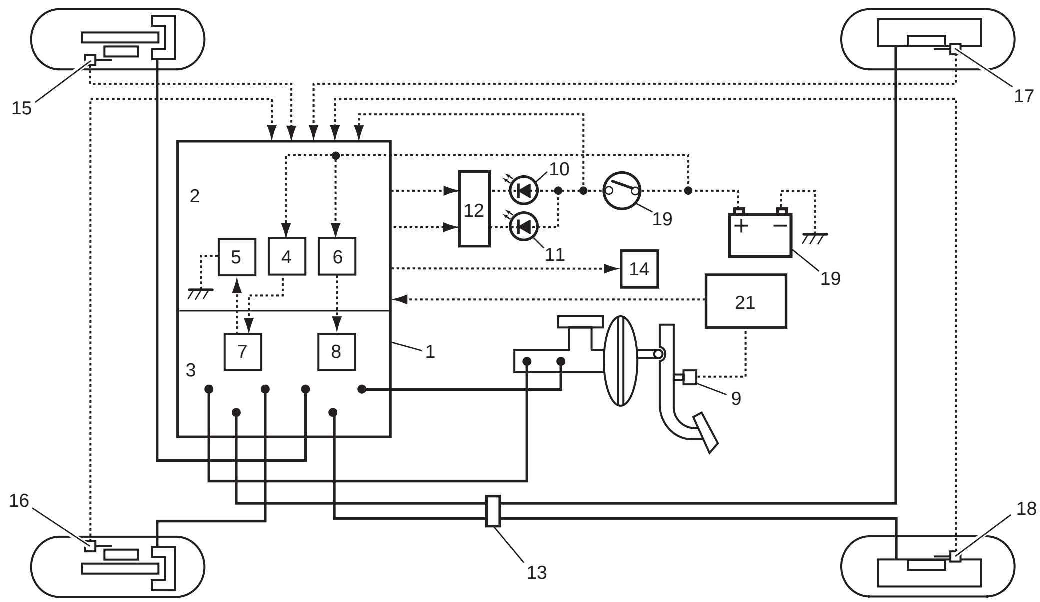
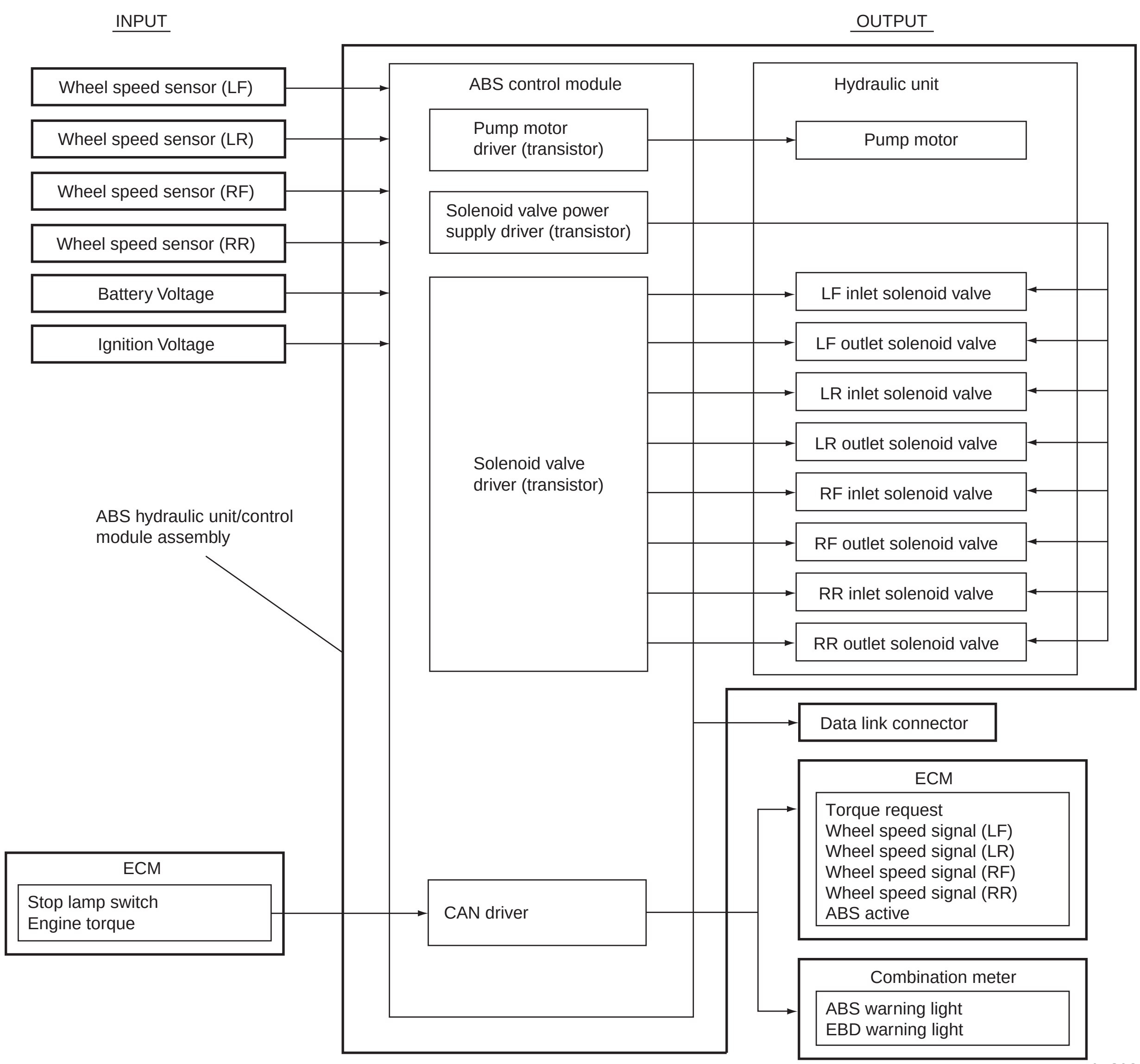
Schematic and Routing Diagram

ABS Schematic

S7RS0B4502001



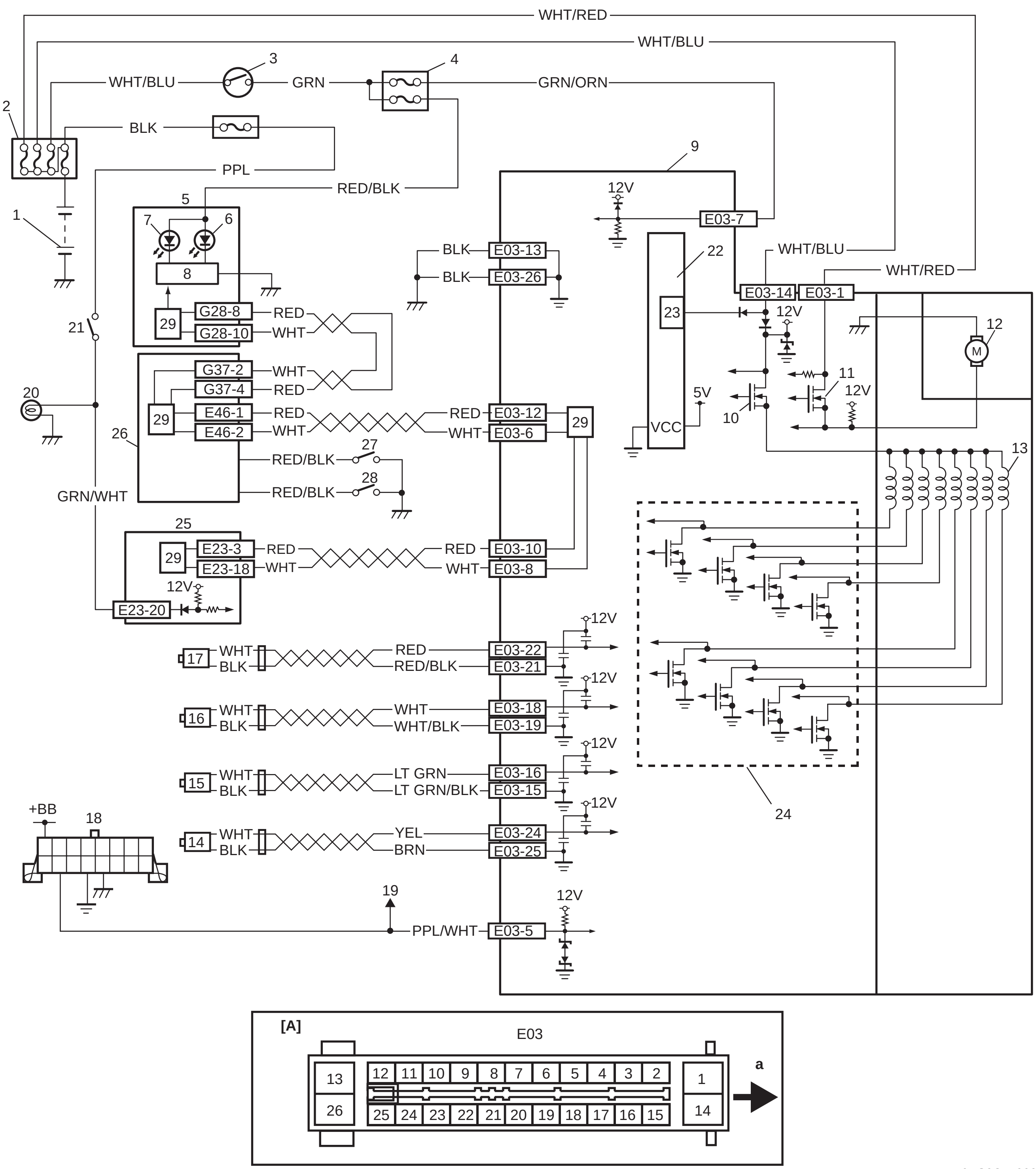


I6RS0C450003-03

1. ABS hydraulic unit / control module assembly	8. Pump motor	15. Wheel speed sensor (Right-front)
2. ABS control module	9. Stop lamp switch	16. Wheel speed sensor (Left-front)
3. ABS hydraulic unit	10. ABS warning light	17. Wheel speed sensor (Right-rear)
4. Solenoid valve power supply driver (transistor)	11. EBD warning light (Brake warning light)	18. Wheel speed sensor (Left-rear)
5. Solenoid valve driver (transistor)	12. Lamp driver module	19. Battery
6. Pump motor driver (transistor)	13. 4 way joint	20. Ignition switch
7. Solenoid valve	14. Data link connector	21. ECM

ABS Wiring Circuit Diagram

S7RS0B4502002



I6RS0C450004-01

[A]: Terminal arrangement of ABS hydraulic unit / control module assembly	10. Solenoid valve power supply driver (transistor)	21. Brake light switch
a: Upside	11. ABS pump motor driver (transistor)	22. Power control unit

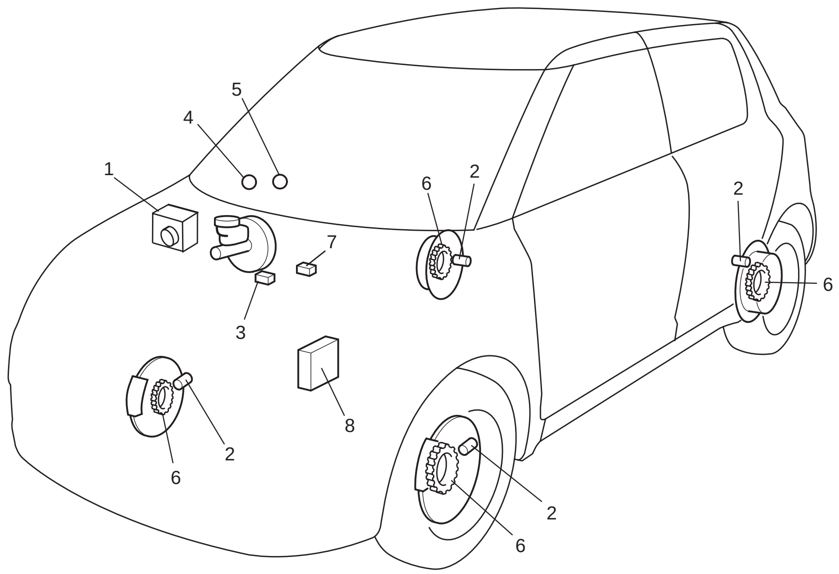
1. Battery	12. Pump motor	23. Internal memory
2. Main fuse box	13. Solenoid valves	24. Solenoid valve driver (transistor)
3. Ignition switch	14. Right-rear wheel speed sensor	25. ECM
4. Circuit fuse box	15. Left-rear wheel speed sensor	26. BCM
5. Combination meter	16. Right-front wheel speed sensor	27. Brake fluid level switch
6. ABS warning light	17. Left-front wheel speed sensor	28. Parking brake switch
7. EBD warning light (Brake warning light)	18. Data link connector	29. CAN driver
8. Lamp driver module	19. To ECM, SDM and BCM	
9. ABS hydraulic unit / control module assembly	20. Stop lamp	

Terminal		Wire color	Circuit
E03	1	WHT/RED	ABS pump motor driver (Transistor)
	2	—	—
	3	—	—
	4	—	—
	5	PPL/WHT	Data link connector
	6	WHT	CAN communication line (low) for BCM
	7	GRN/ORN	Ignition switch
	8	WHT	CAN communication line (low) for ECM
	9	—	—
	10	RED	CAN communication line (high) for ECM
	11	—	—
	12	RED	CAN communication line (high) for BCM
	13	BLK	Ground
	14	WHT/BLU	Solenoid valve power supply driver (Transistor)
	15	LT GRN/BLK	Left–rear wheel speed sensor (–)
	16	LT GRN	Left–rear wheel speed sensor (+)
	17	—	—
	18	WHT	Right–front wheel speed sensor (+)
	19	WHT/BLK	Right–front wheel speed sensor (–)
	20	—	—
	21	RED/BLK	Left–front wheel speed sensor (–)
	22	RED	Left–front wheel speed sensor (+)
	23	—	—
	24	YEL	Right–rear wheel speed sensor (+)
	25	BRN	Right–rear wheel speed sensor (–)
	26	BLK	Ground

Component Location

ABS Components Location

S7RS0B4503001

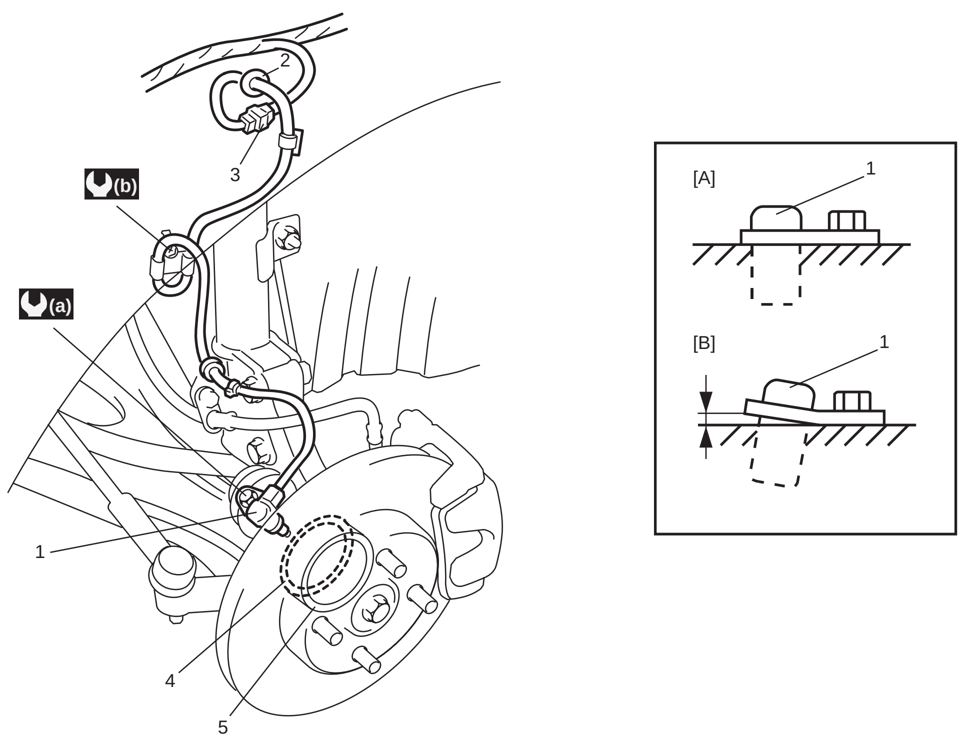


I6RS0C450005-01

1. ABS hydraulic unit / control module assembly	5. EBD warning light (Brake warning light)
2. Wheel speed sensors	6. Wheel speed sensor rings
3. Stop lamp switch	7. Data link connector
4. ABS warning light	8. ECM

Front Wheel Speed Sensor Components Location

S7RS0B4503002

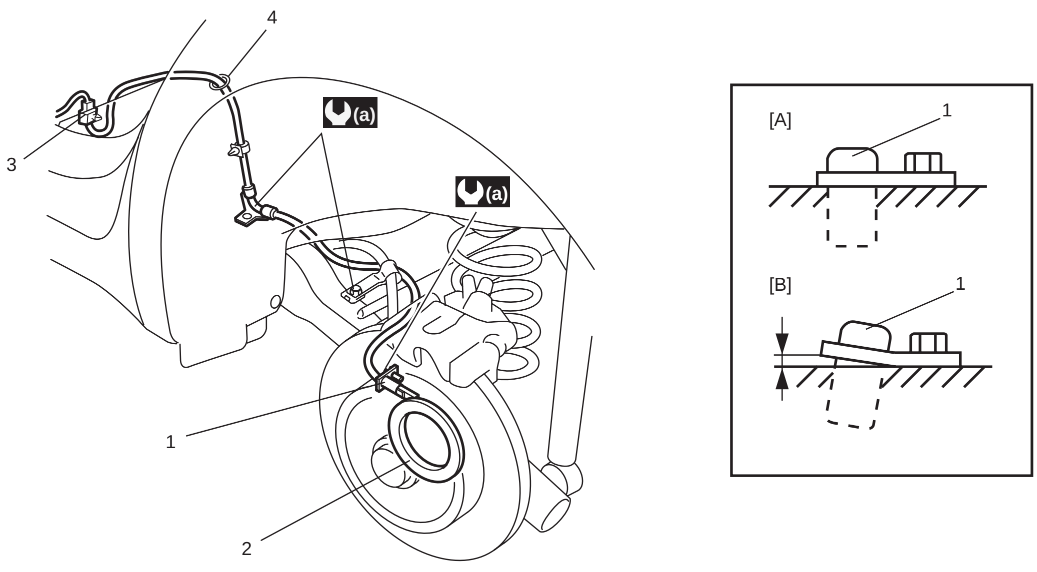


I6RS0C450016-01

[A]: OK	2. Grommet	5. Front wheel bearing
[B]: NG	3. Connector	(a) : 25 N·m (2.5 kgf-m, 18.0 lb-ft)
1. Front wheel speed sensor	4. Sensor ring	(b) : 11 N·m (1.1 kgf-m, 8.0 lb-ft)

Rear Wheel Speed Sensor Components Location

S7RS0B4503003



[A]: OK	1. Rear wheel speed sensor	3. Connector	(a) : 11 N·m (1.1 kgf-m, 8.0 lb-ft)
[B]: NG	2. Sensor ring	4. Grommet	

Diagnostic Information and Procedures

ABS Check

S7RS0B4504001

Refer to the following items for the details of each step.

Step	Action	Yes	No
1	☞ **Malfunction analysis** 1) Perform “Customer complaint analysis: ”. 2) Perform “Problem symptom confirmation: ”. 3) Perform “DTC check, record and clearance: ” and recheck DTC. *Is there any malfunction DTC?*	Go to Step 4.	Go to Step 2.
2	☞ **Driving test** 1) Perform “Step 2: Driving Test: ”. *Is trouble symptom identified?*	Go to Step 3.	Go to Step 6.
3	☞ **DTC check** 1) Perform “DTC Check”. *Is it malfunction code?*	Go to Step 4.	Go to Step 5.
4	☞ **ABS check** 1) Inspect and repair referring to applicable DTC flow. *Does trouble recur?*	Go to Step 5.	Go to Step 7.
5	☞ **Brakes diagnosis** 1) Inspect and repair referring to “Brakes Symptom Diagnosis in Section 4A”. *Does trouble recur?*	Go to Step 3.	Go to Step 7.

Step	Action	Yes	No
6	☞ **Check for intermittent problem** 1) Check intermittent troubles referring to "Intermittent and Poor Connection Inspection in Section 00" and related circuit of trouble code recorded in Step 1. *Does trouble recur?*	Go to Step 4.	Go to Step 7.
7	☞ **Final confirmation test** 1) Perform "Step 7: Final Confirmation Test: ". *Does trouble recur?*	Go to Step 3.	End.

Step 1: Malfunction Analysis

Customer complaint analysis

Record details of the problem (failure, complaint) and how it occurred as described by the customer.

For this purpose, use of such a questionnaire form as shown in the following will facilitate collecting information to the point required for proper analysis and diagnosis.

Customer questionnaire (Example)

Customer's name:	Model:	VIN:	
Date of issue:	Date of Reg:	Date of problem:	Mileage:

Problem Symptoms	• ABS warning lamp abnormal: fails to turn on/fails to go off/flashes • Abnormal noise while vehicle is running: from motor, from valve, other________ • Wheel is locked at braking: • Pump motor does not stop (running): • Braking does not work: • Other:
Frequency of occurrence	• Continuous/Intermittent (times a day, a month)/ other________
Conditions for Occurrence of Problem	• Vehicle at stop & ignition switch ON: • When starting: at initial start only/at every start/Other________ • Vehicle speed: while accelerating/while decelerating/at stop/ while turning/while running at constant speed/ other________ • Road surface condition: Paved road/rough road/snow-covered road/ other________ • Chain equipment:
Environmental Condition	• Weather: fair/cloudy/rain/snow/other________ • Temperature: °F (°C)
Diagnostic Trouble Code	• First check: Normal code/malfunction code ( ) • Second check after test drive: Normal code/malfunction code ( )

I2RH01450014-01

Problem symptom confirmation
Check if what the customer claimed in “Customer Questionnaire” is actually found in the vehicle and if that symptom is found, whether it is identified as a failure. (This step should be shared with the customer if possible.) Check warning lights related to brake system referring to “EBD Warning Light (Brake Warning Light) Check” and “ABS Warning Light Check”.

DTC check, record and clearance
Perform “DTC Check” procedure, record it and then clear it referring to “DTC Clearance”.
Recheck DTC referring to “DTC Check”.
When DTC which is recorded at DTC check procedure is detected again after performing DTC clearance, go to “Step 4: ABS Check: ” to proceed the diagnosis.
When DTC which is recorded at DTC check procedure is not indicated anymore after performing DTC clearance, ABS control module does not perform the system diagnosis, or temporary abnormality may occur, therefore go to “Step 2: Driving Test: ” to proceed the diagnosis.

Step 2: Driving Test
Test drive the vehicle at 40 km/h for more than a minute and check if any trouble symptom (such as abnormal lighting of ABS warning light) exists.
If the malfunction DTC is confirmed again at ignition switch ON, driving test as described is not necessary. Proceed to Step 3.

Step 3: DTC Check
Recheck DTC referring to “DTC Check”.

Step 4: ABS Check
According to ABS Check for the DTC confirmation in Step 3, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator assembly or other part and repair or replace faulty parts.

Step 5: Brakes Diagnosis
Check the parts or system suspected as a possible cause referring to “Brakes Symptom Diagnosis in Section 4A” and based on symptoms appearing on the vehicle (symptom obtained through Steps 1 and 2 and repair or replace faulty parts, if any).

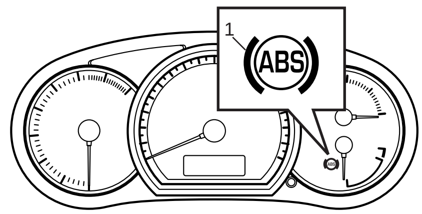
Step 6: Check for Intermittent Problem
Check parts where an intermittent trouble is easy to occur (e.g., wire harness, connector, etc.), referring to “Intermittent and Poor Connection Inspection in Section 00” and related circuit of trouble code recorded in Step 1 to 3.

Step 7: Final Confirmation Test
Confirm that the problem symptom has gone and the ABS is free from any abnormal conditions. If what has been repaired is related to the malfunction DTC, clear the DTC once referring to “DTC Clearance” and perform test driving and confirm that no DTC is indicated.

ABS Warning Light Check

S7RS0B4504002

1) Turn ignition switch ON.
2) Check that ABS warning light (1) comes ON for about 2 seconds and then goes off.
   If any faulty condition is found, advance to “ABS Warning Light Does Not Come ON at Ignition Switch ON” or “ABS Warning Light Comes ON Steady”.



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EBD Warning Light (Brake Warning Light) Check

S7RS0B4504003

NOTE

Perform this check on a level place.

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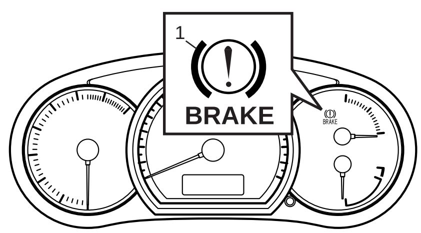
1) Turn ignition switch ON with parking brake applied.
2) Check that EBD warning light (brake warning light) (1) is turned ON.
3) Release parking brake with ignition switch ON and check that EBD warning light (brake warning light) goes off.
   If it doesn’t go off, go to “EBD Warning Light (Brake Warning Light) Comes ON Steady”.



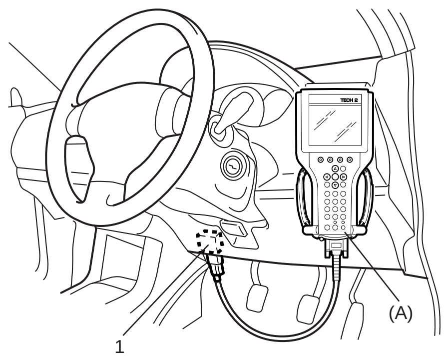
I4RS0A450008-01

DTC Check

S7RS0B4504004

1) Turn ignition switch to OFF position.
2) Connect SUZUKI scan tool to data link connector (1).

   Special tool
   (A): SUZUKI scan tool



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3) Turn ignition switch to ON position.
4) Read DTC according to instructions displayed on SUZUKI scan tool and print it or write it down. Refer to SUZUKI scan tool operator's manual for further details.

   NOTE

   If SUZUKI scan tool can not communicate ABS hydraulic unit / control module, perform "Serial Data Link Circuit Check".

5) After completing the check, turn ignition switch off and disconnect SUZUKI scan tool from DLC.

DTC Table

S7RS0B4504005

⚠ **CAUTION**

Be sure to perform "ABS Check" before starting diagnosis.

DTC (displayed on SUZUKI scan tool)	Diagnostic Items	
NO DTC	Normal	
☞C1021	RF	Wheel speed sensor circuit
☞C1025	LF	
☞C1031	RR	
☞C1035	LR	
☞C1022	RF	Wheel speed sensor circuit or sensor ring
☞C1026	LF	
☞C1032	RR	
☞C1036	LR	
☞C1041	RF	Inlet solenoid valve circuit
☞C1042		Outlet solenoid valve circuit
☞C1045	LF	Inlet solenoid valve circuit
☞C1046		Outlet solenoid valve circuit
☞C1051	RR	Inlet solenoid valve circuit
☞C1052		Outlet solenoid valve circuit
☞C1055	LR	Inlet solenoid valve circuit
☞C1056		Outlet solenoid valve circuit
☞C1057	Power source	
☞C1061	ABS pump motor and/or motor driver circuit	
☞C1063	Solenoid valve power supply driver circuit	
☞C1071	ABS control module	
☞U1073	Control Module Communication Bus Off	
☞U1100	Lost Communication with ECM (Reception error)	

DTC Clearance

S7RS0B4504006

⚠ WARNING

When performing a driving test, select a safe place where there is neither any traffic nor any traffic accident possibility and be very careful during testing to avoid occurrence of an accident.

After repair or replace malfunction part(s), clear all DTCs by performing the following procedure or using SUZUKI scan tool.

1) Connect SUZUKI scan tool to data link connector in the same manner as when making this connection for DTC check.
2) Turn ignition switch to ON position.
3) Erase DTC according to instructions displayed on scan tool. Refer to scan tool operator's manual for further derails.

NOTE

For DTC C 1021, C1022, C1025, C1026, C1031, C1032, C1035, C1036 and C1061, confirm that ABS warning light turns off after performing Step 2 of "Test Driving" under "ABS Check", and then clear the DTCs.

4) After completing the clearance, turn ignition switch OFF and disconnect scan tool from data link connector.
5) Perform "Driving Test" (Step 2 of "ABS Check") and "DTC Check" and confirm that NO DTC is displayed on scan tool.

Scan Tool Data

S7RS0B4504007

The parameter data below are values measured with the scan tool when the normally operating vehicle is under the following conditions. When taking measurements for comparison by using the scan tool, be sure to check that the vehicle is under the following conditions.

- Apply parking brake and block wheels.
- Ignition switch ON.
- Turn OFF air conditioner (if equipped).
- Apply no load to power steering (if equipped). (Don't turn it)
- Turn OFF all electric loads (except ignition).
- No DTC.
- ABS is not operated. (Normal braking operation)

Scan Tool Data	Standards	Condition
Battery Voltage	10.0 – 18.0 V	—
Pump Motor Driver	0.0 V	—
RF Wheel Speed	0 km/h, 0.0 MPH	Vehicle stop
LF Wheel Speed	0 km/h, 0.0 MPH	Vehicle stop
RR Wheel Speed	0 km/h, 0.0 MPH	Vehicle stop
LR Wheel Speed	0 km/h, 0.0 MPH	Vehicle stop
Brake Switch	ON	Brake pedal depressed
	OFF	Brake pedal released

Scan Tool Data Definition

Battery Volt (V): Battery Voltage is an analog input signal read by the ABS control module. Certain ABS control module functions will be modified if the battery voltage falls below or rises above programmed thresholds.

Pump Motor Driver (V): This parameter indicates the operational condition of the pump motor driver (transistor).

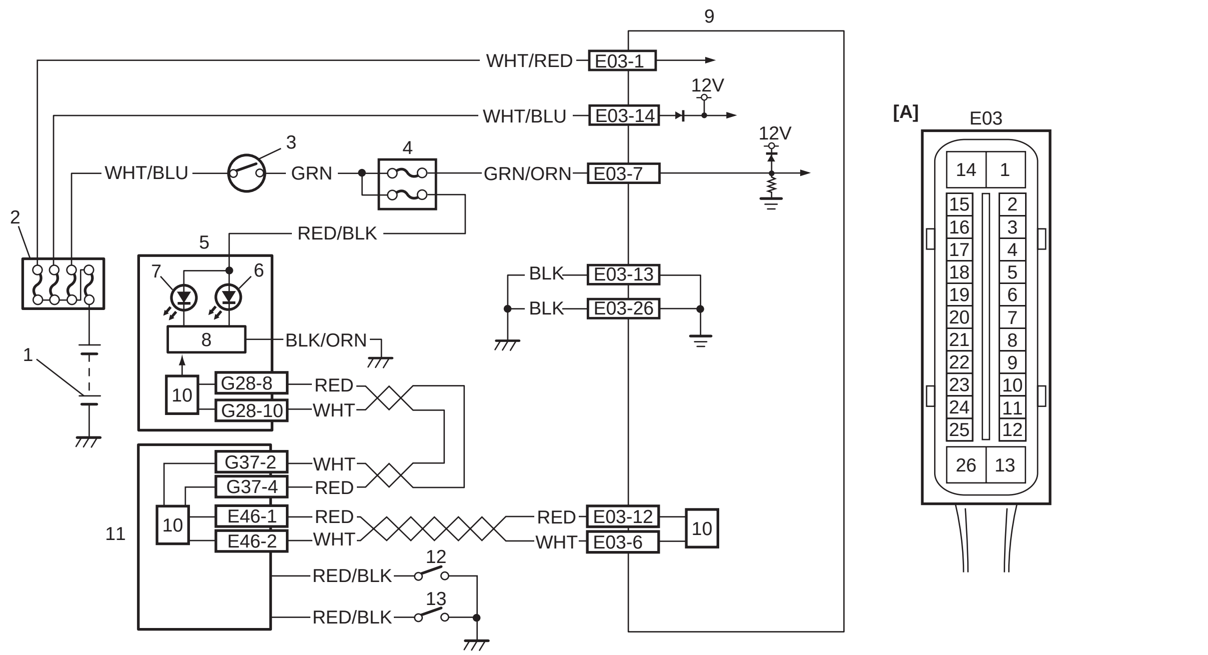
RF Wheel Speed, LF Wheel Speed, RR Wheel Speed and LF Wheel Speed (km/h, MPH): Wheel speed is an ABS control module internal parameter. It is computed by reference pulses from the wheel speed sensor.

Brake Switch (ON, OFF): This switch signal informs the ABS control module whether the brake is active or not.

ABS Warning Light Does Not Come ON at Ignition Switch ON

S7RS0B4504008

Wiring Diagram



I6RS0C450007-01

[A]: ABS hydraulic unit / control module connector (viewed from terminal side)	5. Combination meter	10. CAN driver
1. Battery	6. ABS warning light	11. BCM
2. Main fuse box	7. EBD warning light (Brake warning light)	12. Brake fluid level switch
3. Ignition switch	8. Lamp driver module	13. Parking brake switch
4. Circuit fuse box	9. ABS hydraulic unit / control module assembly	

Circuit Description

Operation (ON/OFF) of ABS warning light is controlled by ABS control module through lamp driver module in combination meter.

If the antilock brake system is in good condition, ABS control module turns ABS warning light ON at the ignition switch ON, keeps it ON for 2 seconds and then turns it OFF. If an abnormality in the system is detected, ABS warning light is turned ON continuously by ABS control module. Also, it is turned ON continuously by lamp driver module when the connector of ABS control module is disconnected.

Troubleshooting

Step	Action	Yes	No
1	1) Turn ignition switch to ON position. *Do other warning lights come ON?*	Go to Step 2.	Go to Step 3.
2	1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ignition switch to ON position and check DTC. *Is there DTC U1073?*	Go to “DTC U1073: Control Module Communication Bus Off”.	Substitute a known-good combination meter and recheck. If ABS warning light remains OFF, substitute a known-good ABS hydraulic unit / control module assembly and recheck.
3	*Is Circuit fuse for combination meter in good condition?*	Go to Step 4.	Replace fuse and check for short circuit to ground.

Step	Action	Yes	No
4	Check CAN communication circuit between combination meter and ABS control module referring to "DTC U1073: Control Module Communication Bus Off". *Is CAN communication circuit in good condition?*	Go to Step 5.	Repair or replace.
5	1) Remove combination meter with ignition switch turned OFF. 2) Check for proper connection to "RED/BLK" and "BLK/ORN" wire of combination meter connector. 3) If OK, turn ON ignition switch and measure voltage at "PPL/RED" wire of combination meter connector and vehicle body ground. *Is it 10 – 14 V?*	Go to Step 6.	Repair power supply circuit for combination meter.
6	1) Measure resistance between "BLK/ORN" wire of combination meter connector and vehicle body ground. *Is resistance less than 2 Ω?*	Replace combination meter.	"BLK/ORN" circuit open or high resistance.

ABS Warning Light Comes ON Steady

S7RS0B4504009

Wiring Diagram

Refer to "ABS Warning Light Does Not Come ON at Ignition Switch ON".

Circuit Description

Operation (ON/OFF) of ABS warning light is controlled by ABS control module through lamp driver module in combination meter.
If the Antilock brake system is in good condition, ABS control module turns ABS warning light ON at the ignition switch ON, keeps it ON for 2 seconds and then turns it OFF. If an abnormality in the system is detected, ABS warning light is turned ON continuously by ABS control module. Also, it is turned ON continuously by lamp driver module when the connector of ABS control module is disconnected.

Troubleshooting

Step	Action	Yes	No
1	1) Perform diagnostic trouble code check. *Is there any DTC(s)?*	Go to applicable DTC diag. flow.	Go to Step 2.
2	*Are main fuses for ABS pump motor and ABS solenoid in good condition?*	Go to Step 3.	Replace fuse and check circuit for short to ground.
3	1) Turn ignition switch to OFF. 2) Disconnect ABS control module connector. 3) Check for proper connection to ABS control module connector at terminals "E03-7", "E03-13" and "E03-26". 4) If OK then turn ignition switch to ON position and measure voltage between terminal "E03-7" and vehicle body ground. *Is it 10 – 14 V?*	Go to Step 4.	"GRN/ORN" circuit open.
4	1) Turn ignition switch to OFF position. 2) Check for proper connection to ABS control module connector at terminals "E03-1" and "E03-14". 3) If OK then turn ignition switch to ON position and measure voltage between each terminal of "E03-1", "E03-14" and vehicle body ground. *Are they 10 – 14 V?*	Go to Step 5.	"WHT/RED" and/or "WHT/BLU" circuit open.

Step	Action	Yes	No
5	1) Turn ignition switch to OFF and measure resistance between each terminal of “E03-13”, “E03-26” and vehicle body ground. *Is resistance less than 2 Ω?*	Go to Step 6.	Ground circuit for ABS hydraulic unit / control module open or high resistance.
6	Check CAN communication circuit between combination meter and ABS control module referring to “DTC U1073: Control Module Communication Bus Off”. *Is CAN communication circuit in good condition?*	Substitute a known-good combination meter and recheck. If ABS warning light remains ON, substitute a known-good ABS hydraulic unit / control module assembly and recheck.	Repair or replace.

EBD Warning Light (Brake Warning Light) Comes ON Steady

S7RS0B4504010

Wiring Diagram

Refer to “ABS Warning Light Does Not Come ON at Ignition Switch ON”.

Circuit Description

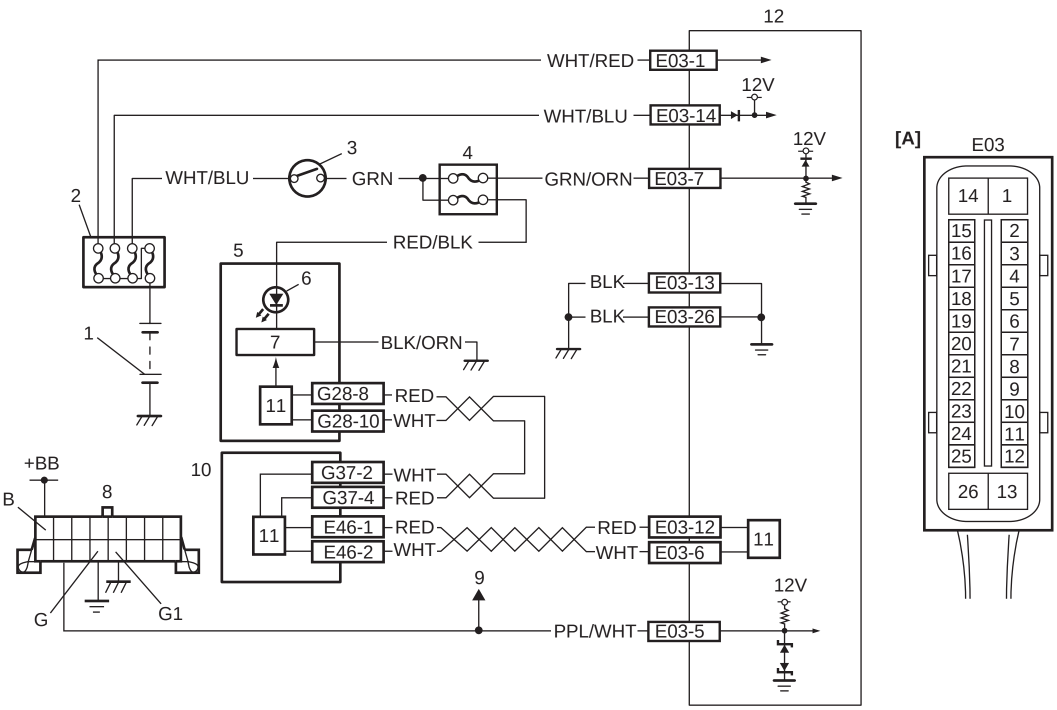
EBD warning light (brake warning light) is controlled by parking brake switch, brake fluid level switch and ABS hydraulic unit / control module assembly through lamp driver module in combination meter.
EBD warning light turns ON when parking brake switch is ON and/or brake fluid level is lower than minimum level.
The information of parking brake switch and brake fluid level are transmitted from BCM to lamp driver module in combination meter through CAN communication line.

Troubleshooting

Step	Action	Yes	No
1	1) Make sure that: • Parking brake is completely released. • Brake fluid level is upper than the minimum level. *Are the check results OK?*	Go to Step 2.	Release parking brake completely and/or replenish brake fluid.
2	1) Turn ignition switch to ON position. *Does “ABS” warning light come on steady?*	Perform “ABS Warning Light Comes ON Steady” previously outlined.	Go to Step 3.
3	1) CAN communication circuit between combination meter, ABS hydraulic unit / control module and BCM referring to “DTC U1073: Control Module Communication Bus Off”. *Is CAN communication circuit in good condition?*	Substitute a known-good combination meter and recheck. If ABS warning light remains ON, substitute a known-good ABS hydraulic unit / control module assembly and recheck.	Repair or replace.

Serial Data Link Circuit Check

S7RS0B4504011

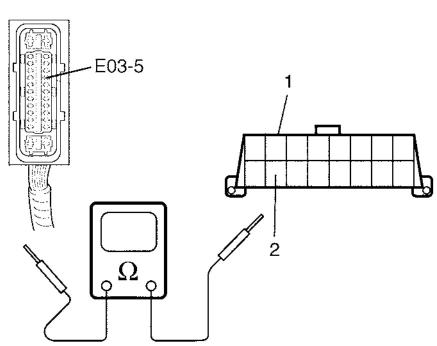


I6RS0C450008-01

[A]: ABS hydraulic unit / control module connector (viewed from terminal side)			
1. Battery	4. Circuit fuse box	7. Lamp driver module	10. BCM
2. Main fuse box	5. Combination meter	8. Data link connector (DLC)	11. CAN driver
3. Ignition switch	6. ABS warning light	9. To ECM, BCM and SDM	12. ABS hydraulic unit / control module assembly

Inspection

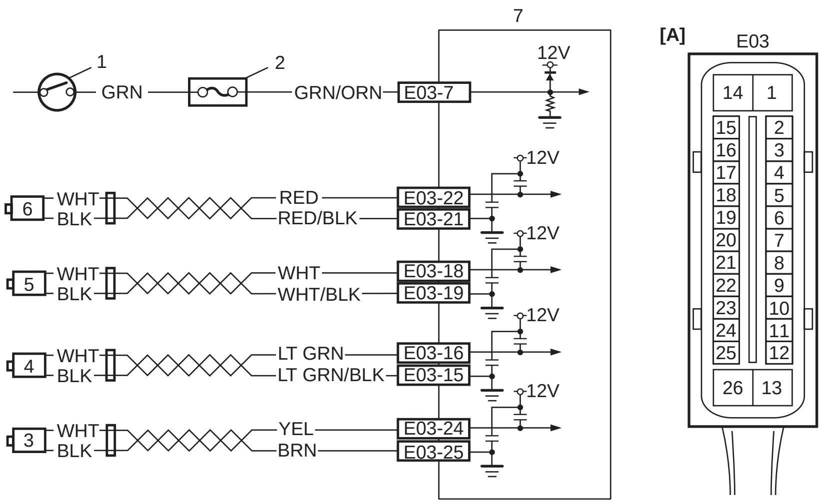
Step	Action	Yes	No
1	1) Turn ignition switch to ON position. *Does ABS warning light come ON?*	Go to Step 2.	Go to Step 6.
2	1) Turn ignition switch to OFF position. *Are main fuses for ABS pump motor and ABS solenoid in good condition?*	Go to Step 3.	Replace fuse and check for short.
3	1) Disconnect ABS hydraulic unit / control module connector. 2) Check for proper connection to ABS hydraulic unit / control module connector at terminal “E03-7”. 3) If OK then turn ignition switch to ON position and measure voltage between terminal “E03-7” and vehicle body ground. *Is it 10 – 14 V?*	Go to Step 4.	“GRN/ORN” wire circuit open.
4	1) Turn ignition switch to OFF position. 2) Check for proper connection to ABS hydraulic unit / control module connector at terminals “E03-1” and “E03-14”. 3) If OK then turn ignition switch to ON position and measure voltage between each terminal of “E03-1”, “E03-14” and vehicle body ground. *Are they 10 – 14 V?*	Go to Step 5.	“WHT/RED” and / or “WHT/BLU” wire circuit open.

Step	Action	Yes	No
5	1) Turn ignition switch to OFF position. 2) Check for proper connection to ABS hydraulic unit / control module connector at terminals “E03-13” and “E03-26”. 3) If OK, measure resistance between each terminal of “E03-13”, “E03-26” and vehicle body ground. *Are resistance less than 2 Ω?*	Go to Step 6.	Ground circuit for ABS hydraulic unit / control module open or high resistance.
6	1) Check if communication is possible by trying communication with other controller (ECM, BCM or SDM). *Is it possible to communicate with other controller?*	Go to Step 7.	Repair open in common section of serial data circuit (“PPL/WHT” wire circuit) used by all controllers or short to ground or power circuit which has occurred somewhere in serial data circuit (“PPL/WHT” wire circuit).
7	1) Turn ignition switch to ON position. 2) Measure voltage between terminal B of data link connector and vehicle body ground. *Is voltage 10 – 12 V?*	Go to step 8.	Terminal B circuit open or shorted to ground.
8	1) Turn ignition switch to OFF position. 2) Measure resistance between the following terminals; • Terminal G of data link connector and vehicle body ground. • Terminal G1 of data link connector and vehicle body ground. *Is each resistance 1Ω or less?*	Go to step 9.	Terminal G and/or G1 circuit open or high resistance.
9	1) Turn ignition switch to OFF position. 2) Check proper connection at “E03-5” (“PPL/WHT” wire) terminal for serial data circuit. 3) If OK, then check resistance between “E03-5” (“PPL/WHT” wire) terminal and “PPL/WHT” wire terminal (2) for serial data circuit in DLC (1). *Is resistance 1 Ω or less?*  I4RS0A450013-02	Substitute a known-good ABS hydraulic unit / control module and recheck.	Repair high resistance or open in “PPL/WHT” wire circuit for anti lock brake system.

DTC C1021, C1022 / C1025, C1026 / C1031, C1032 / C1035, C1036: Right-Front / Left-Front / Right-Rear / Left-Rear Wheel Speed Sensor Circuit or Sensor Ring

S7RS0B4504012

Wiring Diagram



I6RS0C450009-01

[A]: ABS hydraulic unit / control module connector (viewed from terminal side)	3. Right-rear wheel speed sensor	6. Left-front wheel speed sensor
1. Ignition switch	4. Left-rear wheel speed sensor	7. ABS hydraulic unit / control module assembly
2. Circuit fuse box	5. Right-front wheel speed sensor	

DTC Detecting Condition

The ABS control module monitors the voltage at the terminal of each sensor while the ignition switch is ON. When the voltage is not within the specified range, an applicable DTC will be set. Also, when no sensor signal is inputted at running, an applicable DTC will be set.

NOTE

When the vehicle was operated in any of the following ways, one of these DTCs may be set even when the sensor is in good condition. If such possibility is suspected, clear DTC once referring to “DTC Clearance” and then performing the driving test as described in Step 2 of “ABS Check”, check whether or not any abnormality exists.

- **The vehicle was driven with parking brake pulled.**
- **Wheel spin occurred while driving.**
- **Wheel(s) was turned while the vehicle was jacked up.**
- **The vehicle was stuck.**

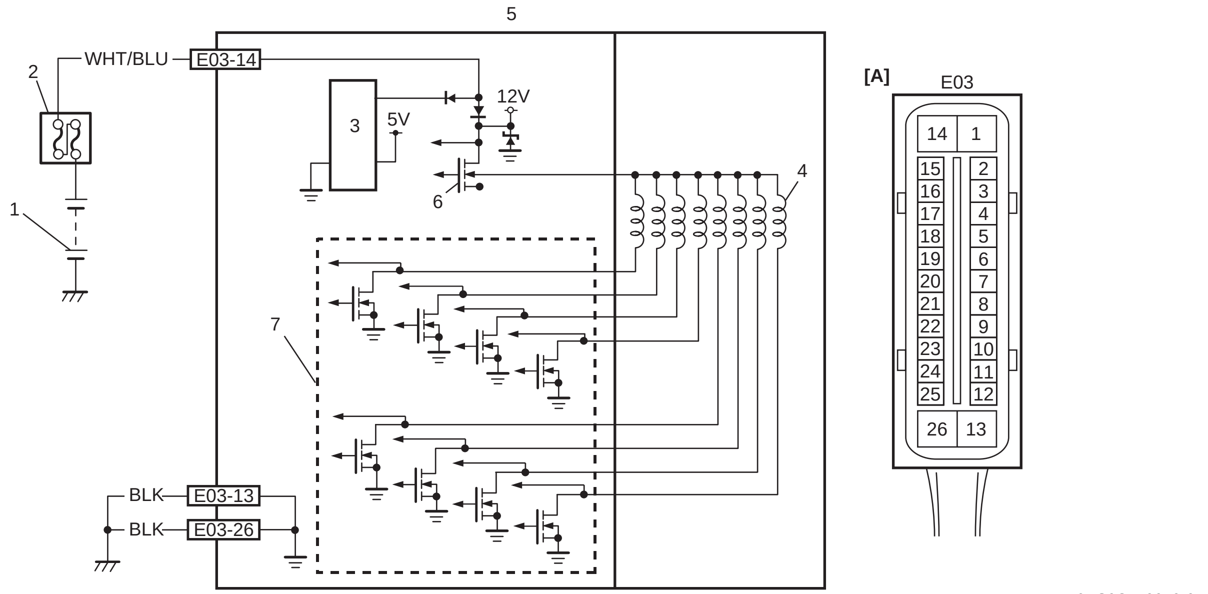
DTC Troubleshooting

Step	Action	Yes	No
1	*Was “ABS Check” performed?*	Go to Step 2.	Go to “ABS Check”.
2	1) Disconnect applicable ABS wheel speed sensor coupler with ignition switch OFF. 2) Measure resistance between terminals of ABS wheel speed sensor. Refer to “Front Wheel Speed Sensor Inspection” and/or “Front Wheel Encoder On-Vehicle Inspection”. *Is measured resistance value as specified?*	Go to Step 3.	Replace ABS wheel speed sensor assembly.
3	1) Turn ignition switch OFF. 2) Connect applicable ABS wheel speed sensor coupler. 3) Disconnect ABS hydraulic unit / control module connector. 4) Check for proper connection to ABS control module at each sensor terminal. 5) If OK, then turn ignition switch ON and measure voltage between applicable sensor terminal of module connector and body ground. *Is it 0 V?*	Go to Step 4.	ABS wheel speed sensor circuit shorted to power.
4	1) Turn ignition switch OFF. 2) Measure resistance between the following points. • Both ABS hydraulic unit / control module connector terminals of the corresponding sensor. This check result should be the same as Step 2). • Either terminal of wheel speed sensor coupler and body ground. This check result should be no continuity. *Are both check results OK?*	Go to Step 5.	Circuit open or shorted to ground.
5	1) Remove applicable ABS wheel speed sensor. 2) Check sensor for damage or foreign material attached. *Is it in good condition?*	Go to Step 6.	Clean, repair or replace.
6	Check front and/or rear sensor ring for the following (remove rear drum as necessary): • Sensor ring serration (teeth) neither missing nor damaged • No foreign material being attached • Sensor ring not being eccentric • Wheel bearing free from excessive play *Are they in good condition?*	Go to Step 7.	Clean, repair or replace.
7	1) Install ABS wheel speed sensor to knuckle. 2) Tighten sensor bolt to specified torque and check that there is no clearance between sensor and knuckle. *Is it OK?*	Go to Step 8.	Replace ABS wheel speed sensor.
8	Refer to “Front / Rear Wheel Speed Sensor On-Vehicle Inspection” and/or “Rear Wheel Speed Sensor Removal and Installation”, check output voltage or waveform. *Is specified voltage and/or waveform obtained?*	Substitute a known-good ABS hydraulic unit / control module assembly and recheck.	Replace sensor and recheck.

DTC C1041 / C1045 / C1051 / C1055, DTC C1042 / C1046 / C1052 / C1056: Right-Front / Left-Front / Right-Rear / Left-Rear Inlet Solenoid Circuit, Right-Front / Left-Front / Right-Rear / Left-Rear Outlet Solenoid Circuit

S7RS0B4504013

Wiring Diagram



I6RS0C450010-01

[A]: ABS hydraulic unit / control module assembly connector (viewed from terminal side)	3. ABS power control module	6. Solenoid valve power supply driver (transistor)
1. Battery	4. Solenoid valve	7. Solenoid valve driver (transistor)
2. Main fuse box	5. ABS hydraulic unit / control module assembly	

DTC Detecting Condition

The ABS control module monitors the output from the valve.
When the output of each valve exceeds the specified value compared with the signal sent from ABS control module, this DTC is set.

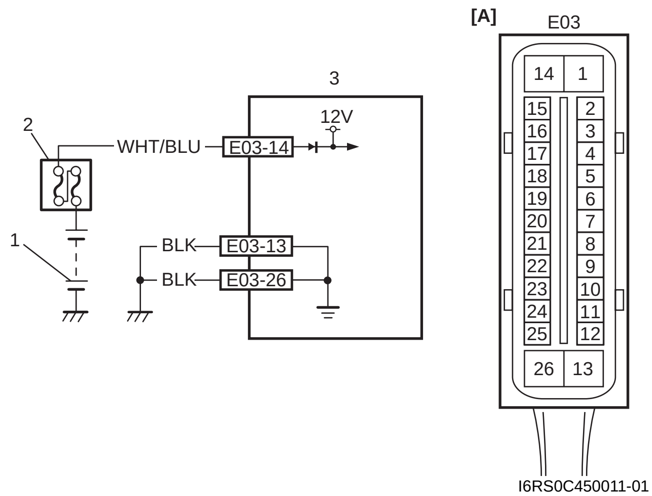
DTC Troubleshooting

Step	Action	Yes	No
1	*Was "ABS Check" performed?*	Go to Step 2.	Go to "ABS Check".
2	1) Turn ignition switch to OFF position. 2) Disconnect ABS hydraulic unit / control module connector. 3) Check for proper connection to ABS hydraulic unit / control module connector at terminal "E03-14". 4) If OK, then measure voltage between terminal "E03-14" of module connector and "E03-26". *Is it 10 – 14 V?*	Substitute a known-good ABS hydraulic unit / control module assembly and recheck.	"WHT/BLU" or "BLK" circuit open.

DTC C1057: Power Source Circuit

S7RS0B4504014

Wiring Diagram



[A]: ABS hydraulic unit / control module connector (viewed from terminal side)	2. Main fuse box
1. Battery	3. ABS hydraulic unit / control module assembly

DTC Detecting Condition

The ABS control module monitors the power source voltage at terminal “E03-14”. When the power source voltage becomes extremely high or low while vehicle is running at more than 20 km/h (13 MPH), this DTC will be set. As soon as the power source voltage becomes normal, the ABS warning light will be turned off and the ABS control module will return to normal operation, but the set DTC will be remain.

DTC Troubleshooting

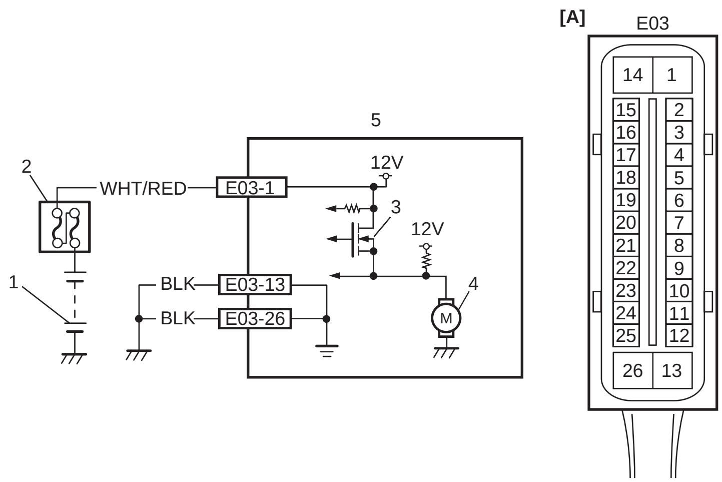
Step	Action	Yes	No
1	*Was “ABS Check” performed?*	Go to Step 2.	Go to “ABS Check”.
2	1) Disconnect ABS hydraulic unit / control module connector with ignition switch turned OFF. 2) Check for proper connection to ABS hydraulic unit / control module connector at terminals “E03-14” and “E03-13”. 3) If OK, then turn ignition switch to ON position and measure voltage between terminals “E03-14” and “E03-13”. *Is voltage 9.7 ± 0.3 V or more?*	Go to Step 5.	Go to Step 3.
3	1) Turn ignition switch to OFF. 2) Check for proper connection to ABS hydraulic unit / control module connector at terminals “E03-13” and “E03-26”. 3) If OK then turn ignition switch to ON and measure resistance between each terminal of “E03-13” and “E03-26” and vehicle body ground. *Is resistance less than 2 Ω?*	Go to Step 4.	“BLK” wire circuit in open or high resistance.
4	1) Measure voltage between positive battery terminal and vehicle body ground with engine running. *Is voltage 9.7 ± 0.3 V or more?*	Imperfect short between “WHT/BLU” wire circuit and body ground.	Check charging system referring to “Generator Test (Undercharged Battery Check) in Section 1J”.

Step	Action	Yes	No
5	1) Measure voltage between terminals “E03-14” and “E03-13” with engine running. *Is voltage 18 ± 1.0 V or less?*	Poor connection of “E03-14” and/or “E03-13” terminals. If the terminals are in good condition, substitute a known-good ABS hydraulic unit / control module and recheck.	Check charging system referring to “Generator Test (Overcharged Battery Check) in Section 1J”.

DTC C1061: ABS Pump Motor and/or Motor Driver Circuit

S7RS0B4504015

Wiring Diagram



I6RS0C450012-01

[A]: ABS hydraulic unit / control module connector (viewed from terminal side)	2. Main fuse box	4. ABS pump motor
1. Battery	3. Pump motor driver (transistor)	5. ABS hydraulic unit / control module assembly

DTC Detecting Condition

The ABS control module monitors the voltage at monitor terminal of pump motor circuit constantly with the ignition switch turned ON. It sets this DTC when the voltage at the monitor terminal does not become high / low according to ON/OFF commands to the motor driver (transistor) of the module (does not follow these commands).

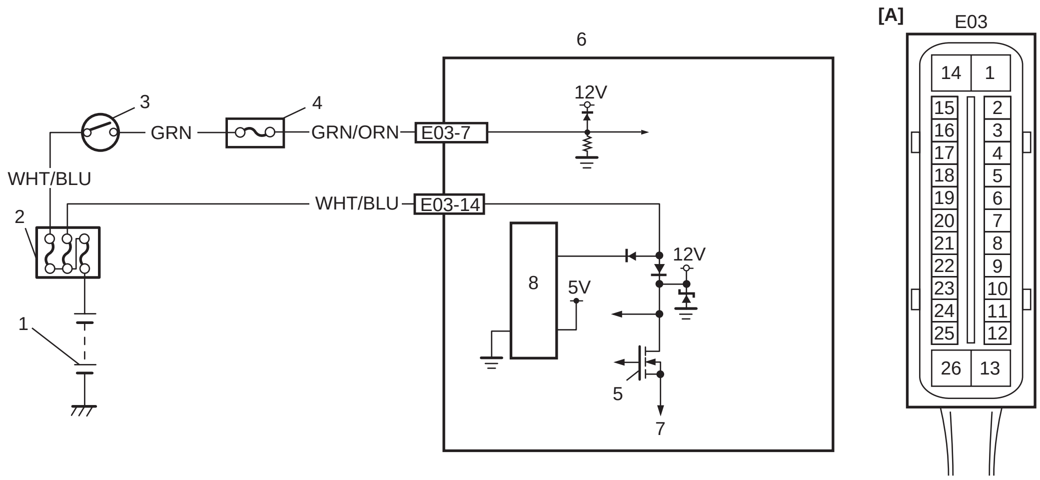
DTC Troubleshooting

Step	Action	Yes	No
1	*Was “ABS Check” performed?*	Go to Step 2.	Go to “ABS Check”.
2	1) Turn Ignition switch to OFF position. 2) Disconnect ABS hydraulic unit / control module connector. 3) Check for proper connection to ABS hydraulic unit / control module connector at terminal “E03-1”. 4) If OK, then measure voltage between terminal “E03-1” of module connector and body ground. *Is it 10 – 14 V?*	Go to Step 3.	“WHT/RED” circuit open.
3	Measure resistance between terminal “E03-13” and “E03-26” of ABS hydraulic unit / control module connector and body ground. *Is resistance less than 1 Ω?*	Substitute a known-good ABS hydraulic unit / control module assembly and recheck.	Ground circuit for ABS hydraulic unit / control module open or high resistance.

DTC C1063: Solenoid Valve Power Supply Driver Circuit

S7RS0B4504016

Wiring Diagram



I6RS0C450013-01

[A]:	ABS hydraulic unit / control module connector (viewed from terminal side)	5.	Solenoid valve power supply driver (transistor)
1.	Battery	6.	ABS hydraulic unit / control module assembly
2.	Main fuse box	7.	To solenoid valve
3.	Ignition switch	8.	ABS power control module
4.	Circuit fuse box		

DTC Detecting Condition

ABS control module monitors the voltage at the terminal of solenoid circuit constantly with ignition switch turned ON. Also, immediately after ignition switch is turned ON, perform initial check as follows.

Switch solenoid valve power supply driver (transistor) in the order of OFF → ON and check if voltage changes to Low → High. If anything faulty is found in the initial check and when the voltage is low with ignition switch turned ON, this DTC will be set.

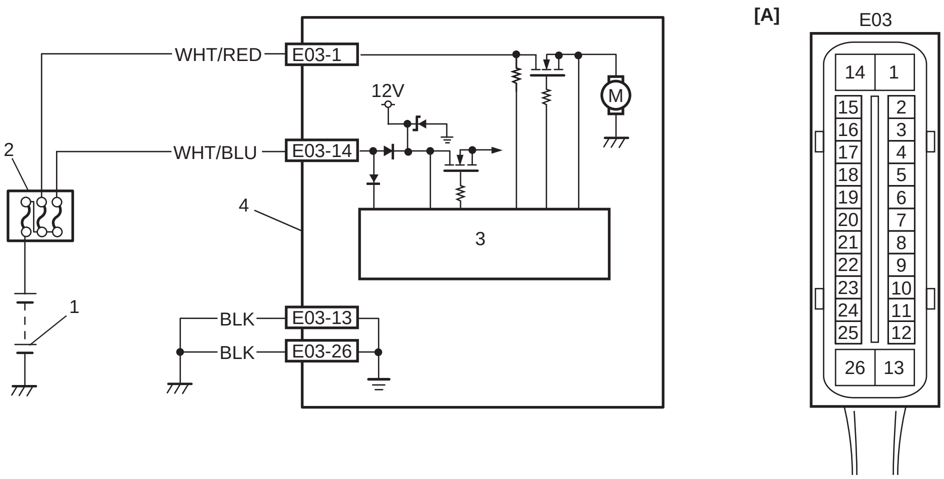
DTC Troubleshooting

Step	Action	Yes	No
1	*Was “ABS Check” performed?*	Go to Step 2.	Go to “ABS Check”.
2	Check battery voltage. *Is it about 11 V or higher?*	Go to Step 3.	Check charging system referring to “Battery Inspection in Section 1J” and “Generator Test (Undercharged Battery Check) in Section 1J”.
3	Check main fuse for ABS solenoid and its terminal. *Is it in good condition?*	Go to Step 4.	Replace fuse and check for short circuit to ground.
4	1) Turn ignition switch to OFF position. 2) Disconnect ABS hydraulic unit / control module connector. 3) Check for proper connection to ABS hydraulic unit / control module at terminal “E03-14”. 4) If OK, then measure voltage between connector terminal “E03-14” and body ground. *Is it 10 – 14 V?*	Substitute a known-good ABS hydraulic unit / control module assembly and recheck.	“WHT/BLU” circuit imperfect short to ground.

DTC C1071: ABS Control Module

S7RS0B4504017

Wiring Diagram



I6RS0C450014-01

[A]: ABS hydraulic unit / control module connector (viewed from terminal side)	2. Main fuse box	4. ABS hydraulic unit / control module assembly
1. Battery	3. ABS power control module	

DTC Detecting Condition

This DTC will be set when an internal malfunction is detected in the ABS control module.

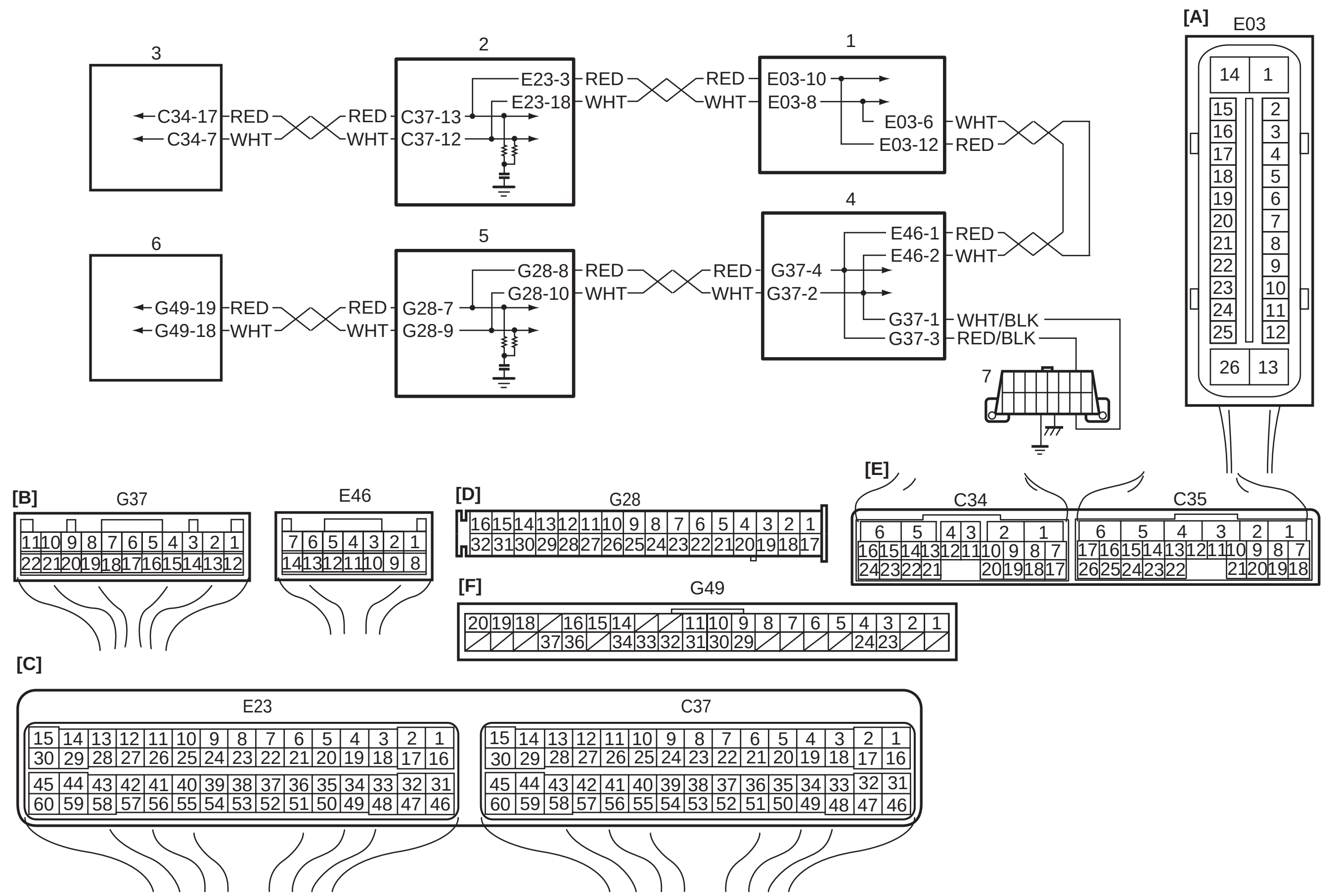
DTC Troubleshooting

Step	Action	Yes	No
1	*Was "ABS Check" performed?*	Go to Step 2.	Go to "ABS Check".
2	Clear all DTCs and check DTC. *Is it DTC C1071?*	Go to Step 3.	Could be a temporary malfunction of the ABS control module.
3	1) Check for proper connection of ABS hydraulic unit / control module connector. 2) If OK, disconnect ABS hydraulic unit / control module connector and check the following. • Voltage "E03-1" terminal: 10 – 14 V • Voltage "E03-14" terminal: 10 – 14 V • Resistance between "E03-13" and body ground: Continuity • Resistance between "E03-26" and body ground: Continuity *Are the check result as specified?*	Replace ABS hydraulic unit / control module assembly.	Repair "WHT/RED", "WHT/BLU" and/or "BLK" circuit and recheck.

DTC U1073: Control Module Communication Bus Off

S7RS0B4504018

Wiring Diagram



I6RS0C450015-01

[A]: ABS control module connector (viewed from terminal side)	[F]: Keyless start control module connector (viewed from harness side)	5. Combination meter
[B]: BCM connector (viewed from harness side)	1. ABS hydraulic unit / control module assembly	6. Keyless start control module (if equipped)
[C]: ECM connector (viewed from harness side)	2. ECM	7. Data link connector (DLC)
[D]: Combination meter connector (viewed from harness side)	3. TCM	
[E]: TCM connector (viewed from harness side)	4. BCM	

DTC Detecting Condition

Transmission error that is inconsistent between transmission data and transmission monitor (CAN bus monitor) data is detected more than 7 times continuously.

DTC Troubleshooting

Step	Action	Yes	No
1	*Was “ABS Check” performed?*	Go to Step 2.	Go to “ABS Check”.
2	1) Check connection of connectors of all control modules communicating by means of CAN. 2) Recheck DTC. *Is DTC U1073 indicated?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00” in related manual.
3	1) Turn ignition switch to OFF position. 2) Disconnect connectors of all control modules communicating by means of CAN. 3) Check CAN communication circuit between control modules for open, short and high resistance. *Is each CAN communication circuit in good condition?*	Go to Step 4.	Repair insulation of CAN communication line circuit referring to “Precaution for CAN Communication System in Section 00” in related manual.
4	1) Turn ignition switch to OFF position. 2) Connect connector of disconnected control modules communicating by means of CAN. 3) Disconnect connector from any one of control modules other than BCM and ABS control module. 4) Recheck ABS control module for DTC. *IS DTC U1073 detected?*	Disconnected connectors of control modules other than the one whose connector is disconnected in Step 3) one by one and check that DTC U1073 is detected by ABS control module each time connector is disconnected. When DTC U1073 is not detected by ABS module while checking in this way, go to description under “NO” below. If DTC U1073 is detected by ABS control module, go to Step 5.	Check power and ground circuit of control module disconnected in Step 3) circuit is OK, substitute a know-good control module disconnected in Step 3) and recheck.
5	1) Substitute a know-good BCM and recheck ABS control module for DTC. *IS DTC U1073 detected?*	Substitute a know-good ABS control module and recheck.	End.

DTC U1100: Lost Communication with ECM (Reception Error)

S7RS0B4504019

Wiring Diagram

Refer to “DTC U1073: Control Module Communication Bus Off”.

DTC Detecting Condition

Reception error of communication data for ECM is detected more than specified time continuously.

DTC Troubleshooting

Step	Action	Yes	No
1	*Was “ABS Check” performed?*	Go to Step 2.	Go to “ABS Check”.
2	1) Check DTC for ABS. *Is DTC U1073 detected?*	Go to “DTC U1073: Control Module Communication Bus Off”.	Go to Step 3.
3	1) Check DTC for ECM. *Is DTC P1674 detected?*	Go to “DTC P1674: CAN Communication (Bus Off Error) in Section 1A”.	Go to Step 4.
4	1) Check connection of connectors of all control modules communicating by means of CAN. 2) Check DTC for ABS. *Is DTC U1100 detected?*	Go to Step 5.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00” in related manual.
5	1) Turn ignition switch to OFF position. 2) Disconnect connectors of ABS control module and ECM communicating by means of CAN. 3) Check CAN communication circuit between ABS control module and ECM for open, short and high resistance. *Is CAN communication circuit in good condition?*	Go to Step 6.	Repair or replace the CAN communication line.
6	1) Disconnect connectors of all control modules communicating by means of CAN. 2) Check CAN communication circuit between control modules other than Step 5 for open, short and high resistance. *Is each CAn communication circuit in good condition?*	Go to Step 7.	Repair or replace the CAN communication line.
7	1) Turn ignition switch to OFF position. 2) Connect connector of disconnected control modules communicating by means of CAN. 3) Disconnect connector from any one of control modules other than BCM and ABS control module. 4) Recheck ABS control module for DTC *IS DTC U1100 detected?*	Disconnected connectors of control modules other than the one whose connector is disconnected in Step 3) one by one and check that DTC U1100 is detected by ABS control module each time connector is disconnected. When DTC U1100 is not detected by ABS module while checking in this way, go to description under “NO” below. If DTC U1100 is detected by ABS control module, go to Step 8.	Check power and ground circuit of control module disconnected in Step 3) circuit is OK, substitute a know-good control module disconnected in Step 3) and recheck.

Step	Action	Yes	No
8	1) Substitute a know-good BCM and recheck ABS control module for DTC. *IS DTC U1100 detected?*	Substitute a know-good ABS control module and recheck.	End.

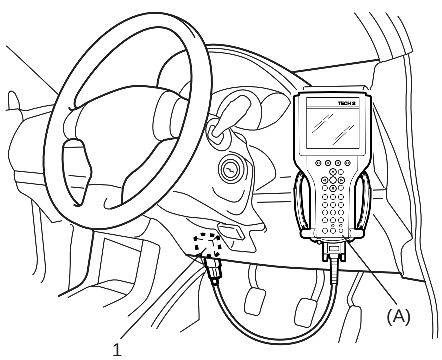
Repair Instructions

ABS Hydraulic Unit Operation Check

S7RS0B4506001

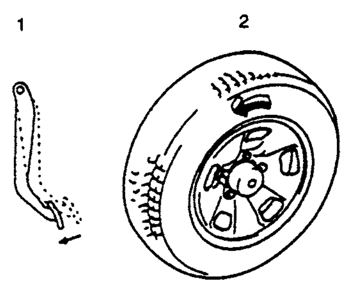
1) Check that basic brake system other than ABS is in good condition.
2) Check that battery voltage is 11 V or higher.
3) Lift up vehicle.
4) Set transmission to neutral and release parking brake.
5) Turn each wheel gradually by hand to check if brake dragging occurs. If it does, correct.
6) Connect SUZUKI scan tool to data link connector (DLC) (1) with ignition switch OFF.

   Special tool
   (A): SUZUKI scan tool



I4RS0A450020-01

7) Turn ignition switch to ON position and select menu to “HYDRAULIC CONTROL TEST” under “miscellaneous test” (“MISC. TEST”) mode of SUZUKI scan tool.
8) Perform the following checks with help of another person.
   Brake pedal (1) should be depressed and then select testing wheel by SUZUKI scan tool and the wheel (2) should be turned by another person’s hand. At this time, check that:
   - Operation sound of solenoid is heard and the wheel turns only about 0.5 sec. (Brake force is depressurized).
   - Operation sound of pump motor is heard and pulsation is felt at brake pedal.



I4RH01450021-01

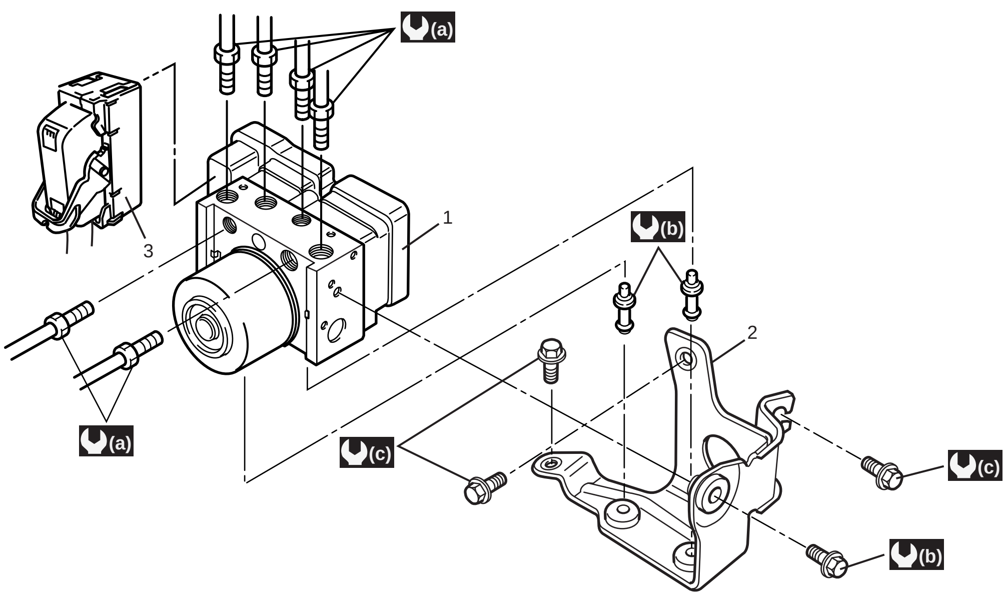
9) Check for all 4-wheels condition respectively. If a faulty condition is found, replace hydraulic unit / control module assembly.
10) After completing the check, turn ignition switch to OFF position and disconnect SUZUKI scan tool from DLC.

ABS Hydraulic Unit / Control Module Assembly Components

S7RS0B4506002

⚠ CAUTION

Never disassemble ABS hydraulic unit / control module assembly, loosen blind plug or remove motor. Performing any of these prohibited services will affect original performance of ABS hydraulic unit / control module assembly.



I4RS0A450021-01

1. ABS hydraulic unit / control module assembly	3. Connector	(b) : 9 N·m (0.9 kgf-m, 6.5 lb-ft)
2. Bracket	(a) : 16 N·m (1.6 kgf-m, 11.5 lb-ft)	(c) : 25 N·m (2.5 kgf-m, 18.0 lb-ft)

ABS Hydraulic Unit / Control Module Assembly On-Vehicle Inspection

S7RS0B4506003

⚠ CAUTION

Never disassemble ABS hydraulic unit / control module assembly, loosen blind plug or remove motor. Performing any of these prohibited services will affect original performance of ABS hydraulic unit / control module assembly.

Check hydraulic unit for fluid leakage.
If any, repair or replace.

ABS Hydraulic Unit / Control Module Assembly Removal and Installation

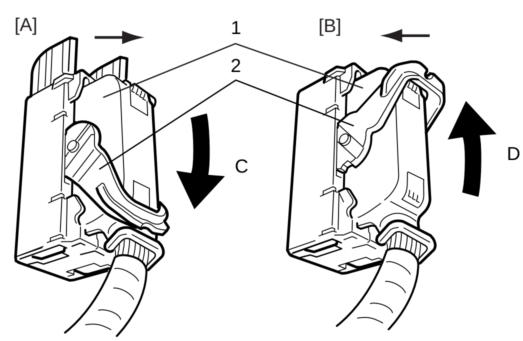
S7RS0B4506004

⚠ CAUTION

Never disassemble ABS hydraulic unit / control module assembly, loosen blind plug or remove motor. Performing any of these prohibited services will affect original performance of ABS hydraulic unit / control module assembly.

Removal

1) Disconnect negative cable from battery.
2) Disconnect ABS hydraulic unit / control module assembly connector (1) by pull down the lock (2).



I4RH01450001-01

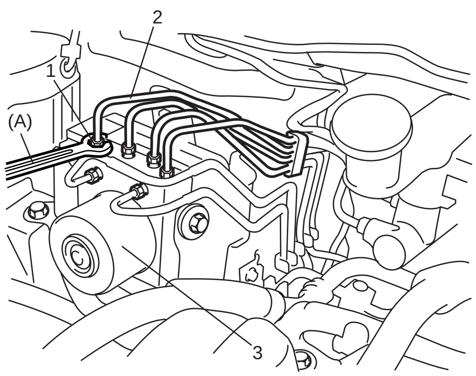
[A]: Disconnect	C: Pull down to disconnect
[B]: Connect	D: Pull up to connect

3) Using special tool, loosen flare nuts (1) and disconnect brake pipes (2) from ABS hydraulic unit / control module assembly (3).

Special tool
(A): 09950–78220

NOTE

Put bleeder plug cap or the like onto pipe to prevent fluid from spilling. Do not allow brake fluid to get on painted surfaces.

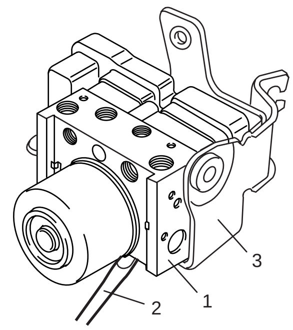


I4RS0A450022-01

4) Remove ABS hydraulic unit / control module with bracket from vehicle by removing three bracket bolts.
5) Remove bolt and pull out ABS hydraulic unit / control module assembly (1) from bracket (3) using flat end rod or the like (2).

⚠ CAUTION

- **Do not give an impact to hydraulic unit.**
- **Use care not to allow dust to enter hydraulic unit.**
- **Do not place hydraulic unit on its side or upside down. Handling it in inappropriate way will affect its original performance.**

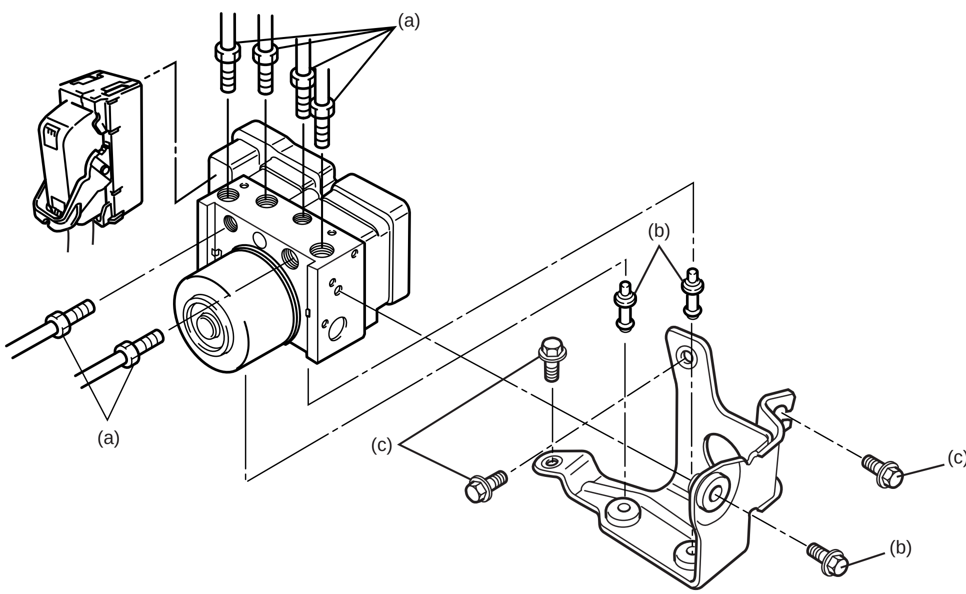


I4RS0A450023-01

Installation

1) Install hydraulic unit / control module assembly by reversing removal procedure.

Tightening torque
Brake pipe flare nut (a): 16 N·m (1.6 kgf-m, 11.5 lb-ft)
ABS hydraulic unit / control module assembly bolt (b): 9 N·m (0.9 kgf-m, 6.5 lb-ft)
ABS hydraulic unit / control module assembly bracket bolt (c): 25 N·m (2.5 kgf-m, 18.0 lb-ft)



I4RS0A450024-01

2) Bleed air from brake system referring to "Air Bleeding of Brake System in Section 4A".
3) Check each installed part for fluid leakage and perform "ABS Hydraulic Unit Operation Check".

NOTE

For new ABS hydraulic unit / control module assembly, if "ABS Hydraulic Unit Operation Check" has not been performed, ABS warning light may flash when ignition switch is turned ON position.
Accordingly preform "ABS Hydraulic Unit Operation Check" to stop flashing of ABS warning light.

Front / Rear Wheel Speed Sensor On-Vehicle Inspection

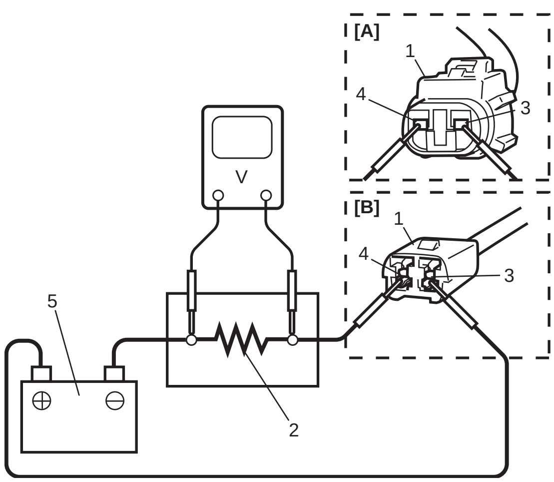
S7RS0B4506005

Output Voltage Inspection

1) Disconnect negative cable from battery.
2) Hoist vehicle a little.
3) Disconnect wheel speed sensor connector.
4) Disconnect wheel speed grommet from vehicle body.
5) Set up measuring devices as shown in figure, the resistance to 115 Ω and the power supply voltage to 12 V.

⚠ CAUTION

Incorrect voltage and/or wrong connection cause damage to wheel speed sensor.



I6RS0B460031-02

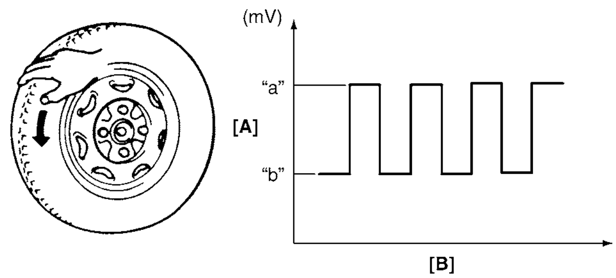
[A]:	Front wheel speed sensor	3.	"WHT" wire terminal
[B]:	Rear wheel speed sensor	4.	"BLK" wire terminal
1.	Wheel speed sensor connector	5.	Power supply (12 V)
2.	Resistance (115 Ω)		

6) Measure voltage at resistance without wheel rotation.
If voltage is out of specification, check sensor, mating encoder and their installation conditions.

Voltage at the resistance (115 Ω) without wheel rotation
680 to 960 mV

7) Measure voltage at resistance with wheel rotation and confirm voltage alternately changes between high and low voltages.
If voltage does not change with wheel rotation, check sensor, mating encoder and their installation conditions.

Voltage at the resistance (115 Ω) with wheel rotation
High voltage "a": 1360 to 1930 mV
Low voltage "b": 680 to 960 mV

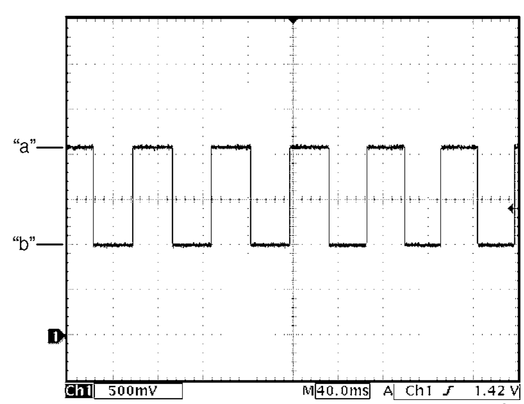


I5JB0A450027-01

[A]: Voltage	[B]: Time

Reference
When using oscilloscope for this check, check if peak-to-peak voltage and waveform meet specification.

Peak-to-peak Voltage at the resistance (115 Ω) with wheel rotation
High voltage "a": 1360 to 1930 mV
Low voltage "b": 680 to 960 mV



I5JB0A450028-02

Front Wheel Speed Sensor Removal and Installation

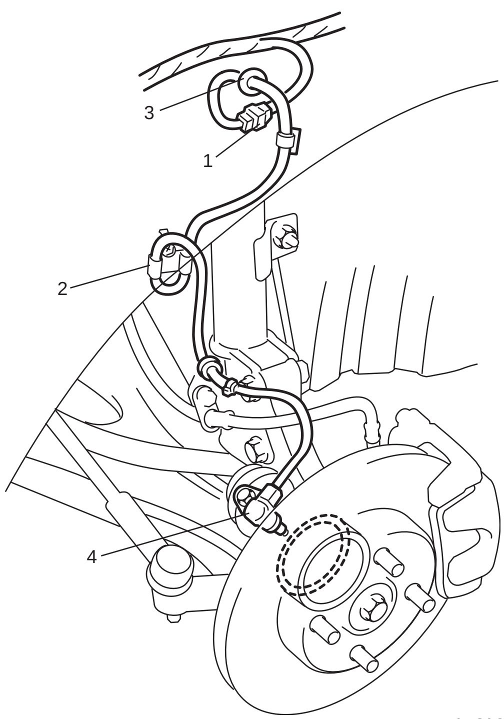
S7RS0B4506006

Removal

1) Disconnect negative cable from battery.
2) Disconnect front wheel speed sensor coupler (1).
3) Hoist vehicle and remove wheel.
4) Remove harness clamp, clamp bolt (2) and grommet (3).
5) Remove front wheel speed sensor (4) from knuckle.

⚠ **CAUTION**

- **Do not pull wire harness when removing front wheel speed sensor.**
- **Do not cause damage to surface of front wheel speed sensor and do not allow dust, etc. to enter its installation hole.**



I6RS0C450017-01

Installation

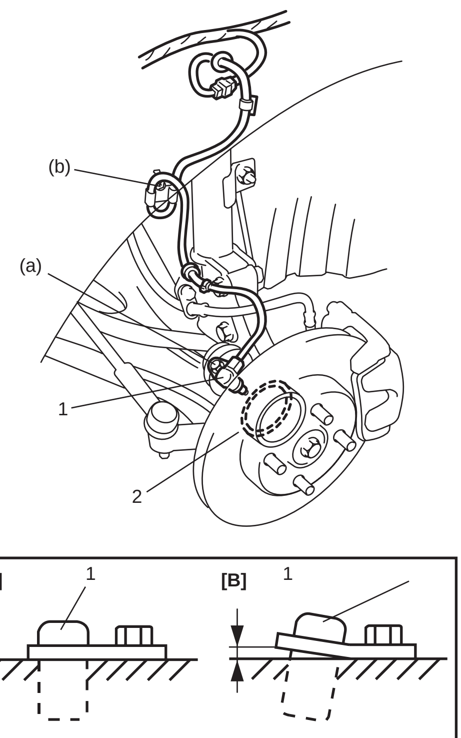
1) Check that no foreign material is attached to sensor (1) and sensor ring (2).
2) Install it by reversing removal procedure.

Tightening torque
Front wheel speed sensor bolt (a): 25 N·m (2.5 kgf-m, 18.0 lb-ft)
Front wheel speed sensor harness clamp bolt (b): 11 N·m (1.1 kgf-m, 8.0 lb-ft)

⚠ **CAUTION**

Do not pull or twist wire harness more than necessary when installing front wheel speed sensor.

3) Check that there is no clearance between sensor and knuckle.



I6RS0C450018-01

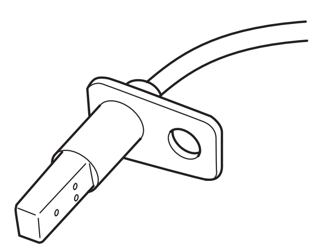
[A]: OK	[B]: NG

Front Wheel Speed Sensor Inspection

S7RS0B4506007

- Check sensor for damage.

If any malcondition is found, replace.



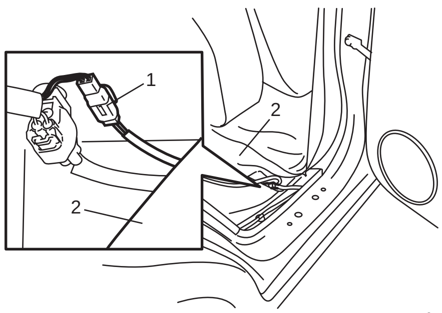
I5JB0A450031-01

Rear Wheel Speed Sensor Removal and Installation

S7RS0B4506008

Removal

1) Disconnect negative (–) cable from battery.
2) Remove quarter inner trim to brake referring to "Floor Carpet Removal and Installation in Section 9H".
3) Turn over floor carpet (2) and disconnect connector (1) of wheel speed sensor.

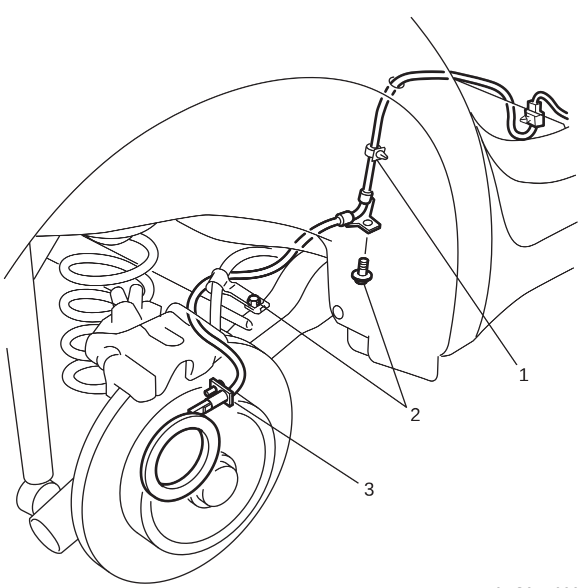


I6RS0B460035-02

4) Hoist vehicle and remove wheel.
5) Remove harness clamp (1) and clamp bolts (2).
6) Remove rear wheel speed sensor (3) from knuckle.

⚠ CAUTION

- **Do not pull wire harness when removing rear wheel speed sensor.**
- **Do not cause damage to surface of rear wheel speed sensor and do not allow dust, etc. enter its installation hole.**



I6RS0B460036-02

Installation

Reverse removal procedure for installation noting the following.

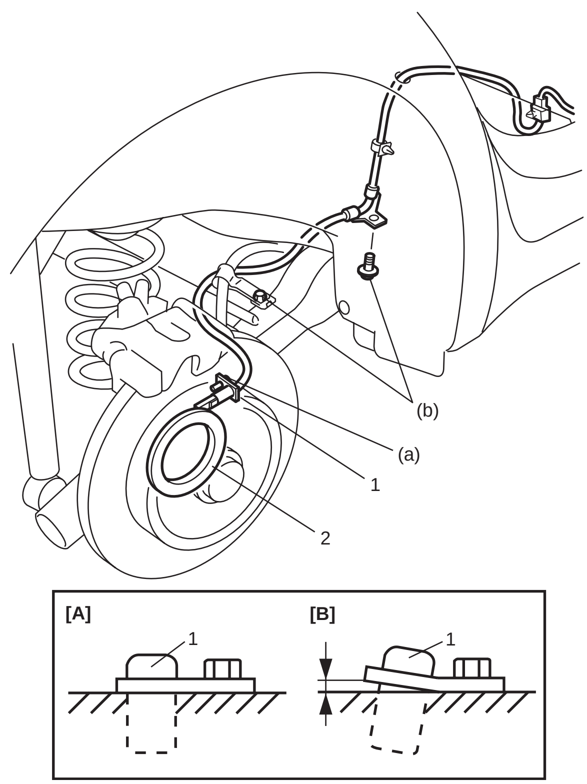
- Check that no foreign material is attached to sensor (1) and mating encoder (2).
- Be sure to install wheel speed sensor (1) and its bolt at the correct position as shown in figure.
  Tighten sensor bolt and harness clamp bolts to specified torque.

  Tightening torque
  Rear wheel speed sensor bolt (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)
  Rear wheel speed sensor harness clamp bolt (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)

⚠ CAUTION

Do not pull or twist wire harness more than necessary when installing rear wheel speed sensor.

- Check that there is no clearance between sensor and brake back plate.



I6RS0B460037-02

[A]: OK	[B]: NG

Rear Wheel Speed Sensor Inspection

S7RS0B4506009

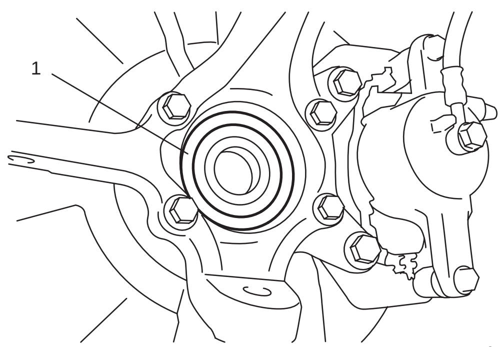
Refer to “Front Wheel Speed Sensor Inspection” since rear wheel speed sensor is the same as front wheel speed sensor.

Front Wheel Encoder On-Vehicle Inspection

S7RS0B4506010

Before inspect front wheel encoder, remove front drive shaft or front wheel spindle referring to “Front Drive Shaft Assembly Removal and Installation in Section 3A”.

- Check encoder (1) for being crack, damaged or deformed.
- Turn wheel and check if encoder rotation is free from eccentricity and looseness.
- Check that no foreign material is attached.
  If any faulty is found, clean encoder or replace wheel bearing. Refer to “Front Wheel Hub, Steering Knuckle and Wheel Bearing Removal and Installation in Section 2B”.



I5JB0A450034-01

Front wheel Encoder Removal and Installation

S7RS0B4506011

⚠ CAUTION

Front wheel encoder is included in front wheel bearing. If front wheel encoder needs to replaced, replace it as a front wheel bearing.

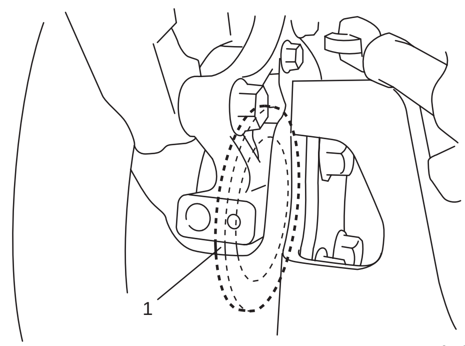
For removal and installation of front wheel bearing, referring to “Front Wheel Hub, Steering Knuckle and Wheel Bearing Removal and Installation in Section 2B”.

Rear Wheel Encoder On-Vehicle Inspection

S7RS0B4506012

Before inspect rear wheel encoder, hoist vehicle and remove wheel.

- Check encoder (1) for being crack, damaged or deformed.
- Turn wheel and check if encoder rotation is free from eccentricity and looseness.
- Check that no foreign material is attached.
  If any faulty is found, clean encoder or replace rear wheel hub assembly. Refer to “Rear Wheel Hub Removal and Installation in Section 2C”.



I6RS0B460038-03

Rear Wheel Encoder Removal and Installation

S7RS0B4506013

⚠ CAUTION

Rear wheel encoder is included in rear wheel hub assembly. If rear wheel encoder needs to replaced, replace it as a rear wheel hub assembly.

For removal and installation of front wheel hub assembly, referring to “Rear Wheel Hub Removal and Installation in Section 2C”.

Specifications

Tightening Torque Specifications

S7RS0B4507001

Fastening part	Tightening torque			Note
	N·m	kgf-m	lb-ft	
Brake pipe flare nut	16	1.6	11.5	☞
ABS hydraulic unit / control module assembly bolt	9	0.9	6.5	☞
ABS hydraulic unit / control module assembly bracket bolt	25	2.5	18.0	☞
Front wheel speed sensor bolt	25	2.5	18.0	☞
Front wheel speed sensor harness clamp bolt	11	1.1	8.0	☞
Rear wheel speed sensor bolt	11	1.1	8.0	☞
Rear wheel speed sensor harness clamp bolt	11	1.1	8.0	☞

NOTE

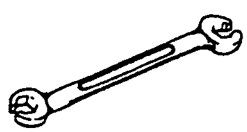
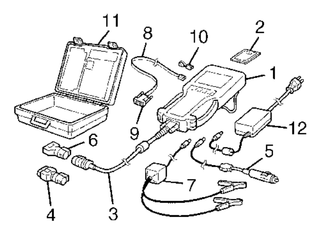
The specified tightening torque is also described in the following.
“Front Wheel Speed Sensor Components Location”
“Rear Wheel Speed Sensor Components Location”
“ABS Hydraulic Unit / Control Module Assembly Components”

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

S7RS0B4508001

09950–78220 Flare nut wrench (10 mm) ☞ 	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 loop back adapter, 7. Battery power cable, 8. RS232 cable, 9. RS232 adapter, 10. RS232 loop back connector, 11. Storage case, 12. ☞ / ☞ 

Electronic Stability Program

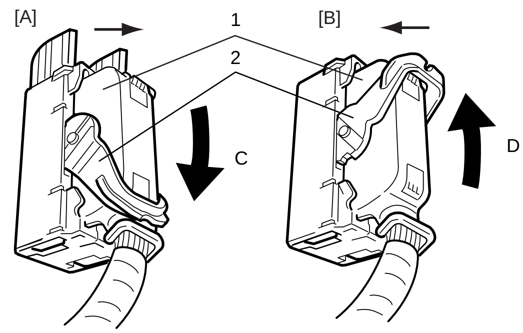
Precautions

Precautions in Diagnosing Troubles

S7RS0B4600001

To ensure that the trouble diagnosis is done accurately and smoothly, observe the following and follow "Electronic Stability Program System Check".

- Diagnostic information stored in ESP® control module memory can be cleared as well as checked by using SUZUKI scan tool. Before using scan tool, read its Operator's (Instruction) Manual carefully to have good understanding as to what functions are available and how to use it.
- If the vehicles was operated in any of the following ways, ESP® warning lamp may light momentarily but this does not indicate anything abnormal in ESP®.
  - The vehicle was driven with parking brake pulled.
  - The vehicle was driven with brake dragging.
  - The vehicle was stuck in mud, sand, etc.
  - Wheel spin occurred while driving.
  - Wheel(s) was rotated while the vehicle was jacked up.
- Be sure to use the trouble diagnosis procedure as described in "Electronic Stability Program System Check". Failure to follow it may result in incorrect diagnosis. (Some other diagnosis trouble code may be stored by mistake in the memory of ESP® control module during inspection.)
- When disconnecting ESP® control module connector (1), pull down the lock lever (2) of connector.
  When connecting, set the connector on ESP® hydraulic unit / control module assembly and pull up the lock lever (2) until it locks.



I4RH01450001-01

[A]: Disconnect	[C]: Pull down to disconnect
[B]: Connect	[D]: Pull up to connect

- Communication of ECM, BCM, ESP® control module, keyless start control module (if equipped), steering angle sensor and combination meter is established by CAN (Controller Area Network).
  Therefore, be sure to read "Precautions for Installing Mobile Communication Equipment in Section 00" before inspection and handling CAN communication line.

Precautions in On-Vehicle Service

S7RS0B4600002

When connector is connected to ESP® hydraulic unit / control module assembly, do not disconnect connectors of sensors with ignition switch ON. Otherwise, DTC will be set in ESP® control module.

Precautions in Hydraulic Unit Operation Check

S7RS0B4600003

ESP® hydraulic unit / control module assembly function is checked by correct wheel lock / release condition when brake pressure is pressurized / depressurized using SUZUKI scan tool. The hydraulic unit operation check referring to "ESP® Hydraulic Unit Operation Check" should be performed to confirm the correct brake pipe connection in the following cases.

- ESP® hydraulic unit / control module assembly was replaced.
- Brake pipe and/or hose were replaced.

Precautions in Sensor Calibration

S7RS0B4600004

ESP® control module stores calibration points data of yaw rate / G sensor assembly and master cylinder pressure sensor. Steering angle sensor stores calibration point data of itself.
TCS and stability control system use these sets of data.
When the following operation is done, sensor calibration should be performed since the original calibration points are deleted.

Sensor	Procedures required calibration
Steering angle sensor	• Power is not supplied to steering angle sensor. (battery, fuse and/or connector is removed.) • Steering angle sensor is replaced. • Power is not supplied to ESP® control module. (battery, fuse and/or connector is removed.) • ESP® hydraulic unit / control module assembly is replaced.
Master cylinder pressure sensor	• ESP® hydraulic unit / control module assembly is removed or replaced.
Yaw rate / G sensor assembly	• Yaw rate / G sensor assembly is removed or replaced. • ESP® hydraulic unit / control module assembly is replaced.

Perform sensor calibration according to “Sensor Calibration”.

Precautions in Speedometer Test or Other Tests

S7RS0B4600005

When performing speedometer or other tests using speedometer tester or chassis dynamometer, ESP® function must be deactivated by ESP® OFF switch or using SUZUKI scan tool to complete the tests correctly.
When using SUZUKI scan tool, set to the “MISC. TEST” mode to stop the ESP® function. Refer to SUZUKI scan tool operator's manual for further details.

General Description

Electronic Stability Program Description

S7RS0B4601006

Electronic Stability Program (ESP®) is an auxiliary function to enable the vehicle to avoid a danger safely while the vehicle is running, stopping or turning.
Electronic Stability Program (ESP®) consists of following functions.
ESP® is a registered trademark of Daimler Chrysler AG.

Antilock Brake System (ABS)

This system prevents tire locking which may occur when brake is applied suddenly or on slippery roads. With this function, as the vehicle body is kept in the stable state and tires unlocked, the driver can avoid any obstacle by turning the steering wheel.

Electronic Brake force Distribution (EBD)

This function distributes braking force of front and rear wheels properly according to the vehicle load condition.
With this function, the braking force of the front and rear wheels is controlled for the optimum effect to secure the maximum braking force regardless of the loadage.

Traction Control System (TCS)

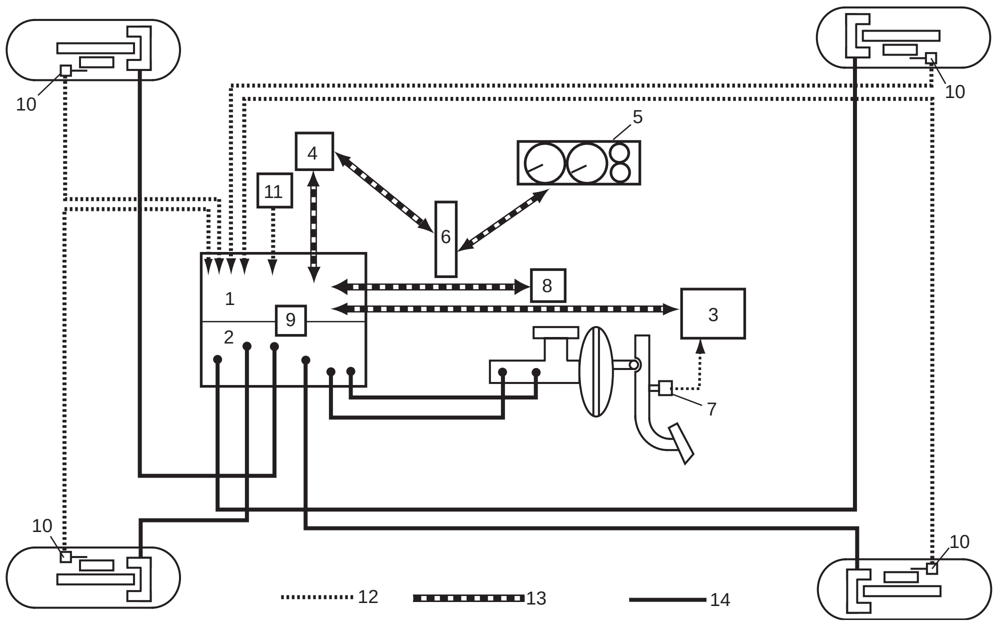
This system controls the engine and brake to prevent the driving wheels from spinning at the time of starting and accelerating. Particularly, this function is helpful for safe driving on muddy or icy roads. When ESP® control module detects wheel spinning using information from the yaw rate sensor and wheel speed sensor, it lower the engine torque by closing the electronic controlled throttle and controlling ignition. At the same time, brake is applied to the spinning tire.

Stability Control

This function controls the vehicle body in the stable state by controlling the engine and braking so as to prevent the vehicle from over-steering or under-steering while turning.
When under-steering occurs, this function lowers the engine torque and applies brake to the inner rear wheel in the vehicle forward direction so as to prevent the vehicle from moving outward.
When over-steering occurs, this function applies brake to the outer front wheel in the vehicle forward direction so as to prevent the vehicle from moving inward.

Electronic Stability Program Construction

S7RS0B4601007



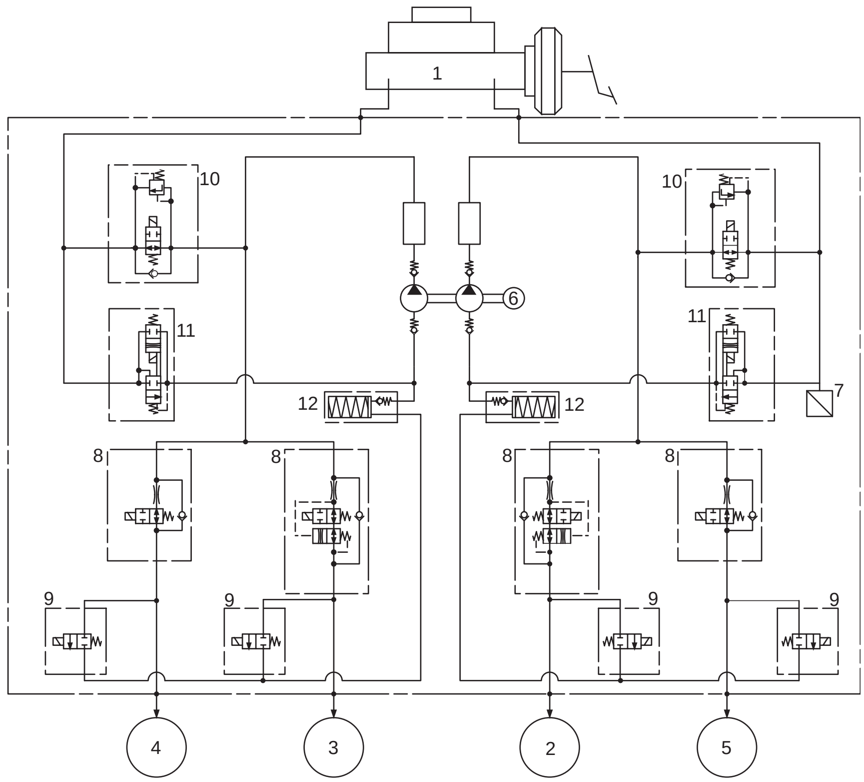
I7RS0B460001-03

1. ESP® control module	6. Steering angle sensor	11. ESP® OFF switch
2. Hydraulic unit	7. Stop lamp switch	12. Electronic signal
3. ECM	8. Yaw rate / G sensor	13. CAN signal
4. BCM	9. Brake master cylinder pressure sensor	14. Hydraulic circuit
5. Combination meter	10. Wheel speed sensor	

ESP® control module/ hydraulic unit

The control module receives signals from each wheel speed sensor, ESP OFF switch, brake master cylinder pressure sensor, steering angle sensor and yaw rate / G sensor. Based on these signals as information, the control module judges the vehicle conditions and controls the brake hydraulic pressure by combining the ON/OFF operation of the solenoid in the hydraulic unit and the pump motor operation.

The hydraulic unit contains an inlet solenoid valve and an outlet solenoid valve for each wheel as well as a cut solenoid valve and a low pressure solenoid valve for each hydraulic unit system. Also, a master cylinder pressure sensor, pump motor, etc. are included. The hydraulic pressure control is done in 3 modes of pressure increase, pressure keeping and pressure reduction.



I7RS0B460002-01

1. Master cylinder	5. Brake caliper (rear-left)	9. Outlet solenoid valve
2. Brake caliper (front-right)	6. Pump motor	10. Cut solenoid valve
3. Brake caliper (front-left)	7. Brake master cylinder pressure sensor	11. Low pressure solenoid valve
4. Brake caliper (rear-right)	8. Inlet solenoid valve	

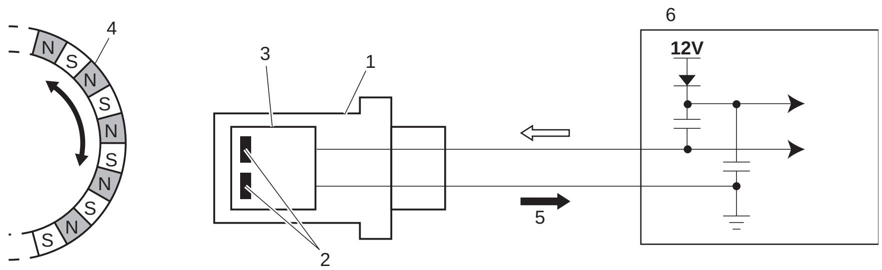
- Pump motor:
  The pump motor turns on and applies pressure to each brake when braking is activated in the TCS and stability control state. When in the pressure reduction mode, it causes the brake fluid in the reservoir to return to the master cylinder.
- Brake master cylinder pressure sensor:
  This sensor detects the brake hydraulic pressure in the primary piping when brake is applied in the normal condition. Also, it detects the pump motor driving state when brake is applied in the TCS and Stability Control state.
- Inlet solenoid valve:
  In the ABS, TCS and Stability Control state, this valve is activated in the pressure keeping and pressure reduction modes to open the fluid passage, thereby restricting increase of the hydraulic pressure applied to the brake caliper.
- Outlet solenoid valve:
  In the ABS, TCS and Stability Control state, this valve is activated in the pressure reduction mode to open the fluid passage, thereby lowering the hydraulic pressure kept in the brake caliper.
- Cut solenoid valve:
  When brake is applied in the TCS and Stability Control state, this valve is activated to close the fluid passage, thereby causing the hydraulic pressure generated by the pump motor to apply to the brake caliper.
- Low pressure solenoid valve:
  When brake is applied in the TCS and Stability Control state, this valve is activated to open the fluid passage from the master cylinder to the pump motor.

Steering angle sensor

The steering angle sensor is assembled with the contact coil as a unit and mounted to the steering column. Detecting the angle as the steering wheel is turned, it sends that information to the ESP® control module.

Yaw rate / G sensor
The yaw rate / G sensor consists of the yaw rate (angular velocity in the vehicle turning direction) sensor and right-left G (acceleration in right-left direction) sensor and is mounted to the P/S controller B/K at the lower part of the center console. It detects the angular velocity in the vehicle turning direction and movement in the right-left direction, and then it sends that information to ESP® control module.

Wheel speed sensor
The vehicle speed is detected by the hall IC type wheel speed sensor (1) and encoder (4). The wheel speed sensor is fixed to the knuckle and includes a hall IC (3) having 2 hall elements (2).
The encoder consisting of a permanent magnet which has S/N electrodes turns inside of the wheel hub along with the wheel. The wheel speed sensor outputs alternate current.
As the cycle of the alternate current is in proportion to the revolution speed of the encoder, this AC signal (5) is converted into the voltage signal in the ESP® control module (6) for detection of the wheel speed.



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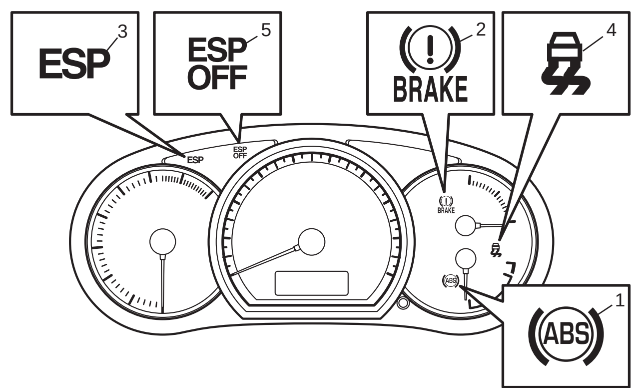
ESP® Hydraulic Unit / Control Module Assembly Description

S7RS0B4601002

ESP® control module is a component of ESP® hydraulic unit / control module assembly and has the following functions.

Self-Diagnosis Function
ESP® control module monitors each input and output signals. When ESP® control module detects any malfunction, some of ABS warning lamp (1), EBD warning lamp (brake warning lamp) (2), ESP® warning lamp (3), SLIP indicator lamp (4), ESP® OFF lamp (5) are turned ON and indicate the abnormality to driver.

- When ignition switch is turned ON, ABS warning lamp, EBD warning lamp, ESP® warning lamp, SLIP indicator lamp and ESP® OFF lamp light for 2 seconds to check its circuit.
- When no abnormality is detected (the system is in good condition), ABS warning lamp, EBD warning lamp, ESP® warning lamp, SLIP indicator lamp and ESP® OFF lamp turn OFF after 2 seconds.
- When an abnormality in the system is detected, some of ABS warning lamp, EBD warning lamp (brake warning lamp), ESP® warning lamp, SLIP indicator lamp and/or ESP® OFF lamp are turned ON and the area where that abnormality lies is stored in the memory in ESP® control module.



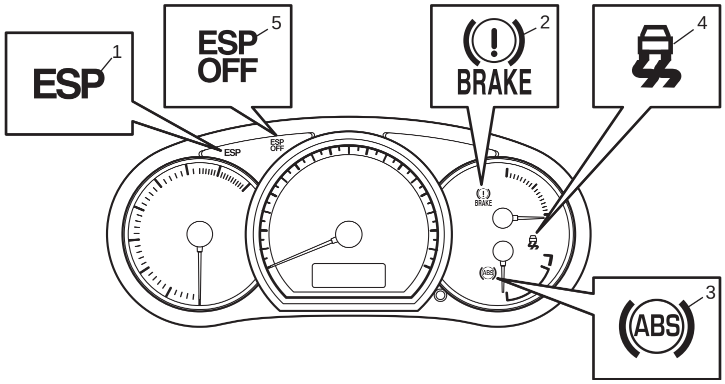
I6RS0B460001-01

Fail-Safe Mode
When ESP® control module detects abnormality, the system goes into fail-safe mode. And some of functions of ABS, TCS, stability control system are shut down. For details of fail safe mode, refer to “Fail-Safe Table”.

Warning Lamp, Indicator Lamp Description

S7RS0B4601003

There are five types of warning lamp and indicator lamp in instrument cluster, which are controlled by ESP® control module. They give warning / indication to driver by changing the modes light ON / blinking / light OFF.



I6RS0B460002-01

1. ESP® warning lamp	3. ABS warning lamp	5. ESP® OFF lamp
2. EBD warning lamp (brake warning lamp)	4. SLIP indicator lamp	

The followings are the condition and operation of warning lamps and indicator lamps.

Warning lamp / Indicator lamp	Condition and operation
ABS warning lamp	If ABS has abnormality, the lamp turns “ON”.
EBD warning lamp (brake warning lamp)	• If EBD system has abnormality, the lamp turns “ON”. • If bake fluid level in reservoir is lower than minimum level, the lamp turns “ON”. • Parking brake switch is ON, the lamp turns “ON”.
ESP® warning lamp	If ESP® systems has abnormality, the lamp turns “ON”.
SLIP indicator lamp	• If stability control system and traction control system is active, the lamp blinks at 5 Hz. • If Steering angle sensor calibration is incompleted, the lamp blinks at 1 Hz.
ESP® OFF lamp	• If ESP® OFF switch is turned “ON”, the ESP® OFF lamp light up. When it is “ON”, TCS and stability control system functions are controlled not to work. • ESP® OFF lamp light up to indicate that brake control of traction control function is controlled not to act if brake pad temperature is over 320 °C (608 °F) and any of wheel is in wheel spin condition.

CAN Communication System Description

S7RS0B4601004

Refer to “CAN Communication System Description in Section 1A” for CAN communication system description. ESP® control module communicates control data with each control module as follows.

ESP® Control Module Transmission Data

				ECM	Combination meter	Steering angle sensor
ESP® control module	Transmit	DATA	Torque request signal	○		
			Wheel speed signal (front right)	○		
			Wheel speed signal (front left)	○		
			ESP® status signal	○	○	
			ABS active signal	○		
			ABS indication signal		○	
			EBD indication signal		○	
			Steering angle neutral position			○

I7RS0B460004-01

ESP® Control Module Reception Data

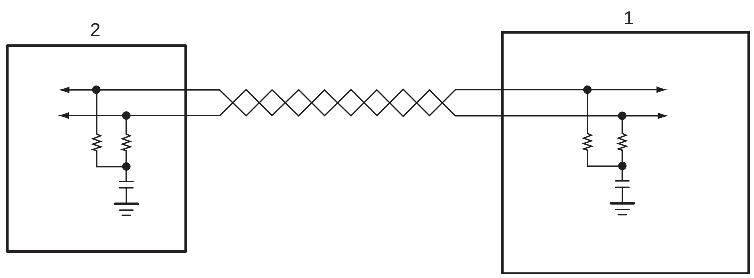
				ECM	BCM	Steering angle sensor
ESP® control module	Receive	DATA	Engine torque signal	○		
			Accelerator pedal position signal	○		
			Engine speed signal	○		
			Brake pedal switch signal	○		
			Brake fluid level switch signal		○	
			Parking brake switch signal		○	
			Steering angle signal			○
			Steering angle sensor related malfunction			○

I7RS0B460005-01

CAN Communication System For Electronic Stability Program Description

S7RS0B4601005

There is CAN communication system only for ESP® control module (1) and yaw rate / G sensor assembly (2). This CAN communication system is independent from other control modules.



I6JB01460006-01

ESP® communicates control data with yaw rate / G sensor assembly as follows.

ESP® Transmission Data to Yaw Rate / G Sensor Assembly

- Longitudinal G neutral position
- Lateral G neutral position

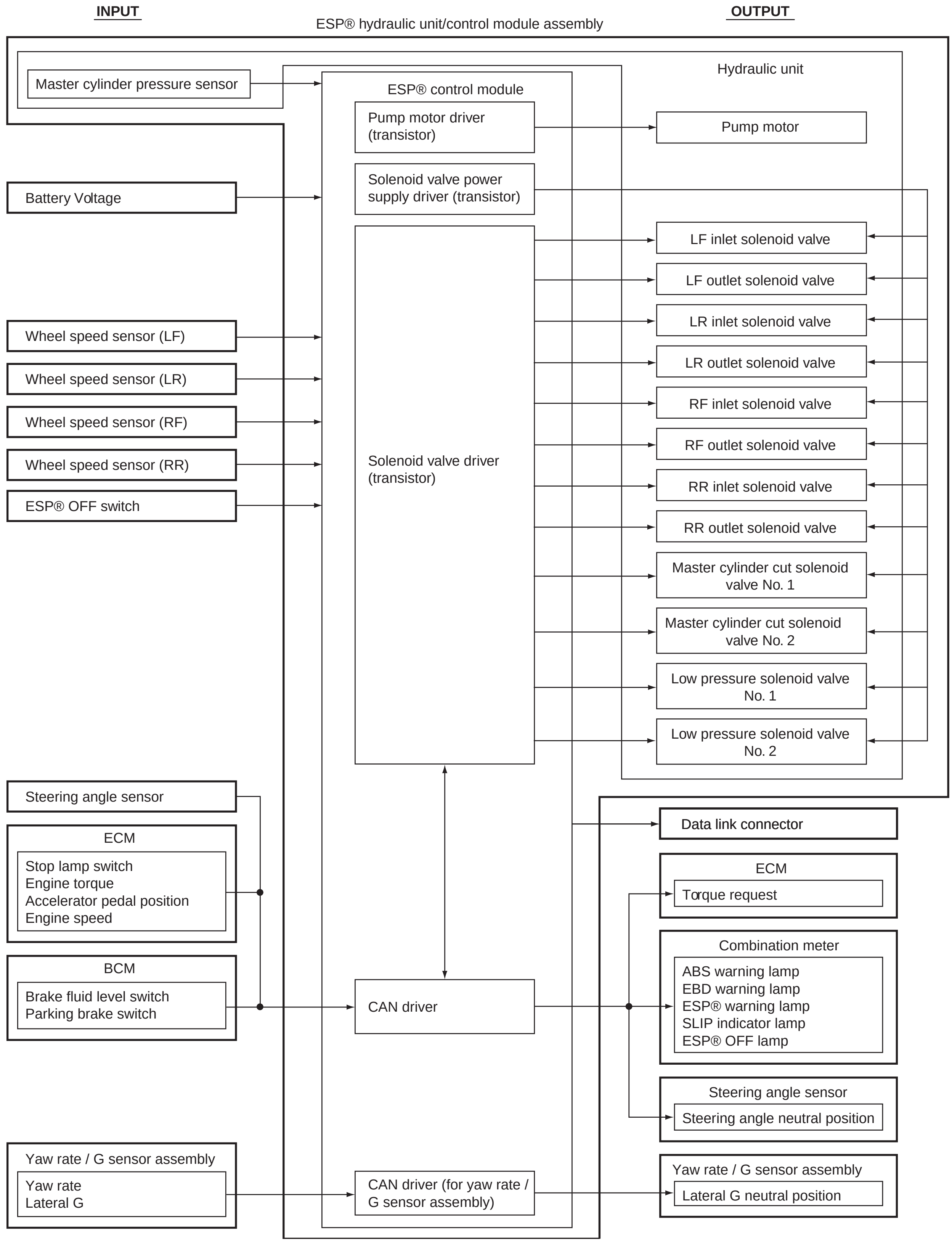
ESP® Reception Data from Yaw Rate / G Sensor Assembly

- Vehicle yaw rate signal
- Vehicle longitudinal G signal
- Vehicle lateral G signal
- Yaw rate / G sensor assembly related malfunction

Schematic and Routing Diagram

Electronic Stability Program Schematic

S7RS0B4602001



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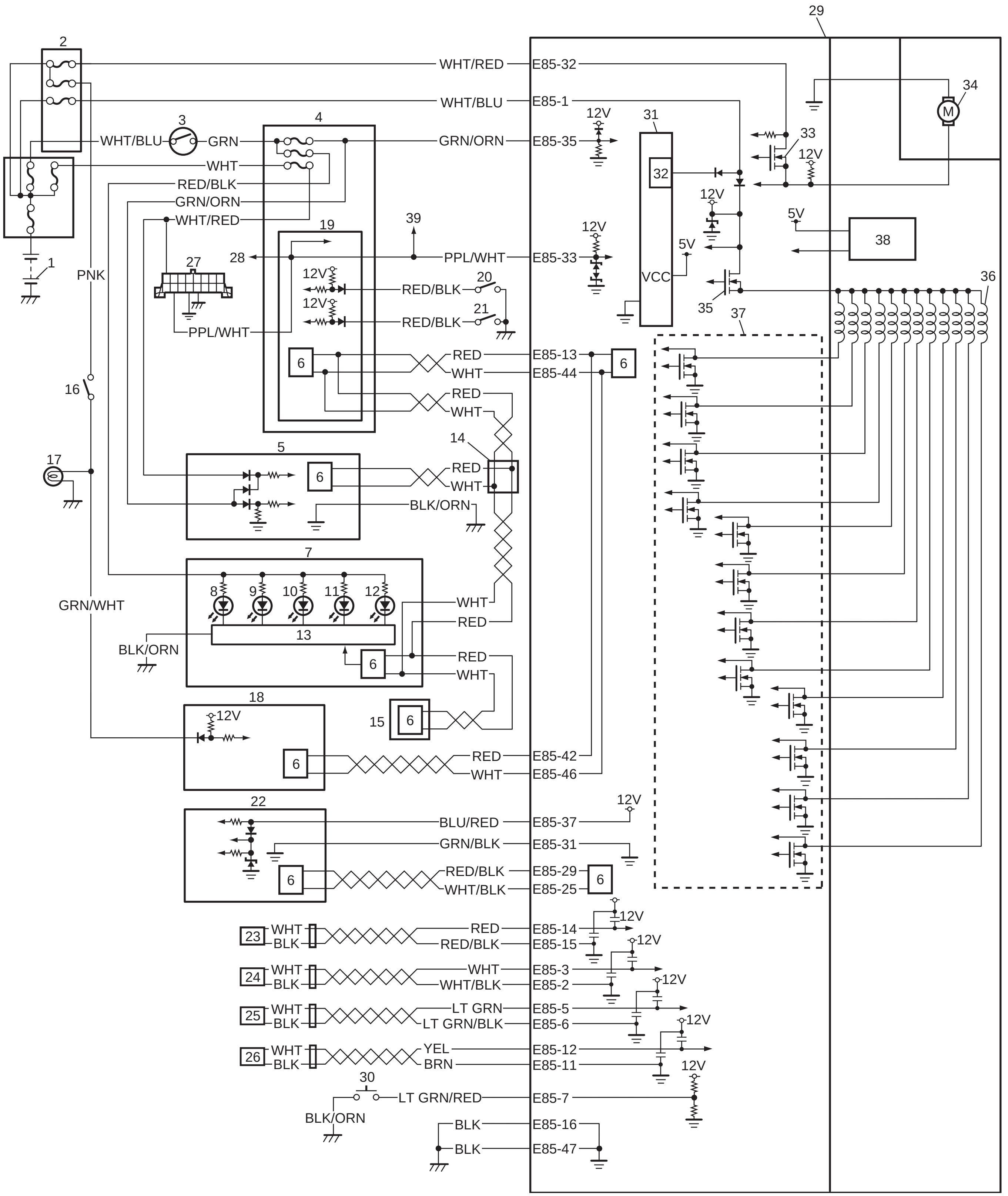
Electronic Stability Program Wiring Circuit Diagram

S7RS0B4602002

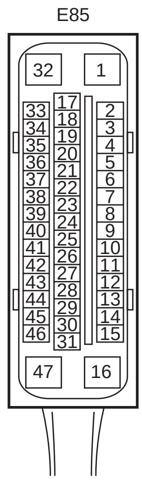


I7RS0B460007-02

1. Battery	14. Junction connector	27. DLC
2. Relay box	15. Keyless start control module	28. To SDM
3. Ignition switch	16. Stop lamp switch	29. ESP® hydraulic unit / control module
4. Junction block assembly	17. Stop lamp	30. “ESP OFF” switch
5. Steering angle sensor	18. ECM	31. Power control unit
6. CAN driver	19. BCM (included in junction block assembly)	32. Internal memory

7. Combination meter	20. Brake fluid level switch	33. Pump motor driver (transistor)
8. SLIP indicator lamp	21. Parking brake switch	34. Pump motor
9. ESP® OFF lamp	22. Yaw rate / G sensor assembly	35. Solenoid valve power supply driver (transistor)
10. ESP® warning lamp	23. Left-front wheel speed sensor	36. Solenoid valve
11. ABS warning lamp	24. Right-front wheel speed sensor	37. Solenoid valve driver (transistor)
12. EBD warning lamp (brake warning lamp)	25. Left-rear wheel speed sensor	38. Master cylinder pressure sensor
13. Lamp driver module	26. Right-rear wheel speed sensor	39. To ECM and P/S control module

Terminal Arrangement of ESP® Control Module Connector (Viewed from Terminal Side)



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Terminal	Circuit	Terminal	Circuit
E85-1	Solenoid valve power supply driver (transistor)	E85-25	CAN communication line (low) for yaw rate / G sensor assembly
E85-2	Right-front wheel speed sensor (–)	E85-26	—
E85-3	Right-front wheel speed sensor (+)	E85-27	—
E85-4	—	E85-28	—
E85-5	Left-rear wheel speed sensor (+)	E85-29	CAN communication line (high) for yaw rate / G sensor assembly
E85-6	Left-rear wheel speed sensor (–)	E85-30	—
E85-7	ESP® OFF switch input	E85-31	Ground for yaw rate / G sensor assembly
E85-8	—	E85-32	Pump motor driver (transistor)
E85-9	—	E85-33	Data link connector
E85-10	—	E85-34	—
E85-11	Right-rear wheel speed sensor (–)	E85-35	Ignition switch
E85-12	Right-rear wheel speed sensor (+)	E85-36	—
E85-13	CAN communication line (high)	E85-37	Power source for yaw rate / G sensor assembly
E85-14	Left-front wheel speed sensor (+)	E85-38	—
E85-15	Left-front wheel speed sensor (–)	E85-39	—
E85-16	Ground	E85-40	—
E85-17	—	E85-41	—
E85-18	—	E85-42	CAN communication line (high) for ECM
E85-19	—	E85-43	—
E85-20	—		CAN communication line (low)
E85-21	—	E85-45	—
E85-22	—	E85-46	CAN communication line (low) for ECM
E85-23	—	E85-47	Ground
E85-24	—		

Component Location

Electronic Stability Program Component Location

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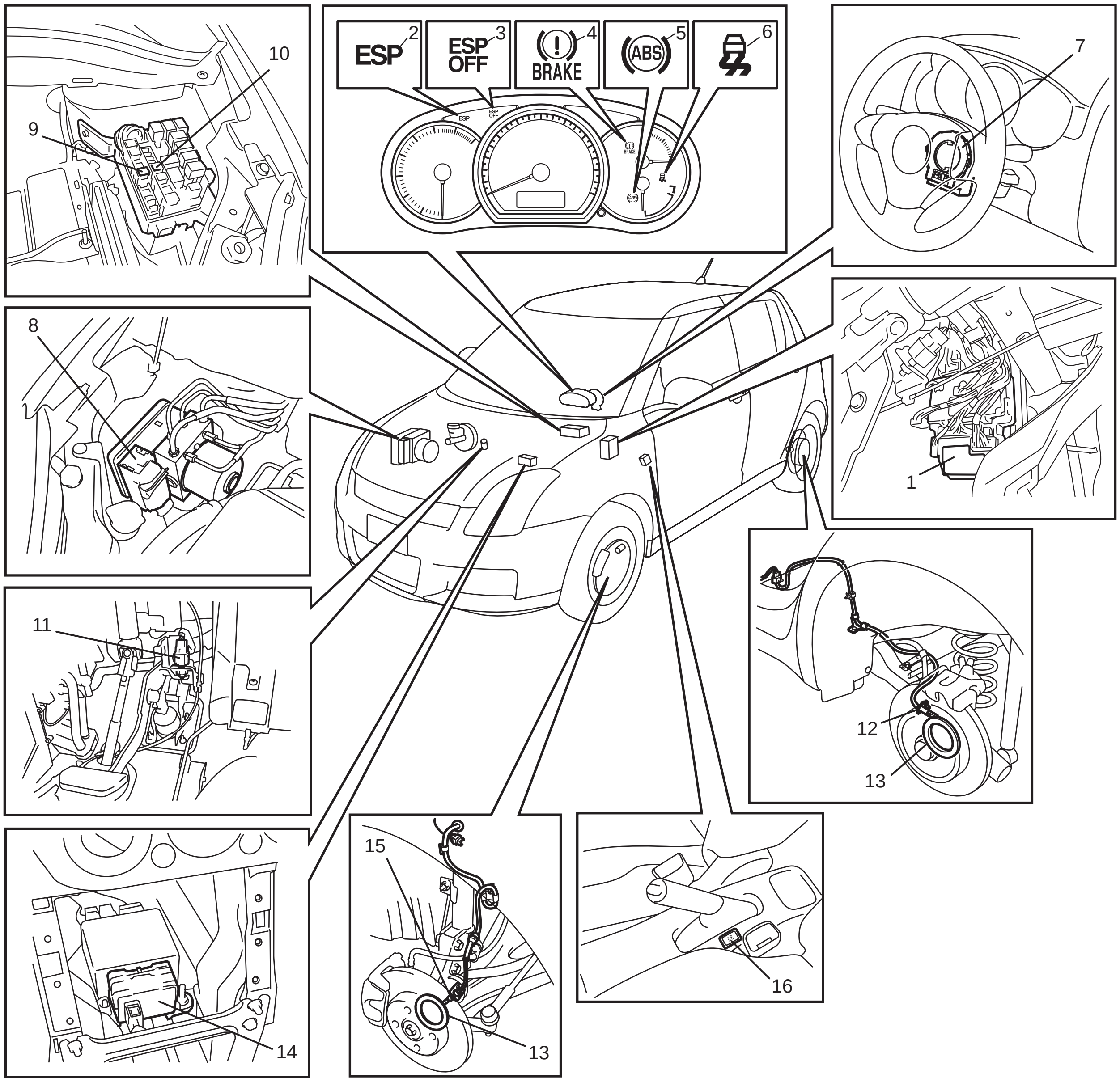


I7RS0B460008-02

1. ABS fuse	7. Steering angle sensor	13. Encoder
2. ESP® warning lamp	8. ESP® hydraulic unit / control module	14. Yaw rate / G sensor
3. ESP® OFF lamp	9. ABS motor fuse	15. Front wheel speed sensor
4. EBD warning lamp (brake warning lamp)	10. ABS solenoid fuse	16. ESP® OFF switch
5. ABS warning lamp	11. Stop lamp switch	
6. SLIP indicator lamp	12. Rear wheel speed sensor	

Diagnostic Information and Procedures

Electronic Stability Program System Check

S7RS0B4604001

Refer to the following items for the details of each step.

Step	Action	Yes	No
1	☞ **Malfunction analysis** 1) Perform “Customer complaint analysis: ”. 2) Perform “Problem symptom confirmation: ”. 3) Perform “DTC check, record and clearance: ” and recheck DTC. *Is there any malfunction DTC?*	Go to Step 4.	Go to Step 2.
2	☞ **Driving test** 1) Perform “Step 2: Driving Test: ”. *Is trouble symptom identified?*	Go to Step 3.	Go to Step 6.
3	☞ **DTC check** 1) Perform “DTC Check”. *Is it malfunction code?*	Go to Step 4.	Go to Step 5.
4	☞ **ESP® check** 1) Inspect and repair referring to applicable DTC flow. *Does trouble recur?*	Go to Step 5.	Go to Step 7.
5	☞ **Brakes diagnosis** 1) Inspect and repair referring to “Brakes Symptom Diagnosis in Section 4A”. *Does trouble recur?*	Go to Step 3.	Go to Step 7.
6	☞ **Intermittent problem check** 1) Check intermittent troubles referring to “Intermittent and Poor Connection Inspection in Section 00” and related circuit of trouble code recorded in Step 1. *Does trouble recur?*	Go to Step 4.	Go to Step 7.
7	☞ **Final confirmation test** 1) Perform “Step 7: Final Confirmation Test: ”. *Does trouble recur?*	Go to Step 3.	End.

Step 1: Malfunction Analysis

Customer complaint analysis

Record details of the problem (failure, complaint) and how it occurred as described by the customer.

For this purpose, use of such a questionnaire form as shown in the following will facilitate collecting information to the point required for proper analysis and diagnosis.

Customer questionnaire (Example)

Customer's name:	Model:	VIN:	
Date of issue:	Date of Reg:	Date of problem:	Mileage:

Problem Symptoms	• ESP® warning lamp abnormal: fails to turn on / fails to turn off • ABS warning lamp abnormal: fails to turn on / fails to turn off • EBD warning lamp abnormal: fails to turn on / fails to turn off • Abnormal noise while vehicle is running: from motor, from valve, other________ • Wheel is locked at braking: • Wheel is skidded at turning. • Pump motor does not stop (running): • Braking does not work: • Other:
Frequency of occurrence	• Continuous/Intermittent (times a day, a month)/ other________
Conditions for Occurrence of Problem	• Vehicle at stop & ignition switch ON: • When starting: at initial start only/at every start/Other________ • Vehicle speed: while accelerating/while decelerating/at stop/ while turning/while running at constant speed/ other________ • Road surface condition: Paved road/rough road/snow-covered road/ other________ • Chain equipment:
Environmental Condition	• Weather: fair/cloudy/rain/snow/other________ • Temperature: °F (°C)
Diagnostic Trouble Code	• First check: Normal code/malfunction code ( ) • Second check after test drive: Normal code/malfunction code ( )

I6JB01460011-02

Problem symptom confirmation

If symptom in “Customer Questionnaire” is found or reproduced in the vehicle, confirm the symptom is problem or not. (This step should be done with the customer if possible.) Check warning lamps related to brake system referring to “EBD Warning Lamp (Brake Warning Lamp) Check”, “ABS Warning Lamp Check” and “ESP® Warning lamp Check”.

DTC check, record and clearance

Perform “DTC Check” procedure, record it and then clear it referring to “DTC Clearance”.
Recheck DTC referring to “DTC Check”.
When DTC which is recorded at DTC check procedure is detected again after performing DTC clearance, go to “Step 4: ESP® Check: ” to proceed the diagnosis.
When DTC which is recorded at DTC check procedure is not indicated anymore after performing DTC clearance, ESP® control module does not perform the system diagnosis, or temporary abnormality may occur, therefore go to “Step 2: Driving Test: ” to proceed the diagnosis.

Step 2: Driving Test
Test the vehicle at 40 km/h for more than a minute including left and right turns and check if any trouble symptom (such as ESP® warning lamp and/or ABS warning lamp) exists.
If the malfunction DTC is confirmed at ignition switch ON, proceed to Step 3.
If the malfunction DTC is not confirmed at ignition switch ON, proceed to Step 6.

Step 3: DTC Check
Recheck DTC referring to "DTC Check".

Step 4: ESP® Check
According to ESP® Check for the DTC confirmation in Step 3, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator assembly or other part and repair or replace faulty parts.

Step 5: Brakes Diagnosis
Check the parts or system suspected as a possible cause referring to "Brakes Symptom Diagnosis in Section 4A" and based on symptoms appearing on the vehicle (symptom obtained through Steps 1 and 2 and repair or replace faulty parts, if any).

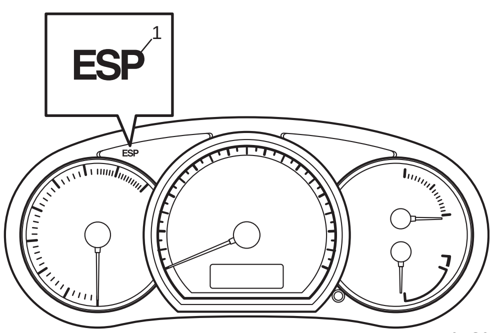
Step 6: Intermittent Problem Check
Check parts where an intermittent trouble is easy to occur (e.g., wire harness, connector, etc.), referring to "Intermittent and Poor Connection Inspection in Section 00" and related circuit of trouble code recorded in Step 1 to 3.

Step 7: Final Confirmation Test
Confirm that the problem symptom has gone and the ESP® is free from any abnormal conditions. If what has been repaired is related to the malfunction DTC, clear the DTC once referring to "DTC Clearance" and perform test driving and confirm that no DTC is indicated.

ESP® Warning lamp Check

S7RS0B4604022

1) Turn ignition switch ON.
2) Check that ESP® warning lamp (1) comes ON for about 2 seconds and then goes off.
   If any faulty condition is found, advance to "ESP® Warning Lamp Does Not Come ON at Ignition Switch ON" or "ESP® Warning Lamp Comes ON Steady".



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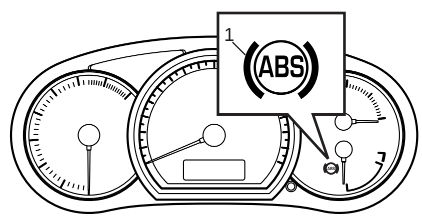
ABS Warning Lamp Check

S7RS0B4604046

1) Turn ignition switch ON.
2) Check that ABS warning lamp (1) comes ON for about 2 seconds and then goes off.
   If any faulty condition is found, advance to "ABS Warning Lamp Does Not Come ON at Ignition Switch ON" or "ABS Warning Lamp Comes ON Steady".



I4RS0A450007-01

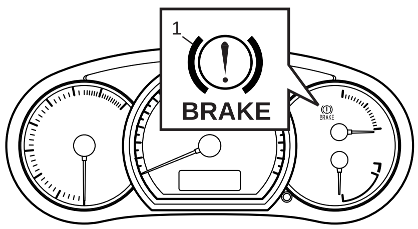
EBD Warning Lamp (Brake Warning Lamp) Check

S7RS0B4604047

NOTE

Perform this check on a level place.

1) Turn ignition switch ON with parking brake applied.
2) Check that EBD warning lamp (brake warning lamp) (1) is turned ON.
3) Release parking brake with ignition switch ON and check that EBD warning lamp (brake warning lamp) goes off.
   If it doesn't go off, go to "EBD Warning Lamp (Brake Warning Lamp) Comes ON Steady".



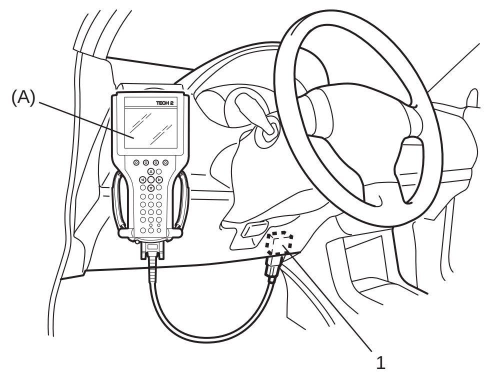
I4RS0A450008-01

DTC Check

S7RS0B4604004

1) Turn ignition switch to OFF position.
2) Connect SUZUKI scan tool to data link connector (1).

   Special tool
   (A): SUZUKI scan tool



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3) Turn ignition switch to ON position.
4) Read DTC according to instructions displayed on SUZUKI scan tool and print it or write it down. Refer to SUZUKI scan tool operator's manual for further details.

   NOTE

   If SUZUKI scan tool can not communicate ESP® control module, perform "Serial Data Link Circuit Check".

5) After completing the check, turn ignition switch off and disconnect SUZUKI scan tool from DLC.

DTC Table

S7RS0B4604005

⚠ CAUTION

Be sure to perform "Electronic Stability Program System Check" before starting diagnosis.

DTC (displayed on SUZUKI scan tool)	Diagnostic Items	Detecting condition (DTC will beset when detecting)	ABS warning lamp	EBD warning lamp	ESP® warning lamp
NO DTC	Normal	—	—	—	—
☞ C1016	Stop lamp switch failure	Vehicle behavior and stop lamp switch signal is disagreed for specified time.	—	—	—
☞ C1017	Lateral G sensor range / performance	Lateral G sensor signal is out of specified range.	—	—	○
☞ C1018	Brake fluid level switch failure	• Brake fluid level is too low. • Input signal of brake fluid level switch to BCM is low level.	—	—	○
☞ C1020	Master cylinder pressure sensor power supply failure	Power supply voltage to master cylinder pressure sensor in ESP® hydraulic unit / control module assembly is out of specification.	—	—	○
☞ C1021	Right-front wheel speed sensor circuit failure	Wheel sensor signal is out of specified range.	○	*1	○

DTC (displayed on SUZUKI scan tool)	Diagnostic Items	Detecting condition (DTC will beset when detecting)	ABS warning lamp	EBD warning lamp	ESP® warning lamp
☞ C1022	Right-front wheel speed sensor or encoder failure	Abnormal wheel speed sensor signal is detected.	○	*1	○
☞ C1023	Yaw rate sensor failure	• Yaw rate sensor signal is out of range. • Vehicle behavior and yaw rate signal is disagreed.	—	—	○
☞ C1024	Steering angle sensor circuit failure	• Steering angle sensor internal defect is detected by CPU in steering angle sensor. • Steering angle sensor signal is out of specified range.	—	—	○
☞ C1025	Left-front wheel speed sensor circuit failure	Wheel sensor signal is out of specified range.	○	*1	○
☞ C1026	Left-front wheel speed sensor or encoder failure	Abnormal wheel speed sensor signal is detected.	○	*1	○
☞ C1027	ESP® OFF switch circuit failure	Mechanical switch failure, failure in switch wiring is shorted to ground.	—	—	—
☞ C1028	Master cylinder pressure sensor circuit failure	Input signal voltage from master cylinder pressure sensor in ESP® control module is too high or low.	—	—	○
☞ C1031	Right-rear wheel speed sensor circuit failure	Wheel sensor signal is out of specified range.	○	*1	○
☞ C1032	Right-rear wheel speed sensor or encoder failure	Abnormal wheel speed sensor signal is detected.	○	*1	○
☞ C1034	Yaw rate / G sensor assembly power supply failure	Power supply voltage of yaw rate / G sensor assembly is too high when ignition switch OFF. Power supply voltage of yaw rate / G sensor assembly is too low when ignition switch ON.	—	—	○
☞ C1035	Left-rear wheel speed sensor circuit failure	Wheel sensor signal is out of specified range.	○	*1	○
☞ C1036	Left-rear wheel speed sensor or encoder failure	Abnormal wheel speed sensor signal is detected.	○	*1	○
☞ C1037	Steering angle sensor power supply failure	Power supply voltage to steering angle sensor is too low.	—	—	○
☞ C1038	Steering angle sensor detect rolling counter failure from ESP® control module	ESP® control module rolling counter failure is detected by steering angle sensor.	—	—	○
☞ C1039	Yaw rate / G sensor assembly internal failure	Yaw rate / G sensor assembly internal failure is detected.	—	—	○
☞ C1040	Stability control system function failure	Stability control is active for more than specified time without yaw rate change.	—	—	○

DTC (displayed on SUZUKI scan tool)	Diagnostic Items	Detecting condition (DTC will beset when detecting)	ABS warning lamp	EBD warning lamp	ESP® warning lamp
☞ C1041	Right-front inlet solenoid valve circuit failure	Mismatching solenoid output and solenoid monitor is detected.	○	○	○
☞ C1042	Right-front outlet solenoid valve circuit failure		○	○	○
☞ C1043	Master cylinder cut solenoid valve circuit No.1 failure		○	○	○
☞ C1044	Master cylinder cut solenoid valve circuit No.2 failure		○	○	○
☞ C1045	Left-front inlet solenoid valve circuit failure		○	○	○
☞ C1046	Left-front outlet solenoid valve circuit failure		○	○	○
☞ C1051	Right-rear inlet solenoid valve circuit failure		○	○	○
☞ C1052	Right-rear outlet solenoid valve circuit failure		○	○	○
☞ C1053	Low pressure solenoid valve circuit No.1 failure		○	○	○
☞ C1054	Low pressure solenoid valve circuit No.2 failure		○	○	○
☞ C1055	Left-rear inlet solenoid valve circuit failure		○	○	○
☞ C1056	Left-rear outlet solenoid valve circuit failure		○	○	○
☞ C1057 *2	ESP® control module power supply circuit failure	ESP® control module power supply voltage is too high.	○	○	○
		ESP® control module power supply voltage is too low.	○	*4	○
☞ C1061	Pump motor and/or motor circuit failure	Defective pump motor and/or motor power supply voltage is too low.	○	—	○
☞ C1063	Solenoid valve power supply driver circuit failure	Mismatching solenoid output and solenoid monitor is detected.	○	○	○
☞ C1071	ESP® control module internal defect	ESP® control module internal defect is detected.	○	○	○
☞ C1073	Lost communication with yaw rate / G sensor assembly	CAN line communication error in ESP® control module and yaw rate / G sensor assembly is detected.	—	—	○
☞ C1075	Steering angle sensor calibration incomplete *3	Missing steering angle sensor calibration point data is detected.	—	—	○
☞ C1076	Master cylinder pressure sensor calibration incomplete	Master cylinder pressure sensor calibration is incompleted.	—	—	○
☞ C1078	Lateral G sensor in yaw rate / G sensor assembly calibration incomplete	Lateral G sensor in yaw rate / G sensor assembly calibration is incompleted.	—	—	○
☞ C1090	Invalid communication with ECM	ESP® control module rolling counter failure is detected by ECM.	—	—	○
☞ C1091	ECM data in CAN line failure	ECM sent invalid signal to ESP® control module.	—	—	○
☞ C1094	Invalid torque control communication with ECM	Reception error of torque control signal with ECM	—	—	○
☞ U1073	Control module communication bus off	Transmission error that is inconsistent between transmission data and transmission monitor (CAN bus monitor) data is detected more than 7 times continuously.	—	—	○

DTC (displayed on SUZUKI scan tool)	Diagnostic Items	Detecting condition (DTC will beset when detecting)	ABS warning lamp	EBD warning lamp	ESP® warning lamp
☞ U1100	Lost communication with ECM (reception error)	ECM message data is missing from CAN communication.	—	—	○
☞ U1126	Lost communication with steering angle sensor (reception error)	Steering angle sensor message data is missing from CAN communication.	—	—	○
☞ U1140	Lost communication with BCM (reception error)	BCM message data is missing from CAN communication.	—	—	○

NOTE

- **"○" in ABS warning lamp, EBD warning lamp and ESP® warning lamp column of the above table means warning lamp is lit when DTC is detected.**
- ***1: If two or more wheel speed sensor are defective, ABS warning lamp, EBD warning lamp and ESP® warning lamp are lit and all the control functions are deactivated. If one wheel speed sensor is defective, ABS warning lamp and ESP® warning lamp are lit and ABS and TCS / stability control are deactivated.**
- ***2: SLIP indicator lamp and ESP® OFF lamp turn ON when power supply circuit voltage is low.**
- ***3: SLIP indicator lamp flashes continuously at Intervals of 1 Hz.**
- ***4: EBD warning lamp is lit when power supply circuit voltage is too low.**

DTC Clearance

S7RS0B4604006

⚠ WARNING

When performing a driving test, select a safe place where there is neither any traffic nor any traffic accident possibility and be very careful during testing to avoid occurrence of an accident.

1) Connect SUZUKI scan tool to data link connector in the same manner as when making this connection for DTC check.
2) Turn ignition switch to ON position.
3) Erase DTC according to instructions displayed on scan tool. Refer to scan tool operator's manual for further derails.
4) After completing the clearance, turn ignition switch OFF and disconnect scan tool from data link connector.
5) Perform "Driving Test" (Step 2 of "Electronic Stability Program System Check") and "DTC Check" and confirm that NO DTC is displayed on scan tool.

Fail-Safe Table

S7RS0B4604023

When any of the following DTC(s) is detected, ESP® system is in fail-safe mode per its DTC and ABS, EBD and/or TCS / stability functions are deactivated until the resolution is applied.

DTC No.	Fail-safe operation			Fail-safe condition resolutive
	ABS	EBD	TCS/stability	
☞ C1016	○	○	○	—
☞ C1017	○	○	—	When ESP® control module detects the system as normal, after ignition switch turned OFF to ON.
☞ C1018	○	○	—	
☞ C1020	○	○	—	
☞ C1021	—	*1	—	When estimated vehicle speed exceeds 10 km/h (6.5 mile/h) and detects system as normal.
☞ C1022	—	*1	—	
☞ C1023	○	○	—	When ESP® control module detects the system as normal, after ignition switch turned OFF to ON.
☞ C1024	○	○	—	
☞ C1025	—	*1	—	When estimated vehicle speed exceeds 10 km/h (6.5 mile/h) and detects system as normal.
☞ C1026	—	*1	—	
☞ C1027 *2	○	○	○	—
☞ C1028	○	○	—	When ESP® control module detects the system as normal, after ignition switch turned OFF to ON.
☞ C1031	—	*1	—	When estimated vehicle speed exceeds 10 km/h (6.5 mile/h) and detects system as normal.
☞ C1032	—	*1	—	
☞ C1034	○	○	—	When ESP® control module detects the system as normal, after ignition switch turned OFF to ON.
☞ C1035	—	*1	—	When estimated vehicle speed exceeds 10 km/h (6.5 mile/h) and detects system as normal.
☞ C1036	—	*1	—	
☞ C1037	○	○	—	—
☞ C1038	○	○	—	When ESP® control module detects the system as normal, after ignition switch turned OFF to ON.
☞ C1039	○	○	—	
☞ C1040	○	○	—	
☞ C1041	—	—	—	
☞ C1042	—	—	—	
☞ C1043	—	—	—	
☞ C1044	—	—	—	
☞ C1045	—	—	—	
☞ C1046	—	—	—	
☞ C1051	—	—	—	
☞ C1052	—	—	—	
☞ C1053	—	—	—	
☞ C1054	—	—	—	
☞ C1055	—	—	—	
☞ C1056	—	—	—	
☞ C1057	—	*3	—	
☞ C1061	—	○	—	When estimated vehicle speed exceeds 10 km/h (6.5 mile/h) and detects system as normal.
☞ C1063	—	—	—	When ESP® control module detects the system as normal, after ignition switch turned OFF to ON.
☞ C1071	—	—	—	
☞ C1073	○	○	—	
☞ C1075	○	○	—	Steering angle sensor calibration completed.
☞ C1076	○	○	—	Master cylinder pressure sensor calibration completed.
☞ C1078	○	○	—	Yaw rate / G sensor assembly calibration completed.
☞ C1090	○	○	—	When ESP® control module detects the system as normal, after ignition switch turned OFF to ON.
☞ C1091	○	○	—	
☞ C1094	○	○	—	
☞ U1073	○	○	—	
☞ U1100	○	○	—	
☞ U1126	○	○	—	
☞ U1140	○	○	—	

NOTE

- **○: Activated**
- **X: Deactivated**
- ***1: If two or more wheel speed sensor are defective, ABS warning lamp, EBD warning lamp and ESP® warning lamp are lit and all the control functions are deactivated. If one wheel speed sensor is defective, ABS warning lamp and ESP® warning lamp are lit and ABS and TCS / stability control are deactivated.**
- ***2: ESP® OFF mode is cancelled and all control functions are activated.**
- ***3: EBD control function is activated only if power supply circuit is little low voltage malfunction.**

Scan Tool Data

S7RS0B4604024

The parameter data below are values measured with the scan tool when the normally operating vehicle is under the following conditions. When taking measurements for comparison by using the scan tool, be sure to check that the vehicle is under the following conditions.

- Apply parking brake and block wheels.
- Ignition switch ON.
- Turn OFF air conditioning (if equipped).
- Set the wheel in straight-ahead position and hands off steering wheel.
- Turn OFF all electric loads (except ignition).
- Check that there is no DTC.

Scan Tool Data	Standards	Condition
Battery Voltage	10.0 – 16.0 V	—
Pump Motor Driver	0.0 V	—
RF Wheel Speed	0 km/h, 0.0 MPH	Vehicle is in stationary condition.
LF Wheel Speed	0 km/h, 0.0 MPH	Vehicle is in stationary condition.
RR Wheel Speed	0 km/h, 0.0 MPH	Vehicle is in stationary condition.
LR Wheel Speed	0 km/h, 0.0 MPH	Vehicle is in stationary condition.
Brake Switch	ON	Brake pedal is depressed
	OFF	Brake pedal is released
Master Cyl Press	0 ± 0.8 MPa	Brake pedal is released
G Sensor (lateral)	0 ± 0.1 G	Vehicle is on the level
Yaw rate sensor	0 ± 4 deg/s	Vehicle is on the level
Steering angle Sen	0 ± 3°	Front wheels are in straight-ahead position
Stability control	INACTIVE	Stability control system is not working
TCS control (brake)	INACTIVE	Brake function by TCS is not working
TCS control (engine)	INACTIVE	Torque control by TCS is not working
ESP® off state (cont)	ESP® ON	ESP® OFF switch is OFF condition
	ESP® OFF	ESP® OFF switch is ON condition
Steering angle Sen	Neutral	Front wheels are in straight-ahead position

Scan Tool Data Definition

Battery Volt (V): Battery Voltage is an analog input signal read by the ESP® control module. Certain ESP® control module functions will be modified if the battery voltage falls below or rises above programmed thresholds.

Pump Motor Driver (V): This parameter indicates the operational condition of the pump motor driver (transistor).

RF Wheel Speed, LF Wheel Speed, RR Wheel Speed and LR Wheel Speed (km/h, MPH): Wheel speed is ESP® control module internal parameter. It is computed by reference pulses from the wheel speed sensor.

Brake Switch (ON, OFF): This switch signal informs the ESP® control module whether the brake is active or not.

Master Cyl Press (MPa): Brake fluid pressure from brake master cylinder.

G Sensor (lateral) (G): Lateral acceleration is measured by yaw rate / G sensor assembly and output to ESP® control module by pulse signal.

Yaw rate sensor (Deg/s): Yaw rate sensor is measured by yaw rate / G sensor assembly and output to ESP® control module by pulse signal.

Steering angle Sen (°): Steering wheel rotation angle is measured by steering angle sensor and output to ESP® control module by pulse signal.

Stability control (ACTIVE, INACTIVE): This indicates stability control in activation / deactivation.

TCS control (brake) (ACTIVE, INACTIVE): This indicates brake function of TCS in activation / deactivation.

TCS control (engine) (ACTIVE, INACTIVE): This indicates torque control of TCS in activation / deactivation.

ESP® off state (cont) (ESP® ON, ESP® OFF): State of ESP® OFF switch.

Steering angle Sen (Neutral, NON newtral): This indicates steering wheel angle measured by steering angle sensor is in straight-ahead or not.

Visual Inspection

S7RS0B4604059

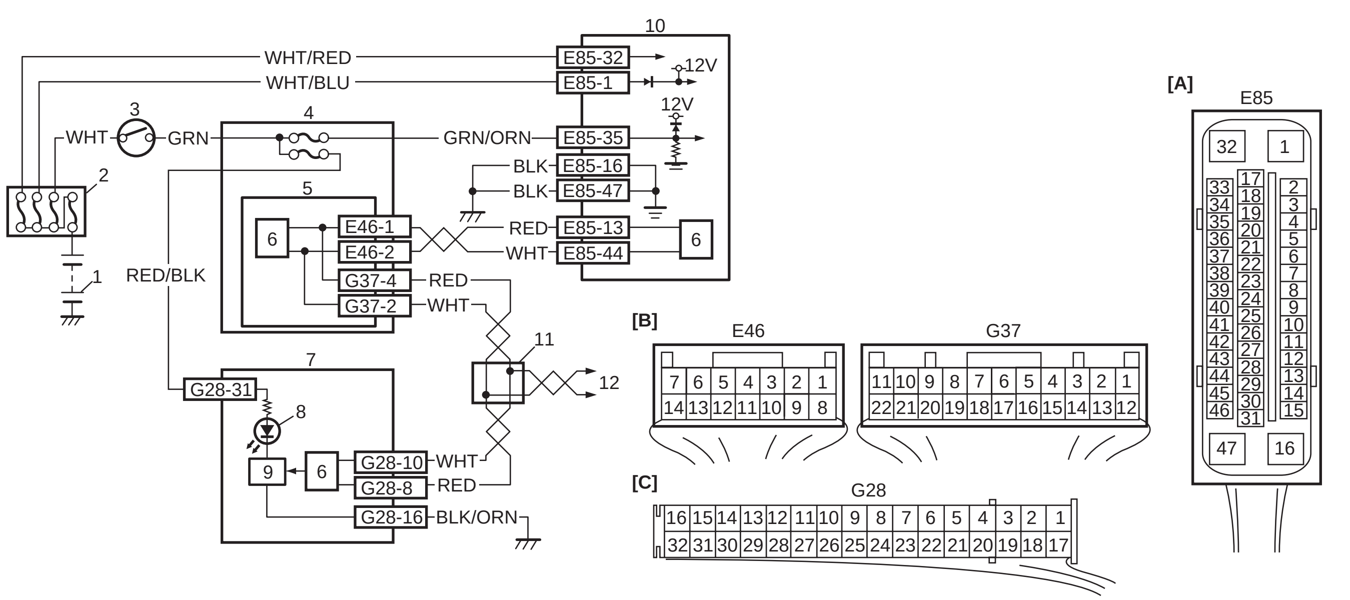
Check the following parts and systems visually.

Inspection Item		Referring section
Battery	Level, leakage	"Battery Description in Section 1J"
Connectors of electric wire harness	Disconnection, friction	"Intermittent and Poor Connection Inspection in Section 00"
Fuses	Burning	
Brake fluid	Level, leakage	"Brake Fluid Level Inspection in Section 4A"
Other parts that can be checked visually		

ESP® Warning Lamp Does Not Come ON at Ignition Switch ON

S7RS0B4604008

Wiring Diagram



I6RS0B460010-01

[A]:	ESP® control module connector (viewed from terminal side)	3.	Ignition switch	8.	ESP® warning lamp
[B]:	BCM connector (viewed from harness side)	4.	Junction block assembly	9.	Lamp driver module
[C]:	Combination meter connector (viewed from harness side)	5.	BCM (included in junction block assembly)	10.	ESP® hydraulic unit / control module assembly
1.	Battery	6.	CAN driver	11.	Junction connector
2.	Main fuse box	7.	Combination meter	12.	To steering angle sensor

Circuit Description

Operation (ON/OFF) of ESP® warning lamp is controlled by ESP® control module through lamp driver module in combination meter.

If ESP® system is in good condition, ESP® control module turns ESP® warning lamp ON at the ignition switch ON, keeps it ON for 2 seconds and then turns it OFF. If an abnormality in the system is detected, ESP® warning lamp is turned ON continuously by ESP® control module. Also, it is turned ON continuously by lamp driver module when the connector of ESP® control module is disconnected.

Troubleshooting

Step	Action	Yes	No
1	**Check warning lamp** 1) Turn ignition switch to ON position. *Do other warning lamps come ON?*	Substitute a known-good combination meter and recheck. If ESP® warning lamp remains OFF, substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	Go to Step 2.
2	**Check fuse** *Is Circuit fuse for combination meter in good condition?*	Go to Step 3.	Replace fuse and check for short circuit to ground.
3	**Check combination meter power supply circuit** 1) Remove combination meter with ignition switch turned OFF. 2) Check for proper connection to combination meter connector terminal at “G28-31” and “G28-16”. 3) If OK, turn ON ignition switch and measure voltage between connector terminal “G28-31” and vehicle body ground. *Is it 10 – 14 V?*	Go to Step 4.	Repair power supply circuit for combination meter.
4	**Check combination meter ground circuit** 1) Measure resistance between connector terminal “G28-16” and vehicle body ground. *Is resistance less than 2 Ω?*	Replace combination meter.	“BLK/ORN” circuit open or high resistance.

ESP® Warning Lamp Comes ON Steady

S7RS0B4604009

Wiring Diagram

Refer to “Wiring Diagram” under “ESP® Warning Lamp Does Not Come ON at Ignition Switch ON”.

Circuit Description

Refer to “Circuit Description” under “ESP® Warning Lamp Does Not Come ON at Ignition Switch ON”.

Troubleshooting

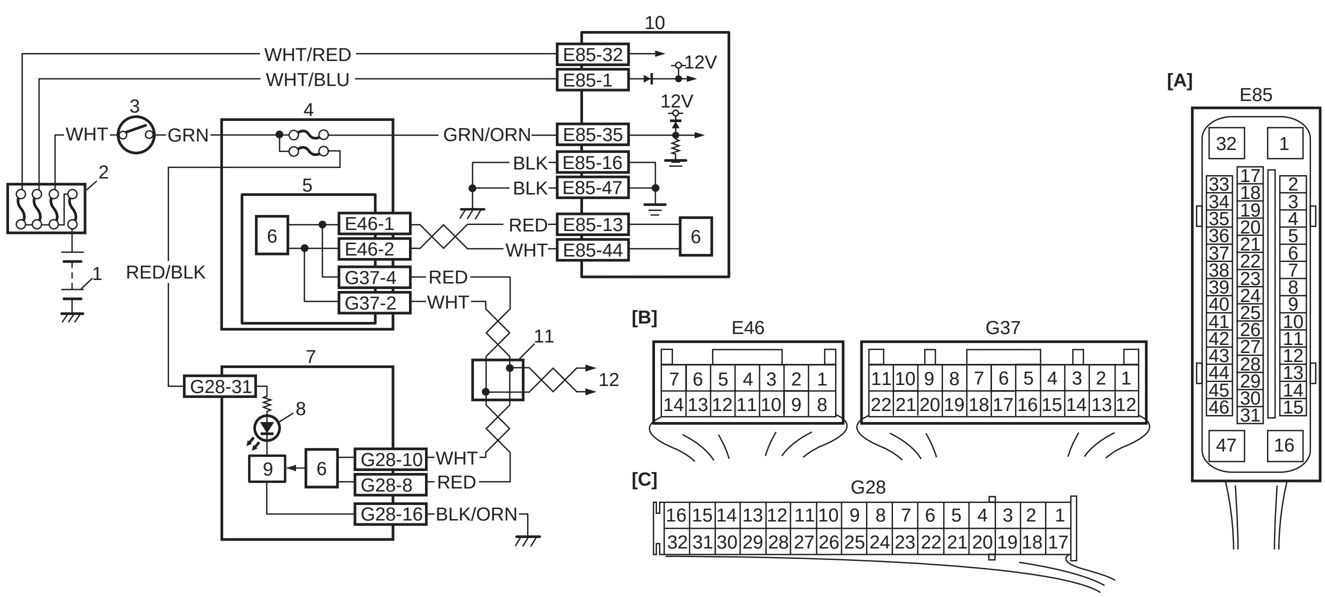
Step	Action	Yes	No
1	**DTC Check for ESP®** 1) Perform diagnostic trouble code check. *Is there any DTC(s)?*	Go to applicable DTC diag. flow.	Go to Step 2.
2	**Check fuse** *Are main fuses for good condition?*	Go to Step 3.	Replace fuse and check circuit for short to ground.
3	**Check ESP® control module power supply circuit** 1) Turn ignition switch to OFF. 2) Disconnect ESP® control module connector. 3) Check for proper connection to ESP® control module connector at terminals “E85-35”, “E85-16” and “E85-47”. 4) If OK, then turn ignition switch to ON position and measure voltage between terminal “E85-35” and vehicle body ground. *Is it 10 – 14 V?*	Go to Step 4.	“GRN/ORN” circuit open.

Step	Action	Yes	No
4	**Check ESP® control module power supply circuit** 1) Turn ignition switch to OFF position. 2) Check for proper connection to ESP® control module connector at terminals “E85-1” and “E85-32”. 3) If OK, then turn ignition switch to ON position and measure voltage between each terminal of “E85-1”, “E85-32” and vehicle body ground. *Are they 10 – 14 V?*	Go to Step 5.	“WHT/BLU” and/or “WHT/RED” circuit open.
5	**Check ESP® control module ground circuit** 1) Turn ignition switch to OFF and measure resistance between each terminal of “E85-16”, “E85-47” and vehicle body ground. *Is resistance less than 2 Ω?*	Go to Step 6.	Ground circuit for ESP® control module open or high resistance.
6	**CAN communication circuit check** 1) Check CAN communication circuit between combination meter and ESP® control module referring to “DTC U1073: Control Module Communication Bus Off”. *Is CAN communication circuit in good condition?*	Substitute a known-good combination meter and recheck. If warning lamp remains ON, substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	Repair or replace.

ABS Warning Lamp Does Not Come ON at Ignition Switch ON

S7RS0B4604048

Wiring Diagram



I6RS0B460010-01

[A]:	ESP® control module connector (viewed from terminal side)	3.	Ignition switch	8.	ABS warning lamp
[B]:	BCM connector (viewed from harness side)	4.	Junction block assembly	9.	Lamp driver module
[C]:	Combination meter connector (viewed from harness side)	5.	BCM (included in junction block assembly)	10.	ESP® hydraulic unit / control module assembly
1.	Battery	6.	CAN driver	11.	Junction connector
2.	Main fuse box	7.	Combination meter	12.	To steering angle sensor

Circuit Description

Operation (ON/OFF) of ABS warning lamp is controlled by ESP® control module through lamp driver module in combination meter.

If antilock brake system is in good condition, ESP® control module turns ABS warning lamp ON at the ignition switch ON, keeps it ON for 2 seconds and then turns it OFF. If an abnormality in the system is detected, ABS warning lamp is turned ON continuously by ESP® control module. Also, it is turned ON continuously by lamp driver module when the connector of ESP® control module is disconnected.

Troubleshooting

Refer to "Troubleshooting" under "ESP® Warning Lamp Does Not Come ON at Ignition Switch ON".

ABS Warning Lamp Comes ON Steady

S7RS0B4604049

Wiring Diagram

Refer to "Wiring Diagram" under "ABS Warning Lamp Does Not Come ON at Ignition Switch ON".

Circuit Description

Refer to "Circuit Description" under "ABS Warning Lamp Does Not Come ON at Ignition Switch ON".

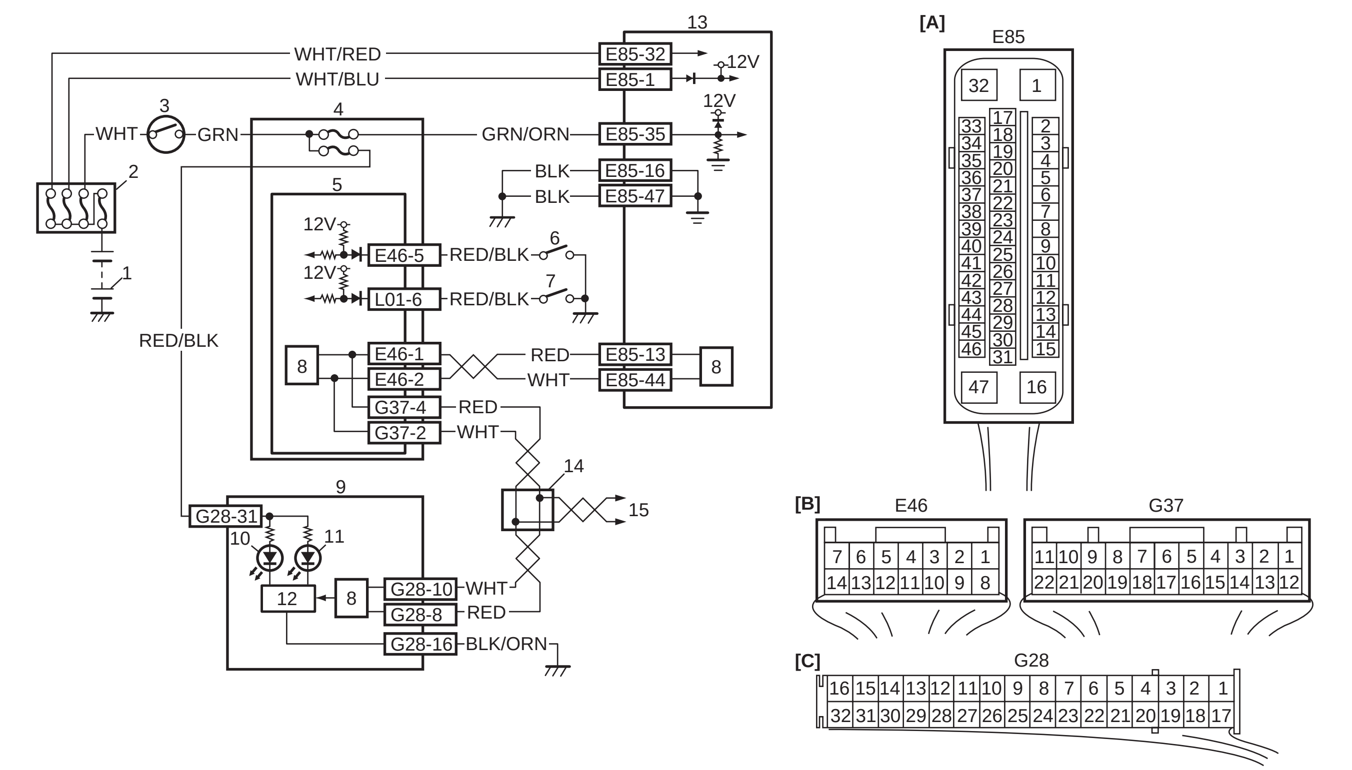
Troubleshooting

Refer to "Troubleshooting" under "ESP® Warning Lamp Comes ON Steady".

EBD Warning Lamp (Brake Warning Lamp) Comes ON Steady

S7RS0B4604050

Wiring Diagram



I6RS0B460011-01

[A]:	ESP® control module connector (viewed from terminal side)	4.	Junction block assembly	10.	EBD warning lamp (brake warning lamp)
[B]:	BCM connector (viewed from harness side)	5.	BCM (included in junction block assembly)	11.	ABS warning lamp
[C]:	Combination meter connector (viewed from harness side)	6.	Brake fluid level switch	12.	Lamp driver module
1.	Battery	7.	Parking brake switch	13.	ESP® hydraulic unit / control module assembly
2.	Main fuse box	8.	CAN driver	14.	Junction connector
3.	Ignition switch	9.	Combination meter	15.	To steering angle sensor

Circuit Description

EBD warning lamp (brake warning lamp) is controlled by ESP® control module and BCM through lamp driver module in combination meter.

If EBD system is in good condition, ESP® control module turns EBD warning lamp ON at the ignition switch ON, keeps it ON for 2 seconds and then turns it OFF.

EBD warning lamp is turned ON continuously at the following conditions.

- EBD system is an abnormality
- Connector of ESP® control module is disconnected
- Parking brake switch is ON
- Brake fluid level is lower than minimum level

The information of parking brake switch and brake fluid level are transmitted from BCM to lamp driver module in combination meter through CAN communication line.

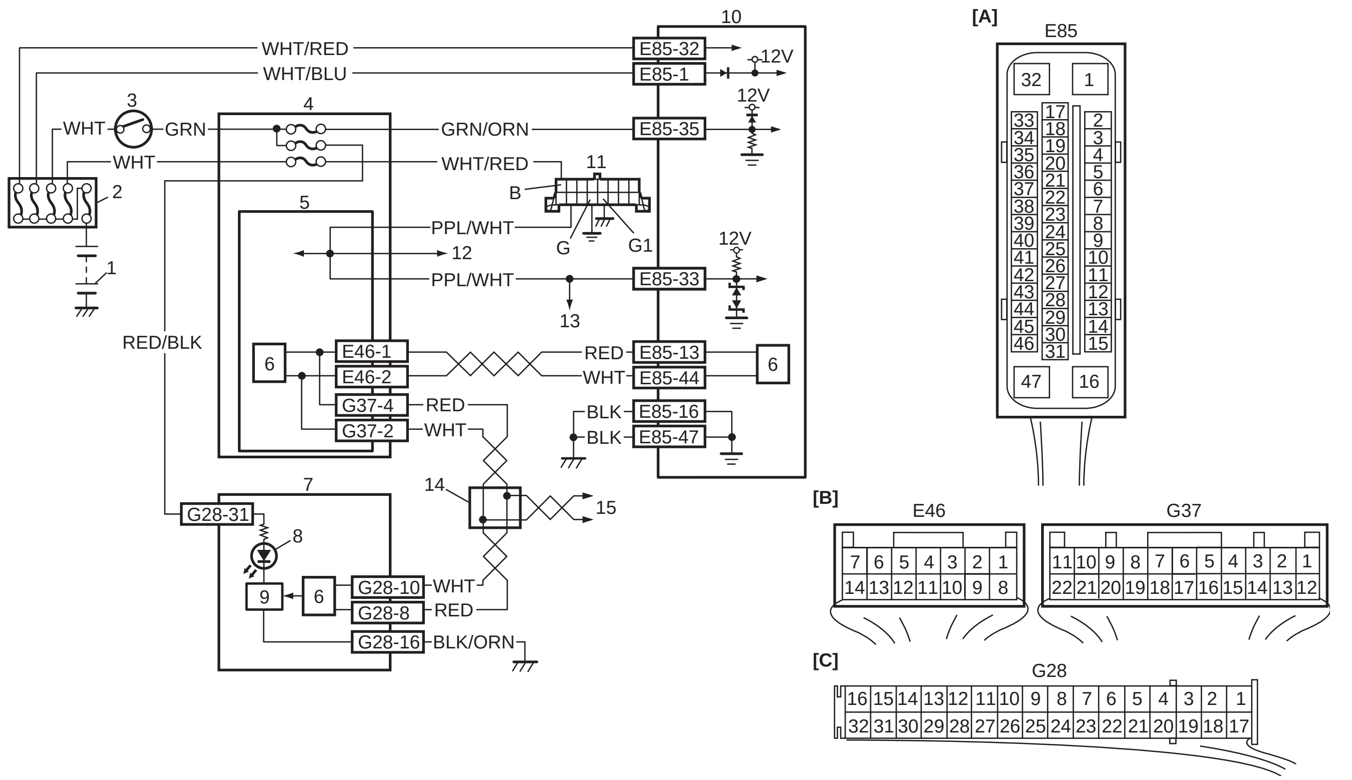
Troubleshooting

Step	Action	Yes	No
1	**Check parking brake and brake fluid level** 1) Make sure that: • Parking brake is completely released. • Brake fluid level is upper than the minimum level. *Are the check results OK?*	Go to Step 2.	Release parking brake completely and/or replenish brake fluid.
2	**Check ABS warning lamp** 1) Turn ignition switch to ON position. *Does ABS warning lamp come on steady?*	Perform “ABS Warning Lamp Does Not Come ON at Ignition Switch ON” previously outlined.	Go to Step 3.
3	**Check parking brake switch circuit and brake fluid level switch circuit** 1) Release parking brake completely, and replenish brake fluid. 2) Disconnect BCM connectors with ignition switch turned OFF. 3) Measure resistance between each terminal of “L01-6”, “E46-5” and vehicle body ground. *Are resistance ∞ Ω?*	Go to Step 4.	Check each applicable circuit for short to vehicle body ground. If OK, then check parking brake switch and/or brake fluid level switch.
4	**CAN communication circuit check** 1) CAN communication circuit between combination meter, ABS (ESP®) control module and BCM referring to “DTC U1073: Control Module Communication Bus Off”. *Is CAN communication circuit in good condition?*	Substitute a known-good combination meter and recheck. If EBD warning lamp remains ON, substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	Repair or replace.

Serial Data Link Circuit Check

S7RS0B4604012

Wiring Diagram



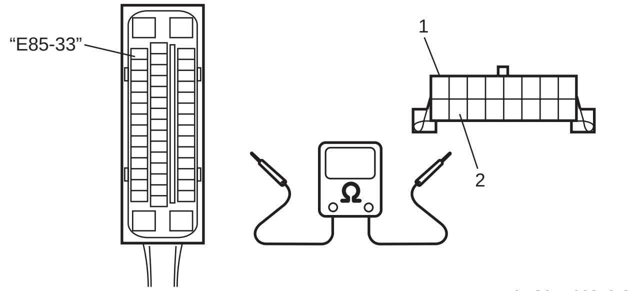
I6RS0B460012-01

[A]:	ESP® control module connector (viewed from terminal side)	4.	Junction block assembly	10.	ESP® hydraulic unit / control module assembly
[B]:	BCM connector (viewed from harness side)	5.	BCM (included in junction block assembly)	11.	Data link connector (DLC)
[C]:	Combination meter connector (viewed from harness side)	6.	CAN driver	12.	To SDM
1.	Battery	7.	Combination meter	13.	To ECM and P/S control module
2.	Main fuse box	8.	ESP® warning lamp	14.	Junction connector
3.	Ignition switch	9.	Lamp driver module	15.	To steering angle sensor

Inspection

Step	Action	Yes	No
1	**Check ESP® warning lamp** 1) Turn ignition switch to ON position. *Does ESP® warning lamp come ON?*	Go to Step 2.	Go to Step 6.
2	**Check fuse** 1) Turn ignition switch to OFF position. *Are main fuses for good condition?*	Go to Step 3.	Replace fuse and check for short.
3	**Check ESP® control module power supply circuit** 1) Disconnect ESP® control module connector. 2) Check for proper connection to ESP® control module connector at terminal “E85-35”. 3) If OK, then turn ignition switch to ON position and measure voltage between terminal “E85-35” and vehicle body ground. *Is it 10 – 14 V?*	Go to Step 4.	“GRN/ORN” wire circuit open.

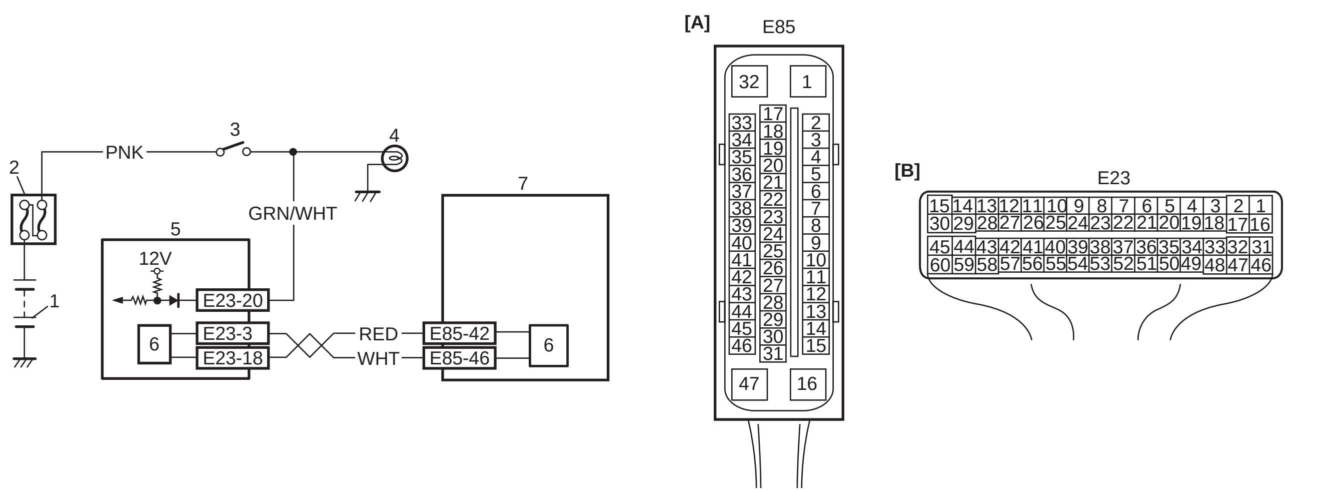
Step	Action	Yes	No
4	**Check ESP® control module power supply circuit** 1) Turn ignition switch to OFF position. 2) Check for proper connection to ESP® control module connector at terminals "E85-1" and "E85-32". 3) If OK, then turn ignition switch to ON position and measure voltage between each terminal of "E85-1", "E85-32" and vehicle body ground. *Are they 10 – 14 V?*	Go to Step 5.	"WHT/BLU" and/or "WHT/RED" wire circuit open.
5	**Check ESP® control module ground circuit** 1) Turn ignition switch to OFF position. 2) Check for proper connection to ESP® control module connector at terminals "E85-16" and "E85-47". 3) If OK, measure resistance between each terminal of "E85-16", "E85-47" and vehicle body ground. *Are resistance less than 2 Ω?*	Go to Step 6.	Ground circuit for ESP® control module open or high resistance.
6	**Check serial data circuit** 1) Check if communication is possible by trying communication with other controller (ECM, BCM, P/S control module or SDM). *Is it possible to communicate with other controller?*	Go to Step 7.	Repair open in common section of serial data circuit ("PPL/WHT" wire circuit) used by all controllers or short to ground or power circuit which has occurred somewhere in serial data circuit ("PPL/WHT" wire circuit).
7	**Check DLC power supply circuit** 1) Turn ignition switch to ON position. 2) Measure voltage between terminal B of data link connector and vehicle body ground. *Is voltage 10 – 12 V?*	Go to step 8.	Terminal B circuit open or shorted to ground.
8	**Check DLC ground circuit** 1) Turn ignition switch to OFF position. 2) Measure resistance between the following terminals; • Terminal G of data link connector and vehicle body ground. • Terminal G1 of data link connector and vehicle body ground. *Is each resistance 1 Ω or less?*	Go to step 9.	Terminal G and/or G1 circuit open or high resistance.

Step	Action	Yes	No
9	**Check serial data circuit** 1) Turn ignition switch to OFF position. 2) Check proper connection at “E85-33” (“PPL/WHT” wire) terminal for serial data circuit. 3) If OK, then check resistance between “E85-33” (“PPL/WHT” wire) terminal and “PPL/WHT” wire terminal (2) for serial data circuit in DLC (1). *Is resistance 1 Ω or less?*  I6RS0B460013-01	Substitute a known-good ESP® hydraulic unit / control module and recheck.	Check high resistance or open in “PPL/WHT” wire circuit for electronic stability program. If circuit is OK, substitute a known-good BCM and recheck.

DTC C1016: Stop Lamp Switch Circuit Failure

S7RS0B4604026

Wiring Diagram



I6RS0B460014-01

[A]:	ESP® control module connector (viewed from terminal side)	3.	Stop lamp switch	6.	CAN driver
1.	Battery	4.	Stop lamp	7.	ESP® hydraulic unit control module assembly
2.	Main fuse box	5.	ECM		

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
Vehicle behavior and stop lamp switch signal is disagreed for specified time.	• Back up light switch circuit • Back up light switch • ECM • ESP® control module

DTC Troubleshooting

Step	Action	Yes	No
1	*Was "Electronic Stability Program Check" performed?*	Go to Step 2.	Go to "Electronic Stability Program System Check".
2	**DTC check for ESP®** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ignition switch ON and check DTC for ESP®. *Is DTC U1073 and/or U1100 detected?*	Go to applicable diag. flow.	Go to Step 3.
3	**Check stop lamp switch circuit** 1) Check stop lamp, stop lamp (brake pedal) switch and their circuit referring to "Brake Light Symptom Diagnosis in Section 9B". *Are they in good condition?*	Go to Step 4.	Repair or replace.
4	**Check ECM circuit for stop lamp switch** 1) Disconnect connectors from ECM. 2) Check for proper connection to "E23-20" wire of ECM connector. 3) If connections are OK, check stop lamp switch circuit for the following. • Resistance of "GRN/WHT" wire terminal of stop lamp switch between stop lamp switch connector and ECM connector is less than 1 Ω (continuity check) • Resistance between "GRN/WHT" wire terminal of stop lamp switch connector and vehicle body ground is infinity (ground short check) • Voltage of between "GRN/WHT" wire terminal of stop switch connector and vehicle body ground is 0 V with ignition switch tuned ON (power short check) *Are they in good condition?*	Substitute a known-good ECM and recheck. If DTC C1016 is still detected, substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	Repair or replace defective wire.

DTC C1017 / C1023: Yaw Rate / G Sensor Assembly Failure

S7RS0B4604025

DTC C1017: Lateral G Sensor Range / Performance
DTC C1023: Yaw Rate Sensor Failure

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
C1017: Lateral G sensor signal is out of specified range. **C1023:** • Yaw rate sensor signal is out of range. • Vehicle behavior and yaw rate signal is disagreed.	• Yaw rate / G sensor assembly • ESP® control module

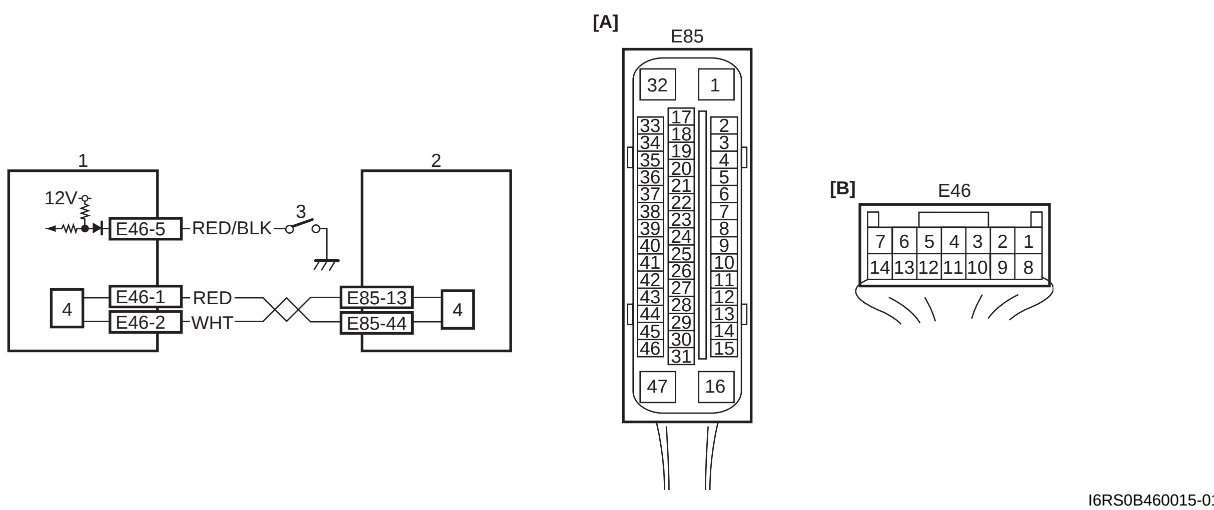
DTC Troubleshooting

Step	Action	Yes	No
1	*Was "Electronic Stability Program Check" performed?*	Go to Step 2.	Go to "Electronic Stability Program System Check".
2	**DTC check for ESP®** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ignition switch ON and check DTC for ESP®. *Are DTC C1034 and/or C1073 detected?*	Go to applicable DTC diag. flow.	Go to Step 3.
3	**Check sensor calibration** 1) Calibrate yaw rate / G sensor assembly referring to "Sensor Calibration". 2) Clear all DTCs and check DTC for ESP®. *Are DTC C1017 and/or C1023 still detected?*	Go to Step 4.	Yaw rate / G sensor assembly calibration is incompleted.
4	**Check yaw rate / G sensor assembly** 1) Check yaw rate / G sensor assembly referring to "Yaw Rate / G Sensor Assembly On-Vehicle Inspection". *Is it good condition?*	Substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	Substitute a known-good yaw rate / G sensor assembly and recheck.

DTC C1018: Brake Fluid Level Switch Failure

S7RS0B4604027

Wiring Diagram



[A]: ESP® control module connector (viewed from terminal side)	1. BCM	3. Brake fluid level switch
[B]: BCM connector (viewed from harness side)	2. ESP® hydraulic unit control module assembly	4. CAN driver

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
• Brake fluid level is too low. • Input signal of brake fluid level switch to BCM is low level.	• Brake fluid level • Brake fluid level switch circuit • Brake fluid level switch • BCM • ESP® control module

DTC Troubleshooting

Step	Action	Yes	No
1	*Was “Electronic Stability Program Check” performed?*	Go to Step 2.	Go to “Electronic Stability Program System Check”.
2	**Check brake fluid level** 1) Check brake fluid level in reservoir. *Is brake fluid level upper than the minimum level?*	Go to Step 3.	Replenish brake fluid to reservoir.
3	**DTC check for ESP®** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ignition switch ON and check DTC for ESP®. *Is DTC U1073 and/or U1140 detected?*	Go to applicable diag. flow.	Go to Step 3.
4	**Check brake fluid level switch** 1) Turn ignition switch to OFF position. 2) Disconnect brake fluid level switch connector. 3) Check for proper connection at each terminal of brake fluid level switch connector. 4) If OK, then check brake fluid level switch referring to “Brake Fluid Level Switch Inspection in Section 9C”. *Is check result OK?*	Go to Step 5.	Replace brake fluid level switch.
5	**Check brake fluid level switch circuit** 1) Disconnect BCM connector. 2) Check for proper connection to BCM connector at “E46-5” terminal. 3) If OK, then check resistance between “E46-5” terminal and vehicle body ground. *Is resistance infinity?*	Go to Step 6.	“BLKL/RED” wire circuit is shorted to ground.
6	**Check BCM** 1) Connect brake fluid level switch connector and BCM connector. 2) Check voltage at “E46-5” terminal of BCM referring to “Inspection of BCM and its Circuits in Section 10B”. *Is voltage in good condition?*	Substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	Check BCM power and ground circuit. If circuit is OK, substitute a known-good BCM and recheck.

DTC 1020: Master Cylinder Pressure Sensor Power Supply Failure

S7RS0B4604028

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
Power supply voltage to master cylinder pressure sensor in ESP® hydraulic unit / control module assembly is out of specification.	• ESP® control module

DTC Troubleshooting

1) Turn ignition switch to OFF position.
2) Check for proper connection from harness to ESP® control module.
3) If OK, substitute an ESP® hydraulic unit / control module assembly with correct part number.
4) Recheck system.

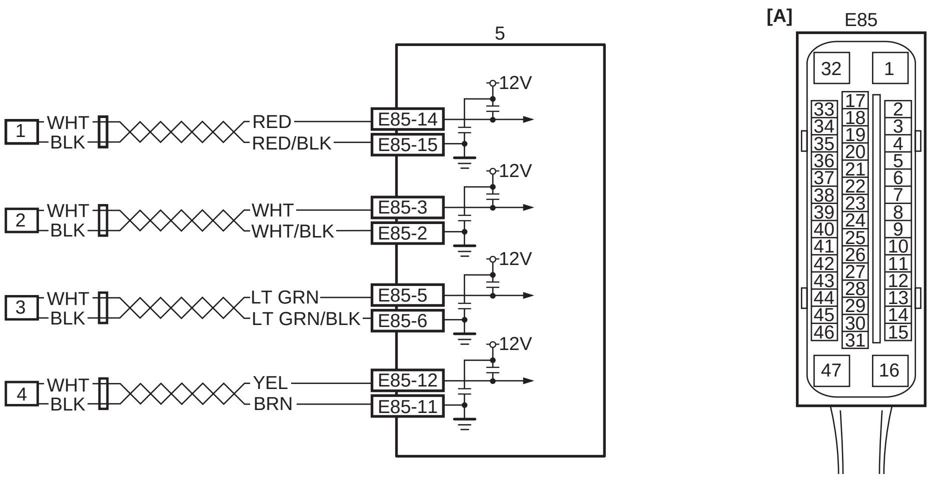
DTC C1021, C1022 / C1025, C1026 / C1031, C1032 / C1035, C1036: Wheel Speed Sensor Circuit or Encoder Failure

S7RS0B4604051

DTC C1021 / C1025 / C1031 / C1035: Right-Front / Left-Front / Right-Rear / Left-Rear Wheel Speed Sensor Circuit Failure

DTC C1022 / C1026 / C1032 / C1036: Right-Front / Left-Front / Right-Rear / Left-Rear Wheel Speed Sensor or Encoder Failure

Wiring Diagram



I6RS0B460016-01

[A]: ESP® control module connector (viewed from terminal side)	2. Right- front wheel speed sensor	4. Right-rear wheel speed sensor
1. Left-front wheel speed sensor	3. Left-rear wheel speed sensor	5. ESP® hydraulic unit / control module assembly

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
DTC C1021, C1025, C1031, C1035: Wheel sensor signal is out of specified range. **DTC C1022, C1026, C1032, C1036:** Abnormal wheel speed sensor signal is detected.	• Wheel speed sensor • Wheel speed sensor circuit • Wheel encoder • ESP® control module

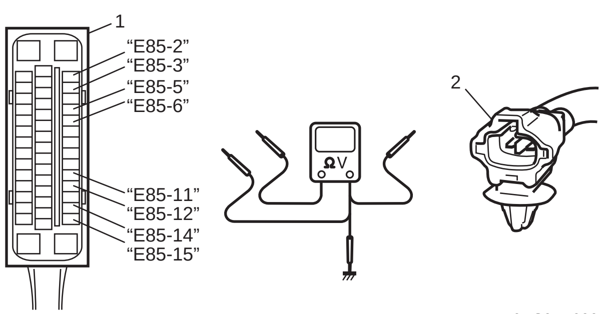
NOTE

When the vehicle was operated in any of the following ways, one of these DTCs may be set even when the sensor is in good condition. If such possibility is suspected, clear DTC once referring to "DTC Clearance" and then performing the driving test as described in Step 2 of "Electronic Stability Program System Check", check whether or not any abnormality exists.

- **The vehicle was driven with parking brake pulled.**
- **Wheel spin occurred while driving.**
- **Wheel(s) was turned while the vehicle was jacked up.**
- **The vehicle was stuck.**

DTC Troubleshooting

Step	Action	Yes	No
1	*Was "Electronic Stability Program Check" performed?*	Go to Step 2.	Go to "Electronic Stability Program System Check".

Step	Action	Yes	No
2	**Check wheel speed sensor circuit** 1) Turn ignition switch OFF. 2) Disconnect connector from ESP® control module and applicable wheel speed sensor coupler. 3) Check for proper connection of ESP® control module and wheel speed sensor coupler. 4) If connections are OK, check wheel speed sensor circuit for the following. • Resistance of both ESP® control module connector (1) terminals a pair of applicable sensor terminals is no continuity (circuit short check) • Resistance of applicable sensor terminal of ESP® control module connector and vehicle body ground is no continuity (ground short check) • Resistance of applicable sensor terminal of ESP® control module connector and corresponding terminal of wheel speed sensor connector (2) in main harness (for front sensor) or floor harness (for rear sensor) is continuity (continuity check) • Voltage of applicable sensor terminal of ESP® control module connector and vehicle body ground is 0 V with ignition switch turned ON (power short check)  I6RS0B460017-02 *Are they in good condition?*	Go to Step 3.	Repair or replace defective circuit.
3	**Check wheel speed sensor** 1) Remove applicable wheel speed sensor. 2) Check sensor for damage or foreign material attached. *Is it in good condition?*	Go to Step 4.	Clean, repair or replace.
4	**Check wheel encoder** 1) Check front and/or rear wheel encoder for the following (remove front drive shaft and/or rear wheel hub assembly): • Encoder surface neither crack nor damaged • No foreign material being attached • Encoder not being eccentric • Wheel bearing free from excessive play *Are they in good condition?*	Go to Step 5.	Clean, repair or replace front wheel bearing and/or rear wheel hub assembly.
5	**Check wheel speed sensor installing condition** 1) Install wheel speed sensor to knuckle. 2) Tighten sensor bolt to specified torque and check that there is no clearance between sensor and knuckle. *Is it OK?*	Go to Step 6.	Replace wheel speed sensor.

Step	Action	Yes	No
6	**Check wheel speed sensor** 1) Refer to “Front / Rear Wheel Speed Sensor On-Vehicle Inspection”, check output voltage or waveform. *Is specified voltage and/or waveform obtained?*	Substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	Replace wheel speed sensor and recheck.

DTC C1024: Steering Angle Sensor Circuit Failure

S7RS0B4604029

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
• Steering angle sensor internal defect is detected by CPU in steering angle sensor. • Steering angle sensor signal is out of specified range.	• Steering angle sensor • ESP® control module

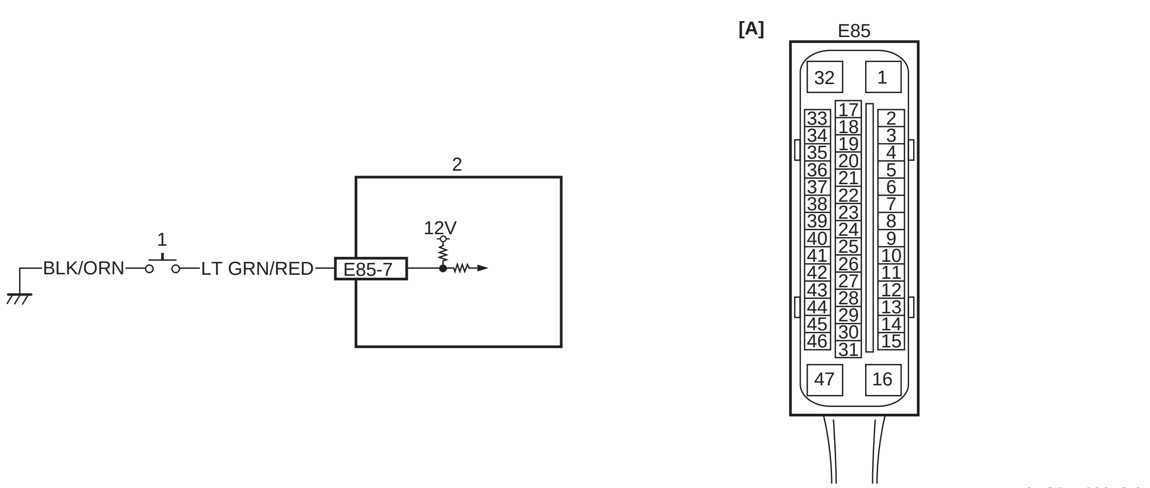
DTC Troubleshooting

Step	Action	Yes	No
1	*Was “Electronic Stability Program Check” performed?*	Go to Step 2.	Go to “Electronic Stability Program System Check”.
2	**DTC check for ESP®** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ignition switch ON and check DTC for ESP®. *Are DTC U1073 and/or U1126 detected?*	Go to applicable DTC diag. flow.	Go to Step 3.
3	**Check sensor calibration** 1) Calibrate steering angle sensor referring to “Sensor Calibration”. 2) Clear all DTC(s) and check DTC for ESP®. *Is DTC C1024 still detected?*	Go to Step 4.	Steering angle sensor calibration was incompleted.
4	**Check steering angle sensor** 1) Check steering angle sensor referring to “Steering Angle Sensor On-Vehicle Inspection”. *Is it good condition?*	Substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	Replace steering angle sensor.

DTC C1027: ESP® OFF Switch Circuit Failure

S7RS0B4604030

Wiring Diagram



[A]: ESP® control module connector (viewed from terminal side)	1. ESP® OFF Switch	2. ESP® hydraulic unit control module assembly

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
Mechanical switch failure, failure in switch wiring is shorted to ground.	• ESP® OFF switch • ESP® OFF switch circuit • ESP® control module

DTC Troubleshooting

Step	Action	Yes	No
1	*Was "Electronic Stability Program Check" performed?*	Go to Step 2.	Go to "Electronic Stability Program System Check".
2	**Check ESP® OFF switch condition** *Is ESP® OFF switch is OFF condition?*	Go to Step 3.	ESP® OFF switch turned OFF condition and recheck.
3	**Check ESP® OFF switch** 1) Turn ignition switch to OFF position. 2) Remove ESP® OFF switch referring to "ESP® OFF Switch Removal and Installation". 3) Check for proper connection at each terminal of ESP® OFF switch. 4) If OK, then check ESP® OFF switch referring to "ESP® OFF Switch Inspection". *Is it good condition?*	Go to Step 4.	Replace ESP® OFF switch.
4	**Check ESP® OFF switch circuit** 1) Disconnect ESP® control module connector. 2) Check for proper connection to ESP® control module connector at "E85-7" terminal. 3) If OK, then check resistance between "E85-7" terminal and vehicle body ground. *Is resistance infinity?*	Substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	"LT GRN/RED" wire circuit is shorted to ground.

DTC C1028: Master Cylinder Pressure Sensor Circuit Failure

S7RS0B4604031

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
Input signal voltage from master cylinder pressure sensor in ESP® control module is too high or low.	• Leakage or air in the hydraulic brake system • Clearance between brake pad and disc too high

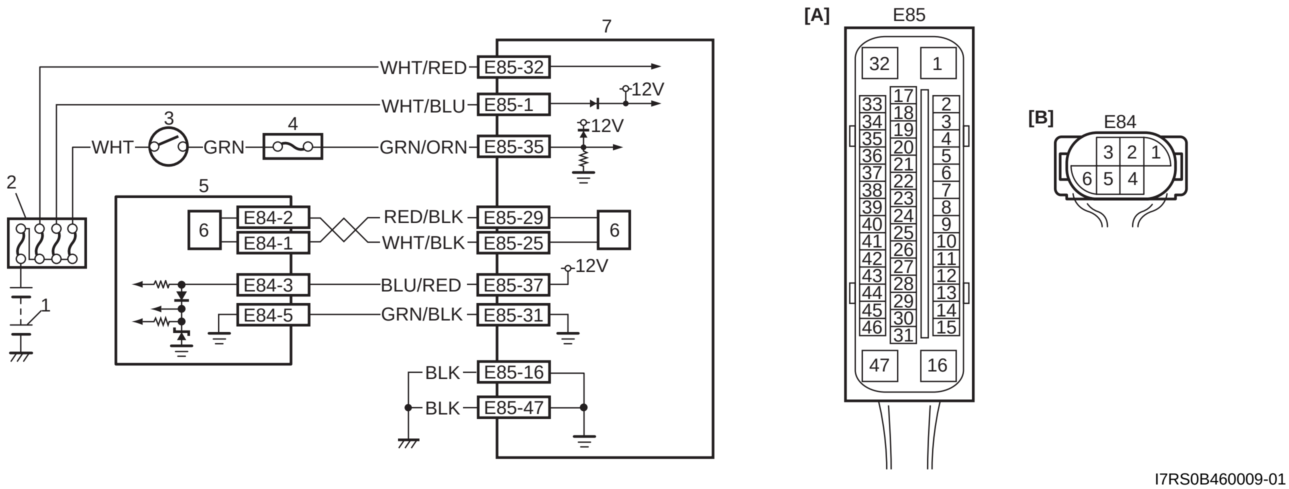
DTC Troubleshooting

Step	Action	Yes	No
1	*Was "Electronic Stability Program Check" performed?*	Go to Step 2.	Go to "Electronic Stability Program System Check".
2	**Check brake system** 1) Check brake system as follows. • Leakage or air in the hydraulic brake system • Clearance between brake pad and disc too high *Are they in good condition?*	Go to Step 3.	Repair, replace or adjust.
3	**Check sensor calibration** 1) Calibrate master cylinder pressure sensor referring to "Sensor Calibration". 2) Clear all DTC(s) and recheck DTC. *Is DTC C1028 still detected?*	Substitute a known-good ESP® hydraulic unit / control module assembly recheck.	Master cylinder pressure sensor calibration was incompleted.

DTC C1034: Yaw Rate / G Sensor Assembly Power Supply Failure

S7RS0B4604032

Wiring Diagram



[A]:	ESP® control module connector (viewed from terminal side)	2.	Main fuse box	5.	Yaw rate / G sensor assembly
[B]:	Yaw rate / G sensor assembly connector (viewed from harness side)	3.	Ignition switch	6.	CAN driver
1.	Battery	4.	Junction block assembly	7.	ESP® hydraulic unit / control module assembly

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
• Power supply voltage of yaw rate / G sensor assembly is too high when ignition switch OFF. • Power supply voltage of yaw rate / G sensor assembly is too low when ignition switch ON.	• Yaw rate / G sensor assembly power supply circuit • ESP® control module power supply circuit • Yaw rate / G sensor assembly • ESP® control module

DTC Troubleshooting

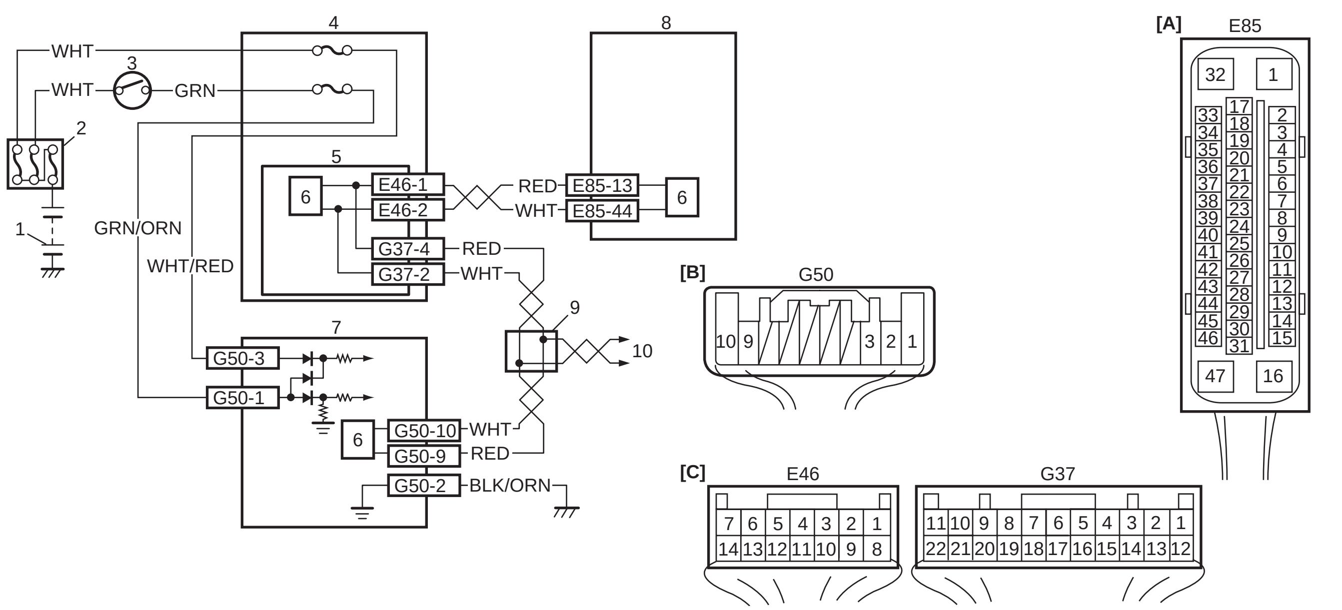
Step	Action	Yes	No
1	*Was “Electronic Stability Program Check” performed?*	Go to Step 2.	Go to “Electronic Stability Program System Check”.
2	**Check yaw rate / G sensor assembly ground circuit** 1) Turn ignition switch to OFF position. 2) Disconnect yaw rate / G sensor assembly connector. 3) Check for proper connection to yaw rate / G sensor assembly connector terminals at “E84-3” and “E84-5”. 4) If OK, then measure voltage between connector terminal “E84-3” and vehicle body ground. *Is it 0 V?*	Go to Step 3.	Go to Step 4.
3	**Check yaw rate / G sensor assembly power supply circuit** 1) Measure voltage between connector terminal “E84-3” and “E84-5” with ignition switch turned ON. *Is it 10 – 14 V?*	Substitute a known-good yaw rate / G sensor assembly and recheck.	Go to Step 4.

Step	Action	Yes	No
4	**Check yaw rate / G sensor assembly power supply circuit** 1) Turn ignition switch to OFF position. 2) Disconnect ESP® control module connector. 3) Check for proper connection to ESP® control module connector terminals at “E85-31” and “E85-37”. 4) If OK, then measure voltage between connector terminal “E85-37” and vehicle body ground. *Is it 0 V?*	Go to Step 5.	“BLU/RED” wire circuit is shorted to power circuit.
5	**Check yaw rate / G sensor assembly power supply circuit** 1) Measure resistance between the following points. • Between terminal “E85-37” of module connector and terminal “E84-3” of sensor terminal. • Between terminal “E85-31” of module connector and terminal “E84-5” of sensor terminal. *Are resistance less than 2 Ω?*	Substitute a known-good ESP® hydraulic unit / control module assembly recheck.	“BLU/RED” and/or “GRN/BLK” wire circuit open or high resistance.

DTC C1037: Steering Angle Sensor Power Supply Failure

S7RS0B4604033

Wiring Diagram



I6RS0B460020-01

[A]:	ESP® control module connector (viewed from terminal side)	3.	Ignition switch	8.	ESP® hydraulic unit control module assembly
[B]:	Steering angle sensor connector (viewed from harness side)	4.	Junction block assembly	9.	Junction connector
[C]:	BCM connector (viewed from harness side)	5.	BCM (included in junction block assembly)	10.	To Combination meter and keyless start control module
1.	Battery	6.	CAN driver		
2.	Main fuse box	7.	Steering angle sensor		

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
Power supply voltage to steering angle sensor is too low.	• Steering angle sensor power supply circuit • Steering angle sensor • ESP® control module

DTC Troubleshooting

Step	Action	Yes	No
1	*Was "Electronic Stability Program Check" performed?*	Go to Step 2	Go to "Electronic Stability Program System Check".
2	**Check fuse** 1) Check circuit fuses for steering angle sensor and its circuit. *Is it good condition?*	Go to Step 3.	Replace fuse and check for short circuit to ground.
3	**Check steering angle sensor power supply circuit** 1) Turn ignition switch to OFF position. 2) Disconnect steering angle sensor connector. 3) Check for proper connection to steering angle sensor connector terminals at "G50-1", "G50-2" and "G50-3". 4) If OK, then measure voltage between connector terminal "G50-3" and vehicle body ground. *Is it 10 – 14 V?*	Go to Step 4.	"WHT/RED" wire circuit open.
4	**Check steering angle sensor power supply circuit** 1) Measure voltage between connector terminal "G50-1" and vehicle body ground with ignition switch turned ON. *Is it 10 – 14 V?*	Go to Step 5.	"GRN/ORN" wire circuit open.
5	**Check steering angle sensor ground circuit** 1) Turn ignition switch to OFF position. 2) Measure resistance between connector terminal "G50-2" and vehicle body ground. *Is resistance less than 2 Ω?*	Go to Step 6.	"BLK/ORN" wire circuit open or high resistance.
6	**Check steering angle sensor** 1) Connect steering angle sensor connector. 2) Check steering angle sensor referring to "Steering Angle Sensor On-Vehicle Inspection". *Is it good condition?*	Substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	Substitute a known-good steering angle sensor and recheck.

DTC C1038: Steering Angle Sensor Detect Rolling Counter Failure from ESP® Control Module

S7RS0B4604034

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
ESP® control module rolling counter failure is detected by steering angle sensor.	• CAN communication circuit • Steering angle sensor • ESP® control module

DTC Troubleshooting

Step	Action	Yes	No
1	*Was "Electronic Stability Program Check" performed?*	Go to Step 2.	Go to "Electronic Stability Program System Check".
2	**Check DTC** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ignition switch ON and check DTC. *Is there any DTC(s) other than C1038 and C1090?*	Go to applicable DTC diag. flow.	Substitute a known-good steering angle sensor and recheck. If DTC C1038 is still detected, substitute a known-good ESP® hydraulic unit control module assembly and recheck.

DTC C1039: Yaw Rate / G Sensor Assembly Internal Failure

S7RS0B4604035

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
Yaw rate / G sensor assembly internal failure is detected.	• Yaw rate / G sensor assembly • ESP® control module

DTC Troubleshooting

Step	Action	Yes	No
1	*Was "Electronic Stability Program Check" performed?*	Go to Step 2.	Go to "Electronic Stability Program System Check".
2	**DTC check** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ignition switch ON and check DTC. *Are DTC C1034 and/or C1073 detected?*	Go to applicable DTC diag. flow.	Go to step 3.
3	**Check yaw rate / G sensor assembly** 1) Check yaw rate / G sensor assembly referring to "Yaw Rate / G Sensor Assembly On-Vehicle Inspection". *Is it good condition?*	Substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	Substitute a known-good yaw rate / G sensor assembly and recheck.

DTC C1040: Stability Control System Function Failure

S7RS0B4604036

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
Stability control is active for more than specified time without yaw rate change.	• ESP® control module

DTC Troubleshooting

Step	Action	Yes	No
1	*Was "Electronic Stability Program Check" performed*	Go to Step 2.	Go to "Electronic Stability Program System Check".
2	**Check DTC for ESP®** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ignition switch ON and check DTC for ESP®. *Is there any DTC(s) other than C1040?*	Go to applicable DTC diag. flow.	Substitute a known-good ESP® hydraulic unit / control module assembly and recheck.

DTC C1041 / C1042 / C1043 / C1044 / C1045 / C1046 / C1051 / C1052 / C1053 / C1054 / C1055 / C1056: Solenoid Circuit Failure

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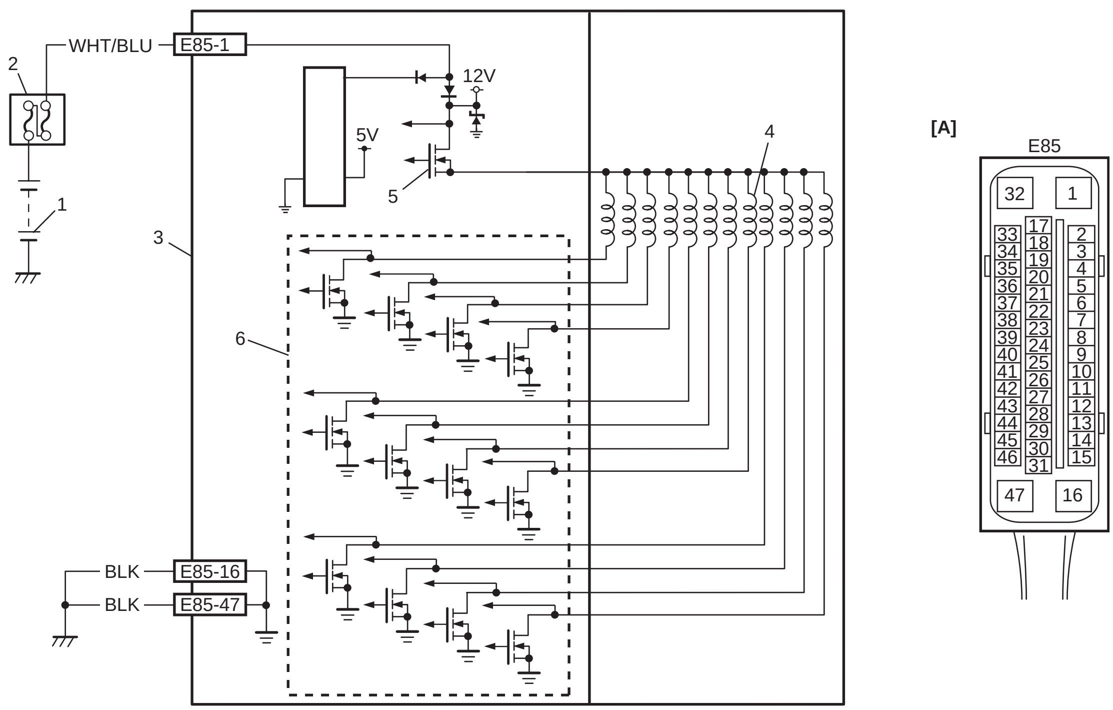
DTC C1041 / C1045 / C1051 / C1055: Right-Front / Left-Front / Right-Rear / Left-Rear Inlet Solenoid Circuit Failure
DTC C1042 / C1046 / C1052 / C1056: Right-Front / Left-Front / Right-Rear / Left-Rear Outlet Solenoid Circuit Failure
DTC C1043 / C1044: Master Cylinder Cut Solenoid Circuit No. 1 / No. 2 Failure
DTC C1053 / C1054: Low Pressure Solenoid Circuit No. 1 / No. 2 Failure

Wiring Diagram



I6RS0B460021-01

[A]: ESP® control module connector (viewed from terminal side)	3. ESP® hydraulic unit / control module assembly	6. Solenoid valve driver (transistor)
1. Battery	4. Solenoid valve	
2. Main fuse box	5. Solenoid valve power supply driver (transistor)	

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
Mismatching solenoid output and solenoid monitor is detected.	• ESP® control module

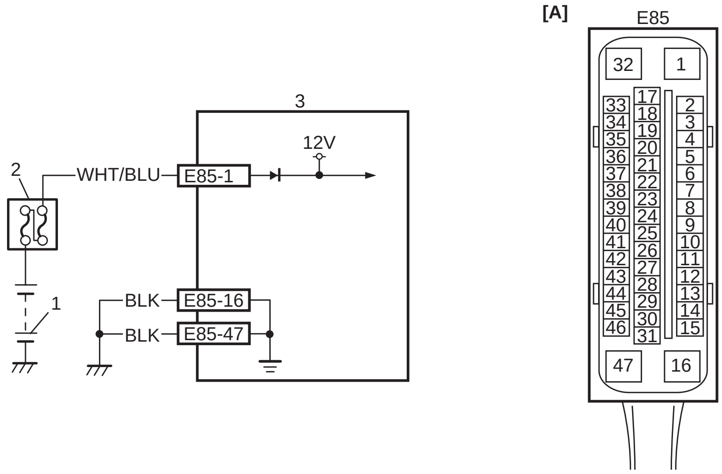
DTC Troubleshooting

Step	Action	Yes	No
1	*Was "Electronic Stability Program Check" performed?*	Go to Step 2.	Go to "Electronic Stability Program System Check".
2	**Check solenoid valve power supply circuit** 1) Turn ignition switch to OFF position. 2) Disconnect ESP® control module connector. 3) Check for proper connection to ESP® control module connector at terminal "E85-1", "E85-16" and "E85-47". 4) If OK, then measure voltage between terminal "E85-1" of module connector and "E85-16, E85-47". *Are they 10 – 14 V?*	Substitute a known-good ESP® hydraulic unit /control module assembly and recheck.	"WHT/BLU" or "BLK" circuit open.

DTC C1057: ESP® Control Module Power Supply Circuit Failure

S7RS0B4604053

Wiring Diagram



I6RS0B460023-02

[A]: ESP® control module connector (viewed from terminal side)	2. Main fuse box
1. Battery	3. ESP® hydraulic unit / control module assembly

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
• ESP® control module power supply voltage is too high. • ESP® control module power supply voltage is too low.	• ESP® control module power supply circuit • ESP® control module

DTC Troubleshooting

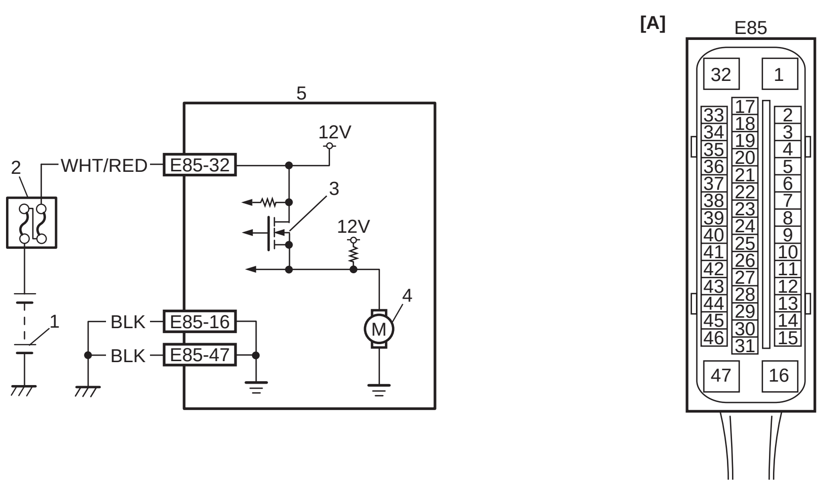
Step	Action	Yes	No
1	*Was "Electronic Stability Program Check" performed?*	Go to Step 2.	Go to "Electronic Stability Program System Check".
2	**Check power supply circuit from battery** 1) Disconnect ESP® hydraulic unit / control module connector with ignition switch turned OFF. 2) Check for proper connection to ESP® control module connector at terminals "E83-1", "E85-16" and "E85-47". 3) If OK, then turn ignition switch to ON position and measure voltage between terminals "E85-1" and "E85-16", "E85-47". *Are voltage 9.7 ± 0.3 V or more?*	Go to Step 5.	Go to Step 3.
3	**Check ESP® control module ground circuit** 1) Measure resistance between each terminal of "E85-16", "E85-47" and vehicle body ground. *Is resistance less than 2 Ω?*	Go to Step 4.	"BLK" wire circuit in open or high resistance.
4	**Check power supply circuit from battery** 1) Measure voltage between positive battery terminal and vehicle body ground with engine running. *Is voltage 9.7 ± 0.3 V or more?*	Imperfect short between "WHT/BLU" wire circuit and vehicle body ground.	Check charging system referring to "Generator Test (Undercharged Battery Check) in Section 1J".

Step	Action	Yes	No
5	**Check power supply circuit from battery** 1) Measure voltage between terminals “E85-1” and “E85-16”, “E85- 47" with engine running. *Are voltage 18 ± 1.0 V or less?*	Poor connection of “E85-1”, “E85-16” and/ or “E85-47” terminals. If the terminals are in good condition, substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	Check charging system referring to “Generator Test (Overcharged Battery Check) in Section 1J”.

DTC C1061: Pump Motor and/or Motor Driver Circuit Failure

S7RS0B4604054

Wiring Diagram



I6RS0B460024-02

[A]: ESP® control module connector (viewed from terminal side)	2. Main fuse box	4. Pump motor
1. Battery	3. Pump motor driver (transistor)	5. ESP® hydraulic unit / control module assembly

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
Defective pump motor and/or motor power supply voltage is too low.	• Pump Motor and/or Motor Driver power supply circuit • ESP® control module

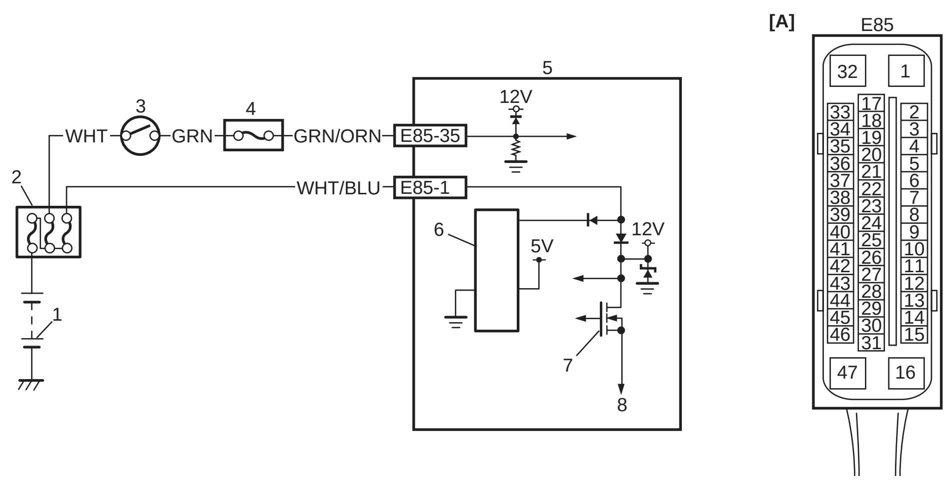
DTC Troubleshooting

Step	Action	Yes	No
1	*Was "Electronic Stability Program Check" performed?*	Go to Step 2.	Go to "Electronic Stability Program System Check".
2	**Check ESP® control module power supply circuit** 1) Turn Ignition switch to OFF position. 2) Disconnect ESP® control module connector. 3) Check for proper connection to ESP® control module connector at terminal "E85-32". 4) If OK, then measure voltage between terminal "E85-32" of module connector and body ground. *Is it 10 – 14 V?*	Go to Step 3.	"WHT/RED" circuit open.
3	**Check ESP® control module ground circuit** 1) Measure resistance between terminal "E85-16" and "E85-47" ESP® control module connector and vehicle body ground. *Are resistance less than 1 Ω?*	Substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	Ground circuit for ESP® control module open or high resistance.

DTC C1063: Solenoid Valve Power Supply Driver Circuit Failure

S7RS0B4604055

Wiring Diagram



I6RS0B460025-02

[A]: ESP® control module connector (viewed from terminal side)	3. Ignition switch	6. Power control unit
1. Battery	4. Junction block assembly	7. Solenoid valve power supply driver (transistor)
2. Main fuse box	5. ESP® hydraulic unit / control module assembly	8. To solenoid valve

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
• Mismatching solenoid output and solenoid monitor is detected. • Solenoid valve circuit is shorted to power or ground circuit in ESP® control module	• Solenoid valve power supply circuit • ESP® control module

DTC Troubleshooting

Step	Action	Yes	No
1	*Was "Electronic Stability Program Check" performed?*	Go to Step 2.	Go to "Electronic Stability Program System Check".
2	**Check power supply circuit from battery** 1) Check battery voltage. *Is it about 11 V or higher?*	Go to Step 3.	Check charging system referring to "Battery Inspection in Section 1J" and "Generator Test (Undercharged Battery Check) in Section 1J".
3	**Check fuse** 1) Check main fuse for solenoid and its terminal. *Is it in good condition?*	Go to Step 4.	Replace fuse and check for short circuit to ground.
4	**Check solenoid valve power supply circuit** 1) Turn ignition switch to OFF position. 2) Disconnect control module connector. 3) Check for proper connection to ESP® control module at terminal "E85-1". 4) If OK, then measure voltage between connector terminal "E85-1" and vehicle body ground. *Is it 10 – 14 V?*	Substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	"WHT/BLU" circuit imperfect short to ground.

DTC 1071: ESP® Control Module Internal Defect

S7RS0B4604056

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
ESP® control module internal defect is detected.	• ESP® control module

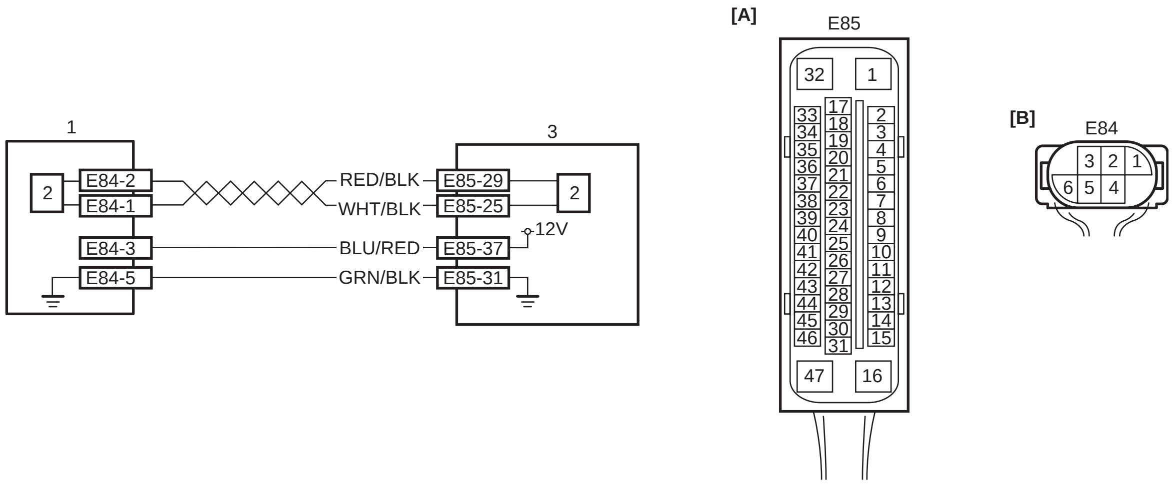
DTC Troubleshooting

1) Turn ignition switch to OFF position.
2) Check for proper connection from harness to ESP® control module.
3) If OK, substitute an ESP® hydraulic unit / control module assembly with correct part number.
4) Recheck system.

DTC C1073: Lost Communication With Yaw Rate / G Sensor Assembly

S7RS0B4604038

Wiring Diagram



I7RS0B460010-01

[A]: ESP® control module connector (viewed from terminal side)	1. Yaw rate / G sensor assembly	3. ESP® hydraulic unit control module assembly
[B]: Yaw rate / G sensor assembly connector (viewed from harness side)	2. CAN driver (for yaw rate / G sensor assembly)	

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
CAN line communication error in ESP® control module and yaw rate / G sensor assembly is detected.	• CAN communication circuit (for yaw rate / G sensor assembly) • Yaw rate / G sensor assembly • ESP® control module

DTC Troubleshooting

Step	Action	Yes	No
1	*Was “Electronic Stability Program Check” performed?*	Go to Step 2.	Go to “Electronic Stability Program System Check”.
2	**Check each control module connectors** 1) Check connection of connectors of all control modules communicating by means of CAN (for yaw rate / G sensor assembly). 2) Check DTC for ESP®. *Is DTC C1073 detected?*	Go to Step 4.	Check for intermittent trouble referring to “Intermittent and Poor Connection Inspection in Section 00”.
3	**CAN communication circuit check** 1) Turn ignition switch to OFF position. 2) Disconnect connectors of ESP® control module and yaw rate / G sensor assembly. *Is each CAN communication circuit between ESP® control module and yaw rate / G sensor assembly opened, shorted or high resistance?*	Repair or replace the CAN communication line.	Go to Step 5.

Step	Action	Yes	No
4	**Check yaw rate / G sensor assembly** 1) Check yaw rate / G sensor assembly power and ground circuit referring to “DTC Troubleshooting” under “DTC C1034: Yaw Rate / G Sensor Assembly Power Supply Failure”. 2) If OK, then substitute a known-good yaw rate / G sensor assembly. 3) Connect connectors to ESP® control module and yaw rate / G sensor assembly. 4) Clear all DTC(s) and check DTC for ESP®. *Is DTC C1073 still detected?*	Check ESP® control module power and ground circuit. If circuits are OK, substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	Yaw rate / G sensor assembly was malfunction.

DTC C1075 / 1076 / 1078: Sensor Calibration Incomplete

S7RS0B4604039

DTC C1075: Steering Angle Sensor Calibration Incomplete
DTC C1076: Master Cylinder Pressure Sensor Calibration Incomplete
DTC C1078: Lateral G Sensor in Yaw Rate / G Sensor Assembly Calibration Incomplete

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
C1075: Missing steering angle sensor calibration point data is detected.	• Steering angle sensor • Steering angle sensor calibration is incompleted • ESP® control module
C1076: Master cylinder pressure sensor calibration is incompleted.	• Master cylinder pressure sensor • Master cylinder pressure sensor calibration is incompleted • ESP® control module
C1078: Lateral G sensor in yaw rate / G sensor assembly calibration is incompleted.	• Yaw rate / G sensor assembly • Lateral G sensor calibration is incompleted • ESP® control module

DTC Troubleshooting

Step	Action	Yes	No
1	*Was "Electronic Stability Program Check" performed?*	Go to Step 2.	Go to "Electronic Stability Program System Check".
2	**DTC check for ESP®** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ignition switch ON and check DTC for ESP®. *Is there any DTC(s) other than C1075, C1076 and C1078?*	Go to applicable DTC diag. flow.	Go to Step 3.
3	**Check sensor calibration** 1) Calibrate all sensors referring to "Sensor Calibration". 2) Clear all DTC(s) and check DTC for ESP®. *Is DTC C1075, C1076 and/or C1078 still detected?*	DTC C1075: Substitute a known-good steering angle sensor and recheck. DTC C1076: Substitute a known-good ESP® hydraulic unit / control module assembly and recheck. DTC C1078: Substitute a known-good yaw rate / G sensor assembly and recheck.	Calibration was incompleted.

DTC C1090: Invalid Communication with ECM

S7RS0B4604040

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
ESP® control module rolling counter failure is detected by ECM.	• CAN communication circuit • ECM • ESP® control module

DTC Troubleshooting

Step	Action	Yes	No
1	*Was "Electronic Stability Program Check" performed?*	Go to Step 2.	Go to "Electronic Stability Program System Check".
2	**DTC check for ESP®** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ignition switch ON and check DTC for ESP®. *Is there any DTC(s) other than C1038 and C1090?*	Go to applicable DTC diag. flow.	Go to Step 3.
3	**DTC check for ECM** 1) Check DTC for ECM. *Is DTC P1674 and/or DTC P1685 detected?*	Go to applicable DTC diag. flow.	Substitute a known-good ESP® hydraulic unit / control module assembly and recheck.

DTC C1091 / C1094: ECM Data in CAN Line Failure / Invalid Torque Control Communication with ECM

S7RS0B4604041

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
C1091: ECM sent invalid signal to ESP® control module. **C1094:** Reception error of torque control signal with ECM	• Engine control system • ECM • ESP® control module

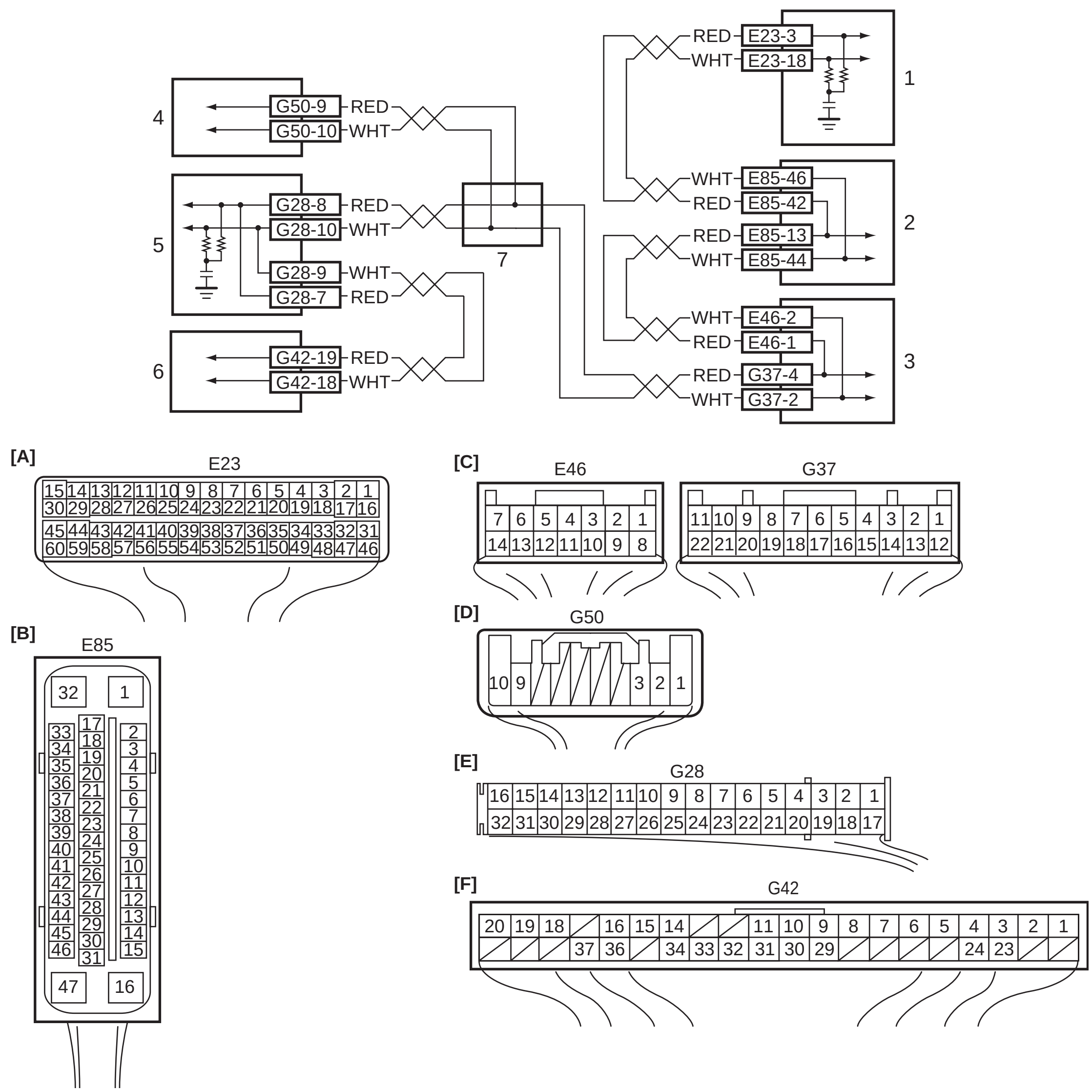
DTC Troubleshooting

Step	Action	Yes	No
1	*Was “Electronic Stability Program Check” performed?*	Go to Step 2.	Go to “Electronic Stability Program System Check”.
2	**DTC check for ESP®** 1) Connect scan tool to DLC with ignition switch turned OFF. 2) Turn ignition switch ON and check DTC for ESP®. *Is DTC C1090 detected?*	Go to applicable DTC diag. flow.	Go to step 3.
3	**DTC check other control module than ESP®** 1) Check DTC for ECM. *Is there any DTC(s)?*	Go to applicable DTC diag. flow.	Substitute a known-good ESP® hydraulic unit / control module assembly and recheck.

DTC U1073: Control Module Communication Bus Off

S7RS0B4604057

Wiring Diagram



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[A]: ECM connector (viewed from harness side)	[F]: Keyless start control module connector (viewed from harness side)	5. Combination meter
[B]: ESP® control module connector (viewed from terminal side)	1. ECM	6. Keyless start control module (if equipped)
[C]: BCM connector (viewed from harness side)	2. ESP® hydraulic unit / control module assembly	7. Junction connector
[D]: Steering angle sensor connector (viewed from harness side)	3. BCM	
[E]: Combination meter connector (viewed from harness side)	4. Steering angle sensor	

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
Transmission error that is inconsistent between transmission data and transmission monitor (CAN bus monitor) data is detected more than 7 times continuously.	• CAN communication circuit • ECM • ESP® control module • BCM • Steering angle sensor • Combination meter • Keyless start control module (if equipped)

DTC Troubleshooting

Step	Action	Yes	No
1	*Was "Electronic Stability Program Check" performed?*	Go to Step 2.	Go to "Electronic Stability Program System Check".
2	**DTC check for ESP®** 1) Check connection of connectors of all control modules communicating by means of CAN. 2) Recheck DTC for ESP®. *Is DTC U1073 indicated?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection in Section 00".
3	**CAN communication circuit check** 1) Turn ignition switch to OFF position. 2) Disconnect connectors of all control modules communicating by means of CAN. 3) Check CAN communication circuit between control modules for open, short and high resistance. *Is each CAN communication circuit in good condition?*	Go to Step 4.	Repair or replace the CAN communication line.
4	**DTC check for ESP®** 1) Connect connectors of disconnected control modules communicating by means of CAN. 2) Disconnect each connector. • ECM • Keyless start control module (if equipped) • Combination meter • Steering angle sensor • BCM 3) Recheck DTC for ESP®. *Is DTC U1073 detected?*	Check ESP® control module power and ground circuit. If circuits are OK, substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	Check applicable control module power and ground circuit. If circuit is OK, substitute a known-good applicable control module and recheck.

DTC U1100: Lost Communication with ECM (Reception Error)

S7RS0B4604058

Wiring Diagram

Refer to "Wiring Diagram" under "DTC U1073: Control Module Communication Bus Off".

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
ECM message data is missing from CAN communication.	• CAN communication circuit • ECM • ESP® control module

DTC Troubleshooting

Step	Action	Yes	No
1	*Was "Electronic Stability Program Check" performed?*	Go to Step 2.	Go to "Electronic Stability Program System Check".
2	**DTC check for ESP®** 1) Check DTC for ESP®. *Is DTC U1100 and DTC U1073 detected together?*	Go to "DTC U1073: Control Module Communication Bus Off".	Go to Step 3.
3	**DTC check for ECM** 1) Check DTC for ECM. *Is DTC P1674 detected?*	Go to "DTC P1674: CAN Communication (Bus Off Error) in Section 1A".	Go to Step 4.

Step	Action	Yes	No
4	**Check each control module connectors** 1) Check connection of connectors of all control modules communicating by means of CAN. 2) Check DTC for ESP®. *Is DTC U1100 detected?*	Go to Step 5.	Check for intermittent trouble referring to "Intermittent and Poor Connection Inspection in Section 00".
5	**CAN communication circuit check** 1) Turn ignition switch to OFF position. 2) Disconnect connectors of ESP® control module and ECM communicating by means of CAN. 3) Check CAN communication circuit between ESP® control module and ECM for open, short and high resistance. *Is each CAN communication circuit in good condition?*	Repair or replace the CAN communication line.	Go to Step 6.
6	**CAN communication circuit check** 1) Disconnect connectors of all control modules communicating by means of CAN. 2) Check CAN communication circuit between control modules other than Step 5 for open, short and high resistance. *Is each CAN communication circuit in good condition?*	Go to Step 7.	Repair or replace the CAN communication line.
7	**DTC check for ESP®** 1) Connect connectors of disconnected control modules communicating by means of CAN. 2) Disconnect each connector. • ECM • Keyless start control module (if equipped) • Combination meter • Steering angle sensor • BCM 3) Recheck DTC for ESP®. *Is DTC U1100 detected?*	Check ESP® control module power and ground circuit. If circuits are OK, substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	Check applicable control module power and ground circuit. If circuit is OK, substitute a known-good applicable control module and recheck.

DTC U1126: Lost Communication with Steering Angle Sensor (Reception Error)

S7RS0B4604043

Wiring Diagram

Refer to "Wiring Diagram" under "DTC U1073: Control Module Communication Bus Off".

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
Steering angle sensor message data is missing from CAN communication.	• CAN communication circuit • Steering angle sensor • ESP® control module

DTC Troubleshooting

Step	Action	Yes	No
1	*Was "Electronic Stability Program Check" performed?*	Go to Step 2.	Go to "Electronic Stability Program System Check".
2	**DTC check for ESP®** 1) Check DTC for ESP®. *Is DTC U1126 and DTC U1073 detected together?*	Go to "DTC U1073: Control Module Communication Bus Off".	Go to Step 3.

Step	Action	Yes	No
3	**Check each control module connectors** 1) Check connection of connectors of all control modules communicating by means of CAN. 2) Check DTC for ESP®. *Is DTC U1126 detected?*	Go to Step 4.	Check for intermittent trouble referring to “Intermittent and Poor Connection Inspection in Section 00”.
4	**CAN communication circuit check** 1) Turn ignition switch to OFF position. 2) Disconnect connectors of ESP® control module, BCM and steering angle sensor communicating by means of CAN. 3) Check CAN communication circuit for open, short and high resistance. • Between ESP® control module and BCM • Between steering angle sensor and BCM *Is each CAN communication circuit in good condition?*	Repair or replace the CAN communication line.	Go to Step 5.
5	**CAN communication circuit check** 1) Disconnect connectors of all control modules communicating by means of CAN. 2) Check CAN communication circuit between control modules other than Step 4 for open, short and high resistance. *Is each CAN communication circuit in good condition?*	Go to Step 6.	Repair or replace the CAN communication line.
6	**DTC check for ESP®** 1) Connect connectors of disconnected control modules communicating by means of CAN. 2) Disconnect each connector. • ECM • Keyless start control module • Combination meter • Steering angle sensor • BCM 3) Check DTC for ESP®. *Is DTC U1126 detected?*	Check ESP® control module power and ground circuit. If circuits are OK, substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	Check applicable control module power and ground circuit. If circuit is OK, substitute a known-good applicable control module and recheck.

DTC U1140: Lost Communication with BCM (Reception Error)

S7RS0B4604045

Wiring Diagram

Refer to “Wiring Diagram” under “DTC U1073: Control Module Communication Bus Off”.

DTC Detecting Condition and Trouble Area

DTC Detecting Condition	Trouble Area
BCM message data is missing from CAN communication.	• CAN communication circuit • BCM • ESP® control module

DTC Troubleshooting

Step	Action	Yes	No
1	*Was “Electronic Stability Program Check” performed?*	Go to Step 2.	Go to “Electronic Stability Program System Check”.
2	**DTC check for ESP®** 1) Check DTC for ESP®. *Is DTC U1140 and DTC U1073 detected together?*	Go to “DTC U1073: Control Module Communication Bus Off”.	Go to Step 3.
3	**DTC check for BCM** 1) Check DTC for BCM. *Is DTC U1073 detected?*	Go to “DTC U1073 (No. 1073): Control Module Communication Bus Off in Section 10B”.	Go to Step 4.
4	**Check each control module connectors** 1) Check connection of connectors of all control modules communicating by means of CAN. 2) Check DTC for ESP®. *Is DTC U1140 detected?*	Go to Step 4.	Check for intermittent trouble referring to “Intermittent and Poor Connection Inspection in Section 00”.
5	**CAN communication circuit check** 1) Turn ignition switch to OFF position. 2) Disconnect connectors of ESP® control module and BCM communicating by means of CAN. 3) Check CAN communication circuit between ESP® control module and BCM for open, short and high resistance. *Is each CAN communication circuit in good condition?*	Repair or replace the CAN communication line.	Go to Step 6.
6	**CAN communication circuit check** 1) Disconnect connectors of all control modules communicating by means of CAN. 2) Check CAN communication circuit between control modules other than Step 5 for open, short and high resistance. *Is each CAN communication circuit in good condition?*	Go to Step 7.	Repair or replace the CAN communication line.
7	**DTC check for ESP®** 1) Connect connectors of disconnected control modules communicating by means of CAN. 2) Disconnect each connector. • ECM • Keyless start control module • Combination meter • Steering angle sensor • BCM 3) Check DTC for ESP®. *Is DTC U1140 detected?*	Check ESP® control module power and ground circuit. If circuits are OK, substitute a known-good ESP® hydraulic unit / control module assembly and recheck.	Check applicable control module power and ground circuit. If circuit is OK, substitute a known-good applicable control module and recheck.

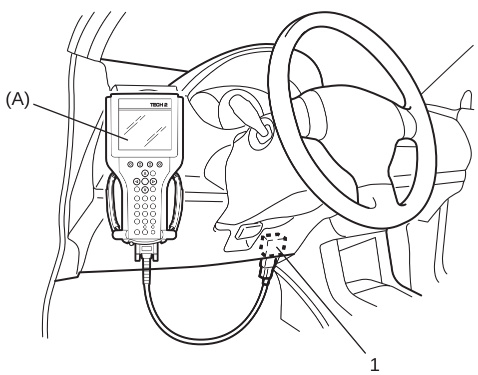
Repair Instructions

ESP® Hydraulic Unit Operation Check

S7RS0B4606025

1) Check that basic brake system other than ESP® is in good condition.
2) Check that battery voltage is 11 V or higher.
3) Lift up vehicle.
4) Set transmission to neutral and release parking brake.
5) Turn each wheel gradually by hand to check if braked ragging occurs. If it does, correct.
6) Connect SUZUKI scan tool to data link connector (DLC) (1) with ignition switch OFF.

Special tool
(A): SUZUKI scan tool



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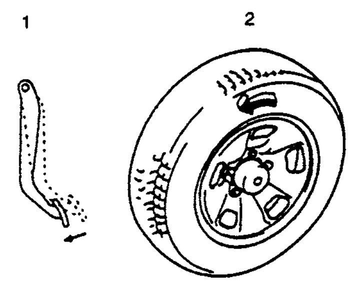
7) Turn ignition switch to ON position and select menu press / depress in “HYDRAULIC CONTROL TEST” under “miscellaneous test” (“MISC. TEST”) mode of SUZUKI scan tool.
   Refer to SUZUKI scan tool operator’s manual for further details.
8) Perform the following checks with help of another person.
   - Depressurization check
     Step on brake pedal (1) and then select testing wheel by SUZUKI scan tool and the wheel (2) should be turned by another person’s hand. At this time, check whether the wheel rotates freely due to brake depressurization.
   - Pressurization check
     Step off brake pedal (1) and then select testing wheel by SUZUKI scan tool and the wheel (2) should be turned by another person’s hand. At this time, check whether the wheel locks due to brake pressurization.

NOTE

Pressurization / Depressurization by SUZUKI scan tool is available for 0.5 second.



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9) Check for all 4-wheels condition respectively. If a faulty condition is found, replace hydraulic unit / control module assembly.
10) After completing the check, turn ignition switch to OFF position and disconnect SUZUKI scan tool from DLC.

Sensor Calibration

S7RS0B4606015

⚠ CAUTION

If any DTC(s) other than C1075, C1076 or C1078 are detected, sensor calibration can not be completed. Repair the detected DTC first.

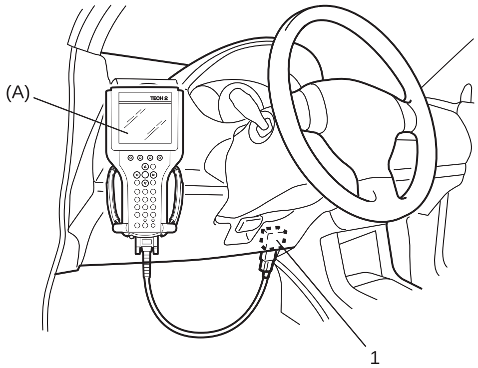
NOTE

Steering angle sensor calibration is needed when battery, “DOME” fuse or the steering angle sensor is removed.
This sensor calibration can be done with/ without SUZUKI Scan Tool.
When ESP® control module and/or yaw rate / G sensor assembly is removed, sensor calibration is needed with SUZUKI Scan Tool.

Sensor Calibration (Using SUZUKI Scan Tool)

1) Set steering wheel in straight-ahead position.
2) Connect SUZUKI scan tool to data link connector (DLC) (1) with ignition switch OFF.

Special tool
(A): SUZUKI scan tool



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3) Turn ignition switch to ON position and confirm that only any of DTC(s) C1075, C1076 and/or C1077 is detected. If any other DTC are detected, repair the detected DTC.
4) Park and level the vehicle with parking brake, stop engine with ignition switch ON, set steering in straight and without stepping on the brake pedal.

NOTE

Hold the above condition in Step 4) to calibrate sensor correctly until sensor calibration is completed.

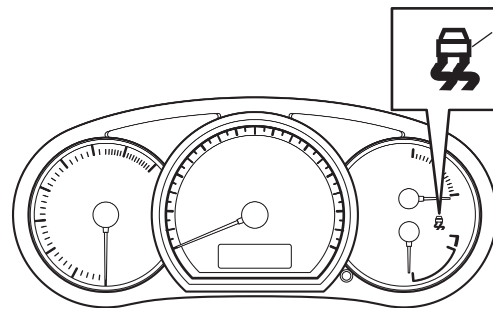
5) Select menu “SENSOR CALIBRATION” under “MISC. TEST” mode of SUZUKI scan tool and calibrate sensor. Refer to scan tool operator's manual for further derails.
6) After completing the calibration, turn ignition switch to OFF position and disconnect SUZUKI scan tool from DLC.

Steering Angle Sensor Calibration (Not Using SUZUKI Scan Tool)

1) Set steering wheel in straight-ahead position.
2) Connect battery terminals and/or fuse and start engine.

NOTE

When power is not supplied to the steering angle sensor by removing battery or fuse, DTC C1075 is detected and SLIP indicator lamp (1) flashes.
If DTC other than C1075 is detected, SLIP indicator lamp flushes and other indicator illuminate. In that case, repair the detected DTC first.



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3) Drive vehicle straight on level ground at 15 km/h (9.5 mph) or above for few seconds without spinning wheels. And confirm that SLIP indicator lamp is OFF.

ESP® Hydraulic Unit / Control Module Assembly On-Vehicle Inspection

S7RS0B4606027

⚠ **CAUTION**

Never disassemble ESP® hydraulic unit / control module assembly, loosen blind plug or remove motor. Performing any of these prohibited services will affect original performance of ESP® hydraulic unit / control module assembly.

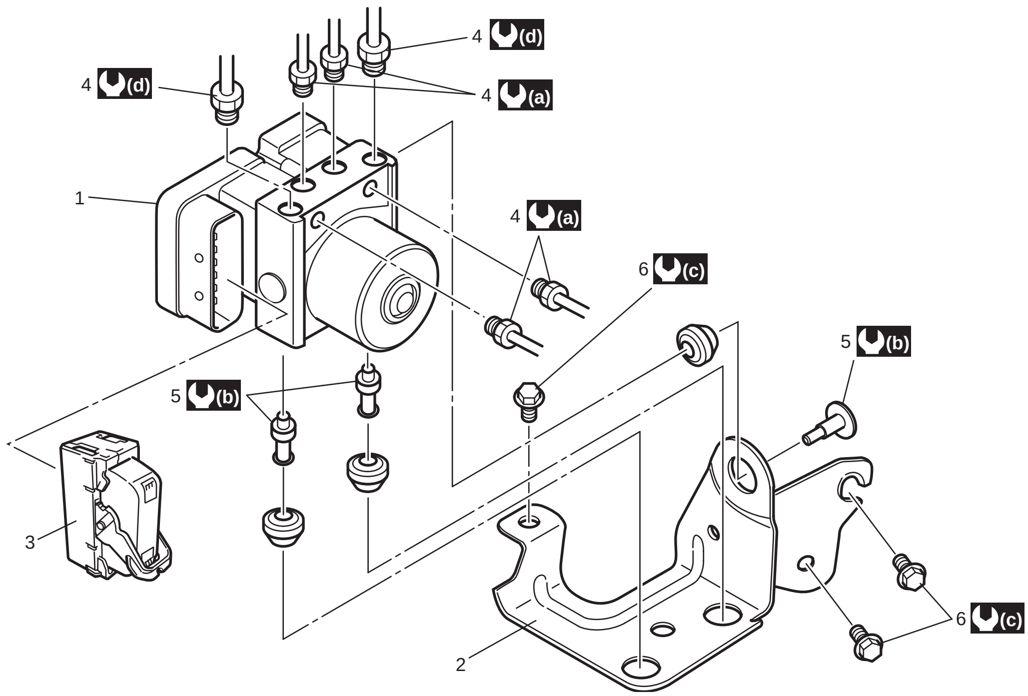
Check hydraulic unit for fluid leakage.
If any, repair or replace.

ESP® Hydraulic Unit / Control Module Assembly Removal and Installation

S7RS0B4606037

⚠ CAUTION

Never disassemble ESP® hydraulic unit / control module assembly loosen blind plug or remove motor. Performing any of these prohibited services will affect original performance of ESP® hydraulic unit / control module assembly.



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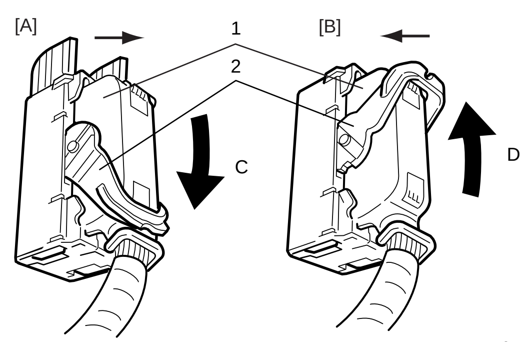
1. ESP® hydraulic unit / control module assembly	5. ESP® hydraulic unit / control module assembly bolt	(c) : 25 N·m (2.5 kgf-m, 18.0 lb-ft)
2. Bracket	6. ESP® hydraulic unit / control module assembly bracket bolt	(d) : 19 N·m (1.9 kgf-m, 13.5 lb-ft)
3. ESP® control module connector	(a) : 16 N·m (1.6 kgf-m, 11.5 lb-ft)	
4. Brake pipe flare nut	(b) : 9 N·m (0.9 kgf-m, 6.5 lb-ft)	

Removal

⚠ CAUTION

- **Do not give an impact to hydraulic unit.**
- **Use care not to allow dust to enter hydraulic unit.**
- **Do not place hydraulic unit on its side or upside down. Handling it in inappropriate way will affect its original performance.**

1) Disconnect negative (–) cable from battery.
2) Disconnect ESP® control module connector (1) as shown in figure.



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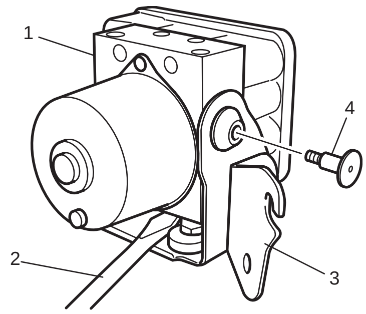
[A]: Disconnect	C: Pull down to disconnect
[B]: Connect	D: Pull up to connect

3) Remove front brake pipe referring to "Front Brake Hose / Pipe Removal and Installation in Section 4A".
4) Remove ESP® hydraulic unit / control module with bracket from vehicle by removing bracket bolts.
5) Remove bolt (4) and pull out ESP® hydraulic unit / control module assembly (1) from bracket (3) using flat end rod or the like (2).



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Installation

1) Install hydraulic unit / control module assembly and by reversing removal procedure.

   Tightening torque
   Brake pipe flare nut: 16 N·m (1.6 kgf-m, 11.5 lb-ft)
   ESP® hydraulic unit / control module assembly bolt: 9 N·m (0.9 kgf-m, 6.5 lb-ft)
   ESP® hydraulic unit / control module assembly bracket bolt: 25 N·m (2.5 kgf-m, 18.0 lb-ft)

2) Bleed air from brake system referring to "Air Bleeding of Brake System in Section 4A".
3) Check each installed part for fluid leakage.
4) Connect SUZUKI Scan Tool.
5) Turn ignition switch to ON position. And SLIP indicator lamp flush. (Other than replace with new one) If other than SLIP indicator lamp light, check DTC and repair it.
6) Turn ignition switch to ON position. And ESP® warning lamp, SLIP indicator lamp, ESP® OFF lamp, Brake warning lamp lights and ABS warning lamp flush. (Replace new one)
7) Check DTC.

   NOTE

   If any DTC(s) other than C1075, C1076 or C1078 are detected, sensor calibration can not be completed. Repair the detected it(s) first.

8) Perform "Sensor Calibration".
9) Perform "ESP® Hydraulic Unit Operation Check".
10) Turn ignition switch to OFF position once and then ON position. In this state, make sure that indicator light and warning light turns off.
11) Check DTC(s) are not stored in hydraulic unit / control module.

Front / Rear Wheel Speed Sensor On-Vehicle Inspection

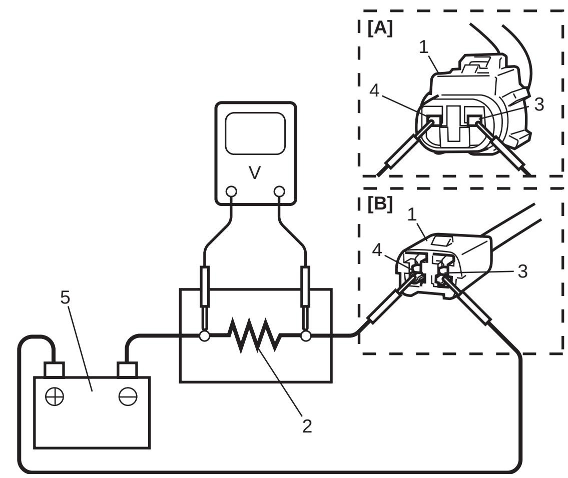
S7RS0B4606028

⚠ CAUTION

Incorrect voltage and/or wrong connection cause damage to wheel speed sensor.

Output Voltage Inspection

1) Disconnect negative (–) cable from battery.
2) Hoist vehicle a little.
3) Disconnect wheel speed sensor connector.
4) Disconnect wheel speed grommet from vehicle body.
5) Set up measuring devices as shown in figure, the resistance to 115 Ω and the power supply voltage to12 V.



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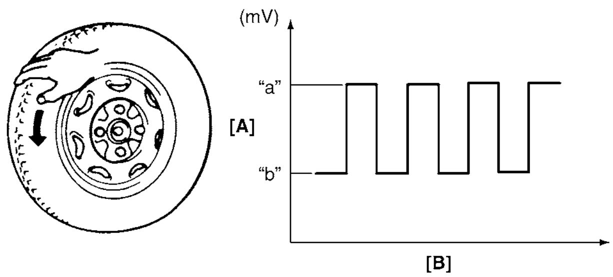
[A]: Front wheel speed sensor	3. "WHT" wire terminal
[B]: Rear wheel speed sensor	4. "BLK" wire terminal
1. Wheel speed sensor connector	5. Power supply (12 V)
2. Resistance (115 Ω)	

6) Measure voltage at resistance without wheel rotation.
If voltage is out of specification, check sensor, mating encoder and their installation conditions.

Voltage at the resistance (115 Ω) without wheel rotation
680 to 960 mV

7) Measure voltage at resistance with wheel rotation and confirm voltage alternately changes between high and low voltages.
If voltage does not change with wheel rotation, check sensor, mating encoder and their installation conditions.

Voltage at the resistance (115 Ω) with wheel rotation
High voltage "a": 1360 to 1930 mV
Low voltage "b": 680 to 960 mV



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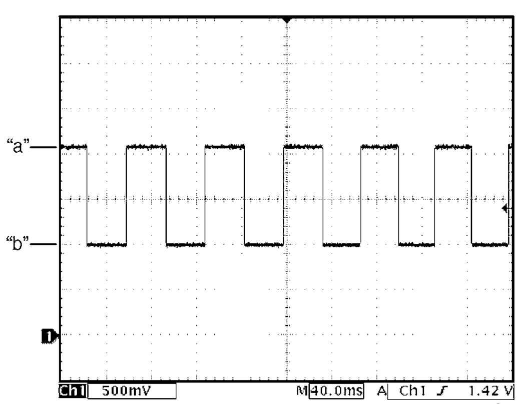
[A]: Voltage	[B]: Time

Reference
When using oscilloscope for this check, check if peak-to-peak voltage and waveform meet specification.

Peak-to-peak Voltage at the resistance (115 Ω) with wheel rotation
High voltage "a": 1360 to 1930 mV
Low voltage "b": 680 to 960 mV



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Front Wheel Speed Sensor Removal and Installation

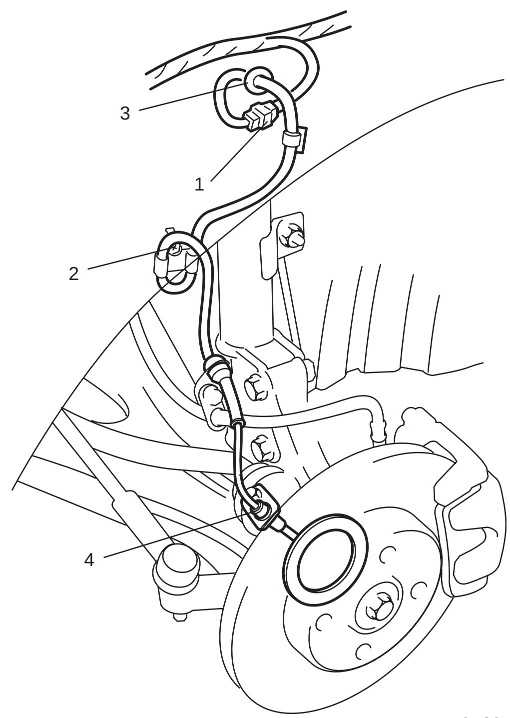
S7RS0B4606029

Removal

1) Disconnect negative (–) cable from battery.
2) Disconnect front wheel speed sensor coupler (1).
3) Hoist vehicle and remove wheel.
4) Remove harness clamp, clamp bolts (2) and grommet (3).
5) Remove front wheel speed sensor (4) from knuckle.

NOTE

- **Do not pull wire harness when removing front wheel speed sensor.**
- **Do not cause damage to surface of front wheel speed sensor and do not allow dust, etc. to enter its installation hole.**



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Installation

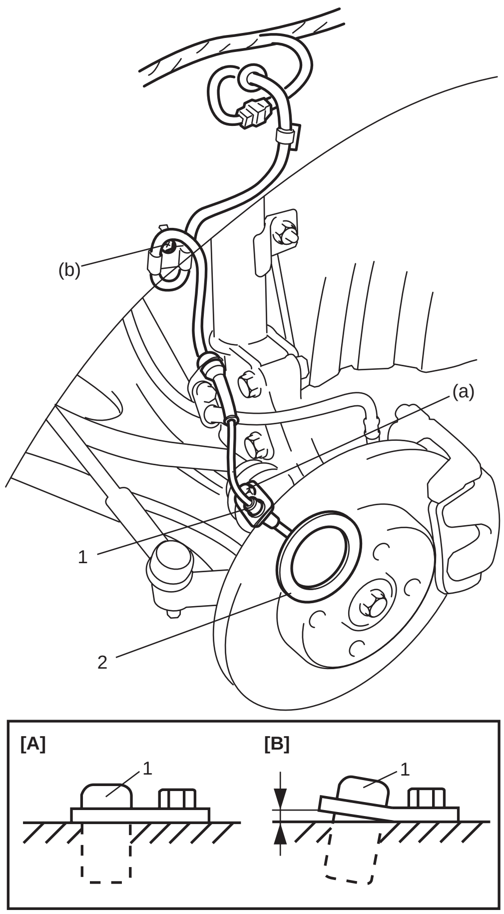
⚠ CAUTION

Do not pull or twist wire harness more than necessary when installing front wheel speed sensor.

1) Check that no foreign material is attached to sensor(1) and mating encoder (2).
2) Install it by reversing removal procedure.

Tightening torque
Front wheel speed sensor bolt (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)
Front wheel speed sensor harness clamp bolt (b): 11 N·m (1.1 kgf-m, 8.0 lb-ft)

3) Check that there is no clearance between sensor and knuckle.



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[A]: OK	[B]: NG

Front Wheel Speed Sensor Inspection

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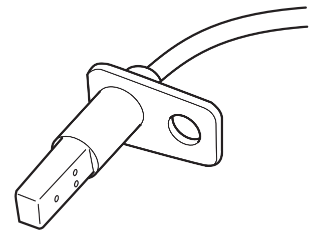
Check sensor for damage.
If any malcondition is found, replace.



I5JB0A450031-01

Rear Wheel Speed Sensor Removal and Installation

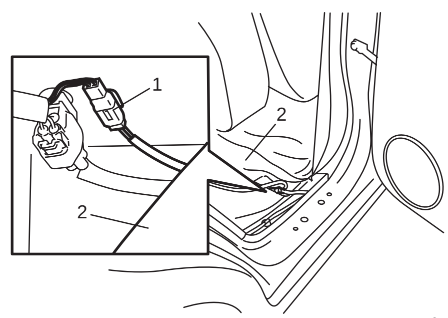
S7RS0B4606031

⚠ CAUTION

- **Do not pull wire harness when removing rear wheel speed sensor.**
- **Do not cause damage to surface of rear wheel speed sensor and do not allow dust, etc. to enter its installation hole.**

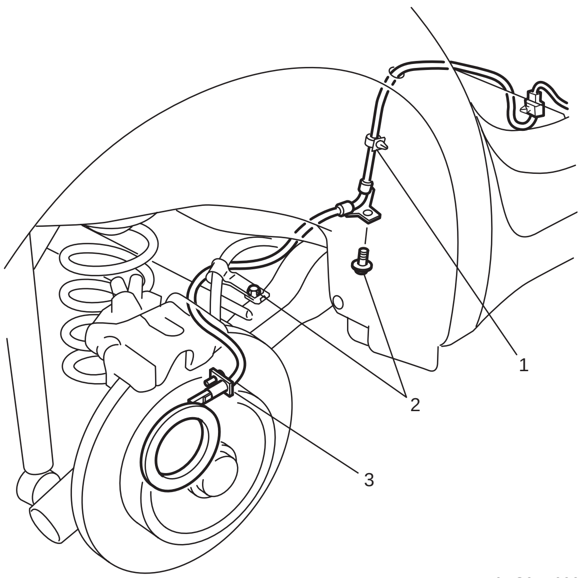
Removal

1) Disconnect negative (–) cable from battery.
2) Remove quarter inner trim to brake referring to “Floor Carpet Removal and Installation in Section 9H”.
3) Turn over floor carpet (2) and disconnect connector (1) of wheel speed sensor.



I6RS0B460035-02

4) Hoist vehicle and remove wheel.
5) Remove harness clamp (1) and clamp bolts (2).
6) Remove rear wheel speed sensor (3) from knuckle.



I6RS0B460036-02

Installation

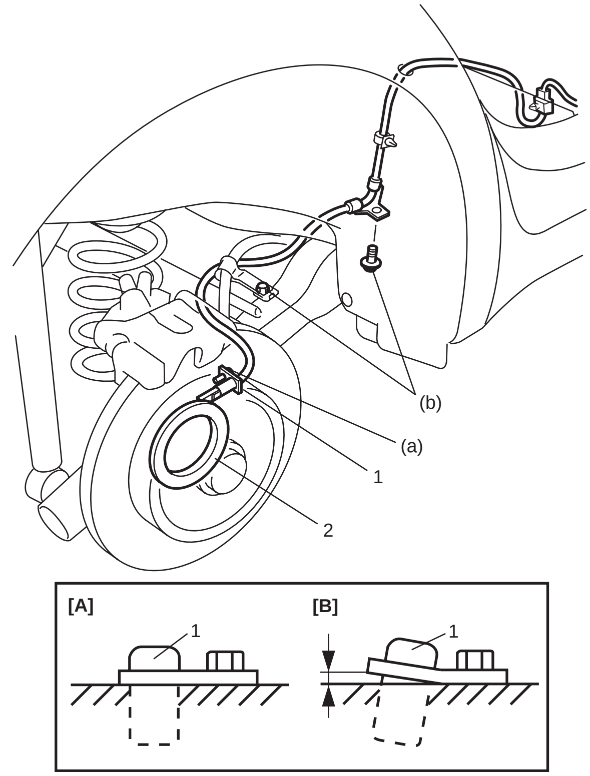
⚠ **CAUTION**

Do not pull or twist wire harness more than necessary when installing rear wheel speed sensor.

Reverse removal procedure for installation noting the following.

- Check that no foreign material is attached to sensor(1) and mating encoder (2).
- Be sure to install wheel speed sensor (1) and its bolt at the correct position as shown in figure.
  Tighten sensor bolt and harness clamp bolts to specified torque.

  Tighttening torque
  Rear wheel speed sensor bolt (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)
  Rear wheel speed sensor harness clamp bolt (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)
- Check that there is no clearance between sensor and brake back plate.



I6RS0B460037-02

[A]: OK	[B]: NG

Rear Wheel Speed Sensor Inspection

S7RS0B4606032

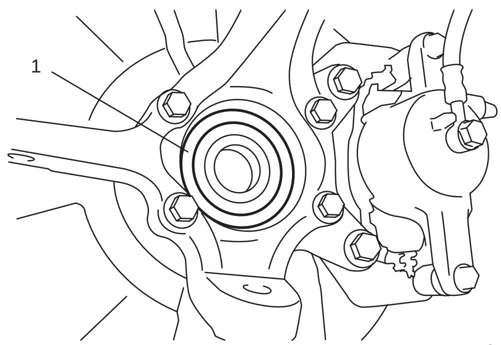
Refer to “Front Wheel Speed Sensor Inspection” since rear wheel speed sensor is the same as front wheel speed sensor.

Front Wheel Encoder On-Vehicle Inspection

S7RS0B4606033

Before inspect front wheel encoder, remove front drive shaft or front wheel spindle referring to "Front Drive Shaft Assembly Removal and Installation in Section 3A".

- Check encoder (1) for being crack, damaged or deformed.
- Turn wheel and check if encoder rotation is free from eccentricity and looseness.
- Check that no foreign material is attached.
  If any faulty is found, clean encoder or replace wheel bearing. Refer to "Front Wheel Hub, Steering Knuckle and Wheel Bearing Removal and Installation in Section 2B".



I5JB0A450034-01

Front Wheel Encoder Removal and Installation

S7RS0B4606034

⚠ CAUTION

Front wheel encoder is included in front wheel bearing. If front wheel encoder needs to replaced, replace it as a front wheel bearing.

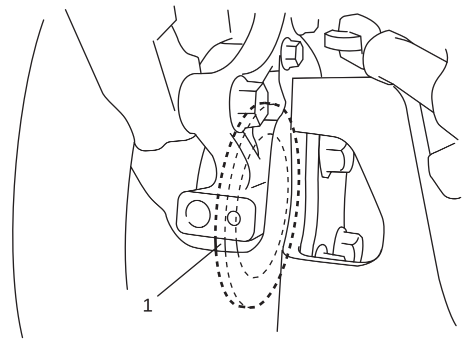
For removal and installation of front wheel bearing, referring to "Front Wheel Hub, Steering Knuckle and Wheel Bearing Removal and Installation in Section 2B".

Rear Wheel Encoder On-Vehicle Inspection

S7RS0B4606035

Before inspect rear wheel encoder, hoist vehicle and remove wheel.

- Check encoder (1) for being crack, damaged or deformed.
- Turn wheel and check if encoder rotation is free from eccentricity and looseness.
- Check that no foreign material is attached.
  If any faulty is found, clean encoder or replace rear wheel hub assembly. Refer to "Rear Wheel Hub Removal and Installation in Section 2C".



I6RS0B460038-03

Rear Wheel Encoder Removal and Installation

S7RS0B4606036

⚠ CAUTION

Rear wheel encoder is included in rear wheel hub assembly. If rear wheel encoder needs to replaced, replace it as a rear wheel hub assembly.

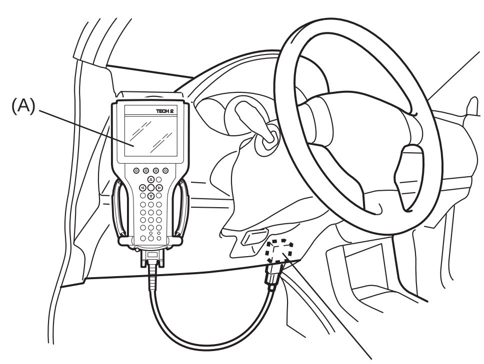
For removal and installation of front wheel hub assembly, referring to "Rear Wheel Hub Removal and Installation in Section 2C".

Master Cylinder Pressure Sensor On-Vehicle Inspection

S7RS0B4606016

1) Calibrate yaw rate / G sensor assembly referring to "Sensor Calibration".
2) Check that basic brake system other than ESP® refer to "Brakes Diagnosis Note in Section 4A".
3) Connect SUZUKI scan tool to data link connector (DLC) (1) with ignition switch OFF.

   Special tool
   (A): SUZUKI scan tool



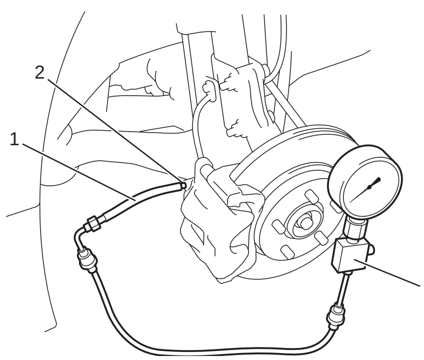
I4RS0B450003-01

4) Turn ignition switch to ON position and select menu “DATA LIST” mode of SUZUKI scan tool. Refer to scan tool operator's manual for further derails.
5) When brake pedal is released, check “Master Cyl Press” under “DATA LIST” of SUZUKI scan tool. If pressure is out of specification, replace ESP® hydraulic unit / control module assembly.

Master cylinder pressure specification
Brake pedal released: 0 ± 0.8 MPa (0 ± 8 kg/cm², 0 ± 113 psi)

6) Hoist vehicle and remove right-side front wheel.
7) Connect special tool with rubber hose (1) to Front brake caliper bleeder plug (2).

Special tool
(A): 09956–02311



I6JB01460025-01

8) When bleeder plug loosen and depress brake pedal to make special tool gauge reading 10 MPa (100 kg/cm², 1422 psi), check “Master Cyl Press” under “DATA LIST” of SUZUKI scan tool. If pressure displayed on SUZUKI scan tool is out of specification, replace ESP® hydraulic unit / control module assembly.

Master cylinder pressure specification
Brake pedal depressed 10 MPa (100 kg/cm², 1422 psi): 10 ± 1.2 MPa (100 ± 12 kg/cm², 1422 ± 170 psi)

9) After completing the check, turn ignition switch to OFF position and disconnect SUZUKI scan tool from DLC.
10) Tighten bleeder plug and bleed air from brake system, referring to “Air Bleeding of Brake System in Section 4A”.

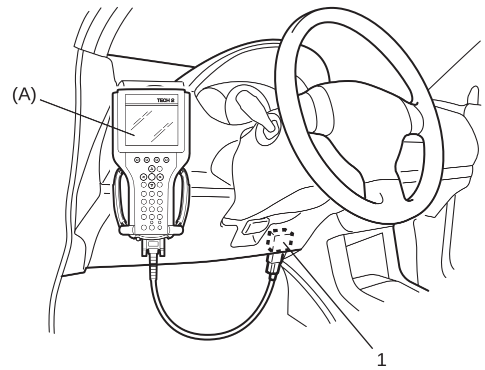
Yaw Rate / G Sensor Assembly On-Vehicle Inspection

S7RS0B4606017

Lateral G Inspection

1) Calibrate yaw rate / G sensor assembly referring to “Sensor Calibration”.
2) Park and level the vehicle with parking brake and fix wheels with chokes.
3) Check yaw rate / G sensor assembly installation condition.
4) Connect SUZUKI scan tool to data link connector (DLC) (1) with ignition switch OFF.

Special tool
(A): SUZUKI scan tool



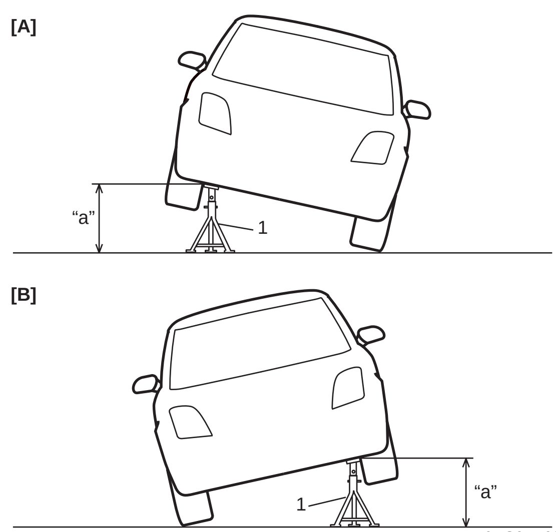
I4RS0B450003-01

5) Turn ignition switch to ON position and select menu “DATA LIST” mode of SUZUKI scan tool. Refer to scan tool operator's manual for further derails.
6) Check “G Sensor (lateral)” under “DATA LIST” of SUZUKI scan tool in the following vehicle conditions.
   - Level condition
   - Right-up condition
   - Left-up condition

   If Lateral G condition is out of specification, replace yaw rate / G sensor assembly.

Lateral G specification

Vehicle condition	G Sensor (lateral)
Level condition	**0 ± 0.1 G**
Right-up condition	**0.1 ± 0.1 G**
Left-up condition	**–0.1 ± 0.1 G**



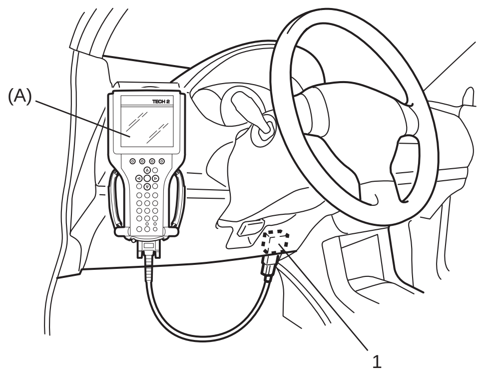
I6RS0B460039-02

[A]: Right-up condition	“a”: Approx 350 mm (13.78 in.)
[B]: Left-up condition	1. Safety stand

Yaw Rate Inspection

1) Calibrate yaw rate / G sensor assembly referring to "Sensor Calibration".
2) Check yaw rate / G sensor assembly installation condition.
3) Connect SUZUKI scan tool to data link connector (DLC) (1) with ignition switch OFF.

Special tool
(A): SUZUKI scan tool



I4RS0B450003-01

4) Turn ignition switch to ON position and select menu "DATA LIST" mode of SUZUKI scan tool. Refer to scan tool operator's manual for further derails.
5) Check "Yaw rate sensor" under "DATA LIST" of SUZUKI scan tool in the following vehicle conditions.
   - Parking condition
   - Drive vehicle in right turning condition with steering wheel fully turned
   - Drive vehicle in left turning condition with steering wheel fully turned

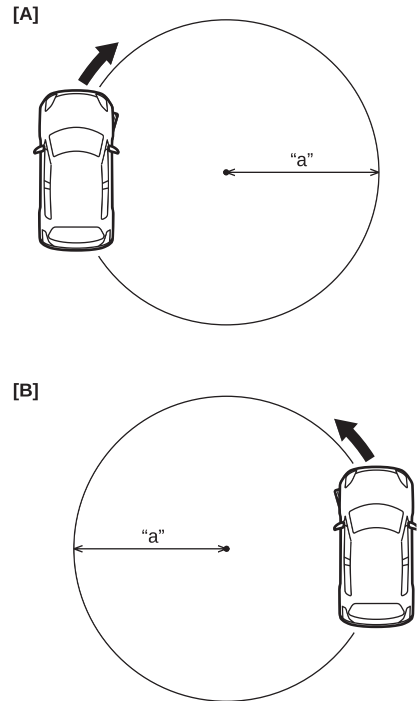
   If yaw rate condition is out of specification, replace yaw rate / G sensor assembly.

Yaw rate specification

Vehicle condition	Yaw rate
Parking	**0 ± 4 deg/s**
Right turning	**30 ± 4 deg/s**
Left turning	**–30 ± 4 deg/s**

NOTE

- **Drive the vehicle on level ground and at 10 km/h (6.2 mph).**
- **Minimum turning radius is 5.2 m (17.1 ft).**



I6RS0B460040-02

[A]: Right turning	"a": Approx 5.2 m (17.1 ft.)
[B]: Left turning	

Yaw Rate / G Sensor Assembly Removal and Installation

S7RS0B4606018

⚠ CAUTION

- **When yaw rate / G sensor assembly is replaced, ESP® control module needs zero calibration. Perform zero calibration by SUZUKI scan tool referring to "Sensor Calibration".**
- **Regarding yaw rate / G sensor assembly removal/installation, confirm specified torque and never use impact wrench to avoid damage.**
- **When handling the yaw rate / G sensor assembly, be careful not to drop it or apply an impact to it.**
  If an excessive impact was applied, never attempt disassembly or repair but replace it with a new one.

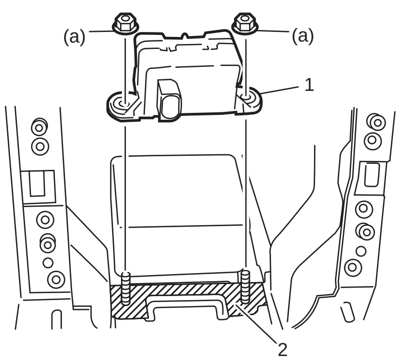
Removal

1) Disconnect negative (–) cable at battery.
2) Remove front console box referring to “Console Box Components in Section 9H”.
3) Disconnect connector from yaw rate / G sensor assembly.
4) Remove yaw rate / G sensor assembly from sensor bracket.

Installation

1) Before installing yaw rate / G sensor assembly (1), check installing condition as follows.
   - Deformations around sensor installation area (2) (in sensor bracket).
   - Foreign matters on mating surface between sensor and sensor bracket.
2) Install yaw rate / G sensor assembly (1) to floor panel.

   Tightening torque
   Yaw rate / G sensor assembly nut (a): 8 N·m (0.8 kgf-m, 6.0 lb-ft)



I6RS0B460041-02

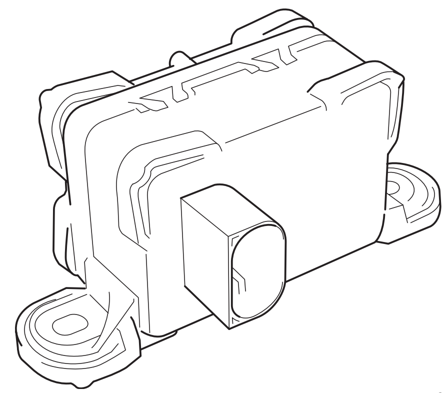
3) Connect connector to yaw rate / G sensor assembly.
4) Install console box referring to “Console Box Components in Section 9H”.
5) Connect negative (–) cable to battery.
6) After completing installation, calibrate yaw rate / G sensor assembly referring to “Sensor Calibration”.

Yaw Rate / G Sensor Inspection

S7RS0B4606019

- Check sensor for dents, cracks or deformation.
- Check sensor connector (sensor side and harness side) and sensor connector lock mechanism for damage or crack.
- Check connector terminals for bend, corrosion or rust.

If it is found faulty, replace yaw rate / G sensor assembly.



I6JB01460031-01

Steering Angle Sensor On-Vehicle Inspection

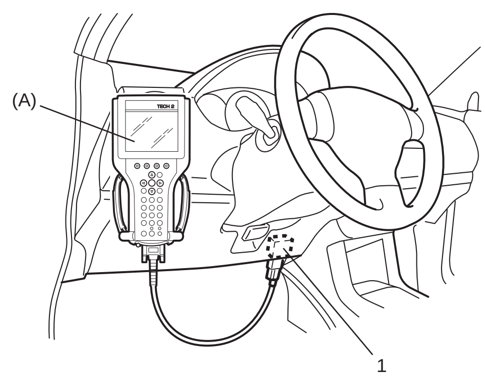
S7RS0B4606020

⚠ **CAUTION**

Before each inspection, confirm steering angle sensor calibration is completed.
If calibration is incompleted, calibrate sensor referring to “Sensor Calibration”.

1) Connect SUZUKI scan tool to data link connector (DLC) (1) with ignition switch OFF.

   Special tool
   (A): SUZUKI scan tool



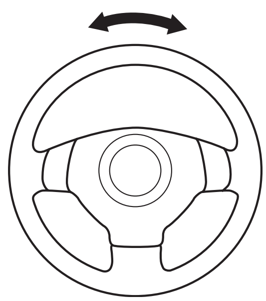
I4RS0B450003-01

2) Turn ignition switch to ON position and select menu “DATA LIST” mode of SUZUKI scan tool.
   Refer to scan tool operator's manual for further derails.
3) Check “Steering angle Sen” under “DATA LIST” of SUZUKI scan tool in the following steering wheel conditions.
   - Front wheels in straight-ahead position
   - Rotate steering wheel a round in clockwise (counter clockwise) from straight-ahead position

   If steering angle condition is out of specification, replace steering angle sensor.

Steering angle Specification

Vehicle condition	Steering angle
Front wheels in straight-ahead position	**0 ± 3°**
Rotate steering wheel a round in clockwise	**360 ± 3°**
Rotate steering wheel a round in counterclockwise	**–360 ± 3°**



I6JB01460032-01

Steering Angle Sensor Removal and Installation

S7RS0B4606021

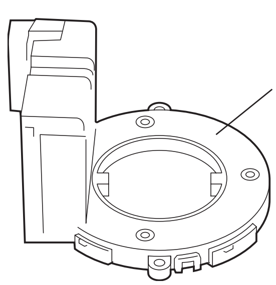
Refer to “Steering Angle Sensor Removal and Installation in Section 6B”.

Steering Angle Sensor Inspection

S7RS0B4606022

- Check sensor for dents, cracks or deformation.
- Check sensor connector (sensor side and harness side) and sensor connector lock mechanism for damage or crack.
- Check connector terminals for bend, corrosion or rust.

If it is found faulty, replace steering angle sensor (1).



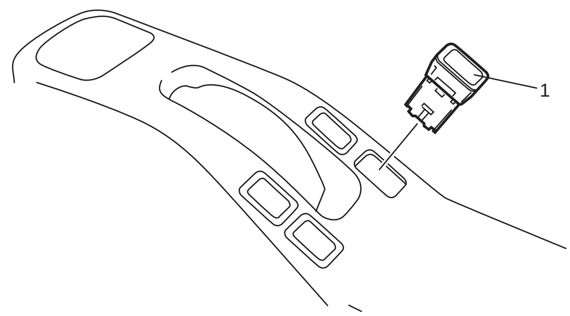
I6JB01460033-01

ESP® OFF Switch Removal and Installation

S7RS0B4606023

Removal

1) Disconnect negative (–) cable at battery.
2) Remove rear console box referring to “Console Box Components in Section 9H”.
3) Disconnect ESP® OFF switch coupler.
4) Remove ESP® OFF switch (1) from rear console box (2).



I6RS0B460042-02

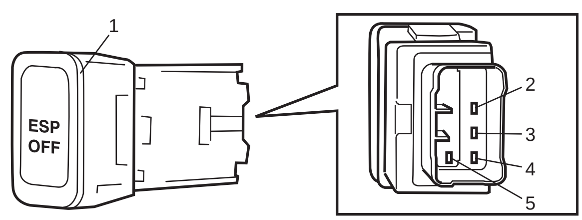
Installation

Reverse removal procedure.

ESP® OFF Switch Inspection

S7RS0B4606024

Check for continuity between terminals at each switch position.
If check result is not as specified, replace ESP® OFF switch.



	2	3	4	5
[A]			○—	—○
[B]	○—	—○	○—	—○

I6RS0B460043-02

[A]: Free	[B]: Push

Specifications

Tightening Torque Specifications

S7RS0B4607001

Fastening part	Tightening torque			Note
	N⋅m	kgf-m	lb-ft	
Brake pipe flare nut	16	1.6	11.5	☞
ESP® hydraulic unit / control module assembly bolt	9	0.9	6.5	☞
ESP® hydraulic unit / control module assembly bracket bolt	25	2.5	18.0	☞
Front wheel speed sensor bolt	11	1.1	8.0	☞
Front wheel speed sensor harness clamp bolt	11	1.1	8.0	☞
Rear wheel speed sensor bolt	11	1.1	8.0	☞
Rear wheel speed sensor harness clamp bolt	11	1.1	8.0	☞
Yaw rate / G sensor assembly nut	8	0.8	6.0	☞

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

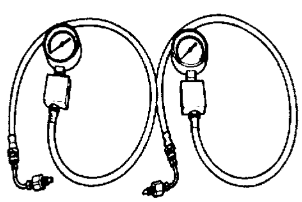
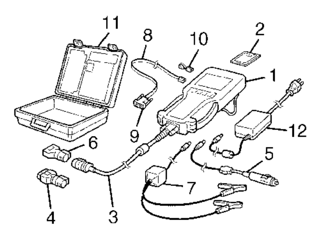
NOTE

The specified tightening torque is also described in the following.
“ESP® Hydraulic Unit / Control Module Assembly Removal and Installation”

Special Tools and Equipment

Special Tool

S7RS0B4608001

09956–02311 Brake pressure 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 loop back adapter, 7. Battery power cable, 8. RS232 cable, 9. RS232 adapter, 10. RS232 loop back connector, 11. Storage case, 12.☞ / ☞ / ☞ / ☞ / ☞ / ☞ / ☞ 

Section 5

Transmission / Transaxle

CONTENTS

5

Precautions

Precautions

Precautions on Transmission / Transaxle

S7RS0B5000001

Air Bag Warning
Refer to “Air Bag System Service Warning in Section 00”.

Precautions in Diagnosing Trouble
Refer to “Precautions in Diagnosing Trouble in Section 5A”.

Precautions for Disassembly and Reassembly
Refer to “Precautions for Disassembly and Reassembly in Section 5A”.

Precaution for CAN Communication System
Refer to “Precaution for CAN Communication System in Section 00”.

Precautions for Electrical Circuit Service
Refer to “Precautions for Electrical Circuit Service in Section 00”.

Automatic Transmission/Transaxle

Precautions

Precautions in Diagnosing Trouble

S7RS0B5100001

- Do not disconnect couplers from TCM, battery cable from battery, TCM ground wire harness from engine or main fuse before checking the diagnostic information (DTC, freeze frame data, etc.) stored in TCM memory. Such disconnection will clear memorized information in TCM memory.
- Diagnostic information stored in TCM memory can be cleared as well as checked by using SUZUKI scan tool or generic scan tool. Before using scan tool, read its Operator's (Instruction) Manual carefully to have good understanding as to what functions are available and how to use it.
  It is indistinguishable which module turns on MIL because not only ECM but also TCM turns on MIL. Therefore, check both ECM and TCM for DTC when MIL lights on.
  When checking TCM for DTC, keep in mind that DTC is displayed on the scan tool as follows depending on the scan tool used.
  – SUZUKI scan tool displays DTC detected by TCM.
  – Generic scan tool displays DTC detected by each of ECM and TCM simultaneously.
- Using SUZUKI scan tool the diagnostic information stored in TCM memory can be checked and cleared as well. Before its use, be sure to read Operator's Manual supplied with it carefully to have good understanding of its functions and usage.
- Be sure to read "Precautions for Electrical Circuit Service in Section 00" before inspection and observe what is written there.
- TCM replacement
  – When substituting a known-good TCM, check that all relays and actuators have resistance of specified value.
    Neglecting this check may result in damage to good TCM.
- Communication of ECUs, ECM, TCM, ABS control module, keyless start control module and BCM is established by CAN (Controller Area Network). Therefore, handle CAN communication line with care referring to "Precaution for CAN Communication System in Section 00".

Precautions for Disassembly and Reassembly

S7RS0B5100002

When repairing automatic transaxle, it is necessary to conduct the on-vehicle test to investigate where the cause of the trouble lies first.
Then whether overhaul should be done or not is determined. If the transaxle is disassembled without such preliminary procedure, not only the cause of the trouble would be unknown, but also a secondary trouble may occur and often time would be wasted.
As the automatic transaxle consists of high precision component, the following cautions should be strictly observed when handling its parts in disassembly and reassembly.

- Disassembling valve body assembly is prohibited essentially. However, a few parts can be disassembled. When disassembling valve body component parts, confirm whether their parts are allowed to disassemble or not referring to "Valve Body Assembly Disassembly and Reassembly".
- When component part of forward clutch, direct clutch, 2nd brake and/or O/D and 2nd coast brake, namely clutch disc, brake disc, retaining plate and/or separator plate, have been replaced, all learned contents, which have been stored in TCM memory by executing learning control, should be initialized referring to "Learning Control Initialization".
- Make sure to wash dirt off from the transaxle so that no such dirt will enter the transaxle during dismounting and remounting.
- Select a clean place free from dust and dirt for overhauling.
- Place a rubber mat on the work bench to protect parts from damage.
- Work gloves or shop cloth should not be used. (Use a nylon cloth or a paper towel.)
- When separating the case joint, do not pry with a screwdriver or such but tap with a plastic hammer lightly.
- Make sure to wash dirt off from the transaxle so that no such dirt will enter the transaxle during disassembly and reassembly.
- Wash the disassembled parts in ATF (Automatic Transaxle Fluid) or kerosene (using care not to allow ATF or kerosene to get on your face, etc.) and confirm that each fluid passage is not clogged by blowing air into it. But use kerosene to wash the discs, resin washers and rubber parts.
- Replace each gasket, oil seal and O-ring with a new one.
- Apply ATF to sliding or rotating parts before reassembly.

⚠ CAUTION

- **Keep component parts in group for each subassembly and avoid mixing them up.**
- **Clean all parts with cleaning solvent thoroughly and air dry them.**
- **Use kerosene or automatic transaxle fluid as cleaning solvent.**
- **Do not use wiping cloths or rags to clean or dry parts.**
- **All oil passages should be blown out and checked to make sure that they are not obstructed.**
- **Keep face and eyes away from solvent spray while air blowing parts.**
- **Check mating surface for irregularities and remove them, if any, and clean it again.**
- **Soak new clutch discs and brake discs in transaxle fluid for at least 2 hours before assembly.**
- **Replace all gaskets and O-ring with new ones.**
- **Apply automatic transaxle fluid to all O-rings.**
- **When installing seal ring, be careful so that it is not expanded excessively, extruded or caught.**
- **Replace oil seals that are removed and apply grease to their lips.**
- **Before installing, be sure to apply automatic transaxle fluid to sliding, rolling and thrusting surface of all component part. Also after installation, make sure to check each part for proper operation.**
- **Always use torque wrench when tightening bolts.**

- A new discs should be soaked in ATF at least 2 hours before use.

Part Inspection and Correction Table

Part	Inspect for	Correction
Casted part, machined part	Small flaw, burr	Remove with oil stone.
	Deep or grooved flaw	Replace part.
	Clogged fluid passage	Clean with air or wire.
	Flaw on installing surface, residual gasket	Remove with oil stone or replace part.
	Crack	Replace part.
Bearing	Unsmooth rotation	Replace.
	Streak, pitting, flaw, crack	Replace.
Bushing, thrust washer	Flaw, burr, wear, burning	Replace.
Oil seal, gasket	Flawed or hardened seal ring	Replace.
	Worn seal ring on its periphery or side	Replace.
	Piston seal ring, oil seal, gasket, etc.	Replace.
Gear	Flaw, burr	Replace.
	Worn gear tooth	Replace.
Splined part	Burr, flaw, torsion	Correct with oil stone or replace.
Snap ring	Wear, flaw, distortion	Replace.
	No interference	Replace.
Thread	Burr	Replace.
	Damage	Replace.
Spring	Settling, sign of burning	Replace.
Friction plate	Wear, burning, distortion, damaged claw	Replace.
Separator plate, retaining plate	Wear, burning, distortion, damaged claw	Replace.
Sealing surface (where lip contacts)	Flaw, rough surface, stepped wear, foreign material	Replace.

General Description

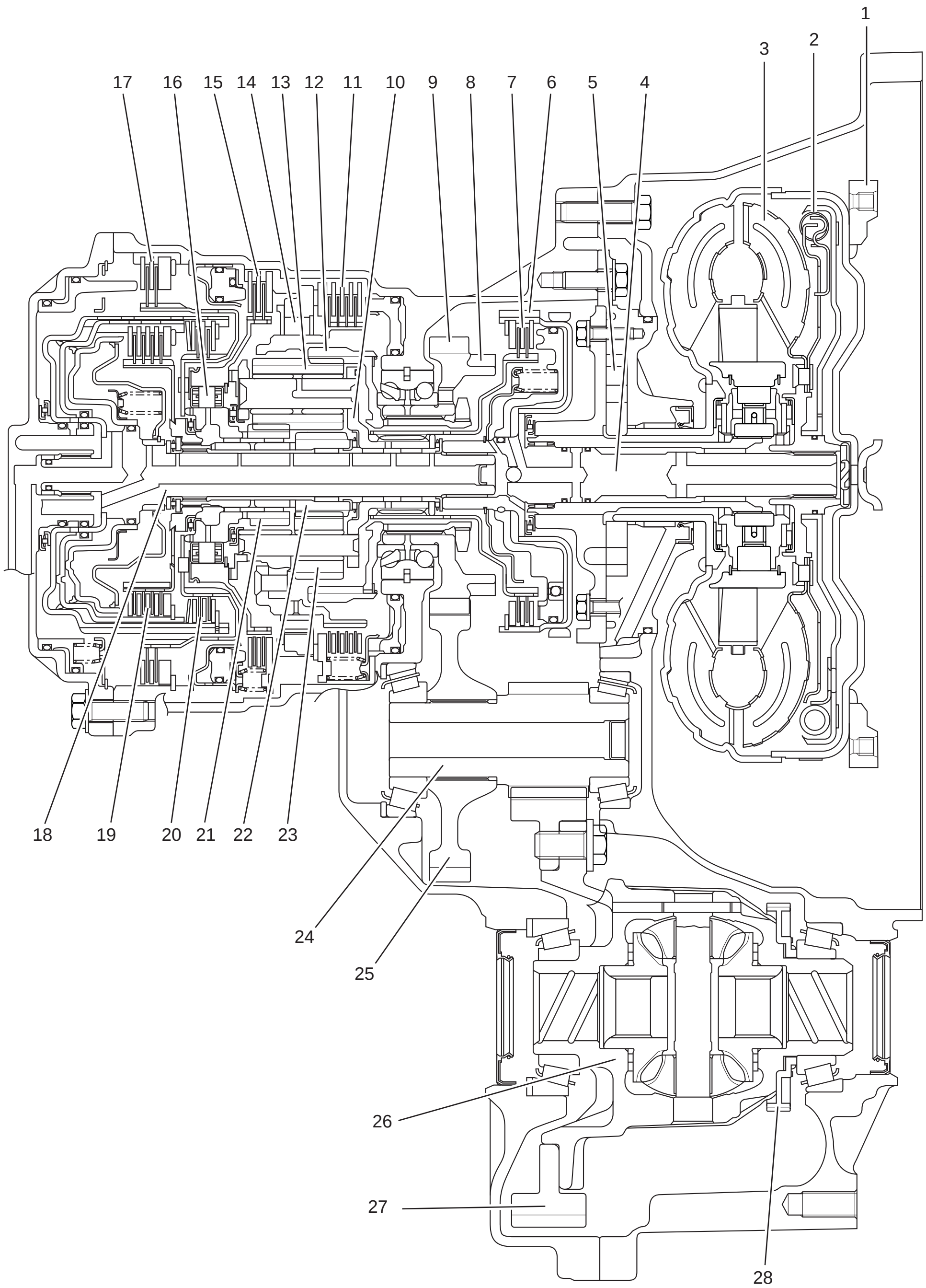
A/T Description

S7RS0B5101001

This automatic transaxle is electronic control full automatic transaxle with forward 4-speed and reverse 1-speed.
The torque converter is a 3-element, 1-step and 2-phase type and is equipped with an automatically controlled lock-up mechanism.
The gear change device consists of a ravigneau type planetary gear unit, 3 multiple disc type clutches, 3 multiple disc type brakes and 2 one-way clutches.
The hydraulic pressure control device consists of a valve body assembly, pressure control solenoid valve (linear solenoid), 2 shift solenoid valves, TCC pressure control solenoid valve (linear solenoid) and a timing solenoid valve.
Optimum line pressure complying with engine torque is produced by the pressure control solenoid valve in dependence upon control signal from transmission control module (TCM). This makes it possible to control the line pressure with high accuracy in accordance with the engine power and running conditions to achieve smooth shifting characteristics and high efficiency.
A clutch-to-clutch control system is provided for shifting between 3rd gear and 4th gear. This clutch-to-clutch control system is made to function optimally, so that hydraulic pressure controls such as shown below are conducted.

- When upshifting from 3rd gear to 4th gear, to adjust the drain hydraulic pressure at releasing the forward clutch, a timing solenoid valve is used to switch a hydraulic passage with an orifice to another during shifting.
- When downshifting from 4th gear to 3rd gear, to adjust the line pressure applied to the forward clutch at engaging the forward clutch, a timing solenoid valve is used to switch a hydraulic passage with an orifice to another during shifting.
- When upshifting from 3rd gear to 4th gear with engine throttle opened, to optimize the line pressure applied to the forward clutch at releasing the forward clutch, the learning control is processed to compensate the switching timing of the timing solenoid at every shifting.
- When downshifting from 4th gear to 3rd gear with engine throttle opened, to optimize the line pressure applied to the forward clutch at engaging the forward clutch, the learning control is processed to compensate the line pressure at every shifting.

Employing the ravigneau type planetary gear unit and this clutch-to-clutch control system greatly simplifies the construction to make possible a lightweight and compact transaxle.
A line pressure learning control is conducted to provide optimum shifting time at every upshifting with engine throttle opened. If long upshifting time is detected, the subsequent line pressure applied during upshifting is intensified. On the contrary, if short upshifting time is detected, the subsequent line pressure applied during upshifting is weakened.
Slip controlled lock-up function
Even at a lower speed than when the TCC gets engaged completely, control over the TCC pressure control solenoid works to cause the TCC to slip (be engaged slightly), thereby improving the transmission efficiency. While such slip control is being executed, the oil pressure applied to the TCC is controlled by the TCC pressure control solenoid so that the difference between the engine speed and the input shaft speed becomes close to the specified value.
Also, during deceleration, the TCC is made to slip (be engaged slightly) to raise the engine speed and enlarge the fuel cut operation range so that better fuel consumption is achieved.
Due to this reason, it is absolutely necessary for the automatic transmission to use ATF suitable for slip control. Use of any fluid other than the specified ATF may cause juddering or some other faulty condition to occur.



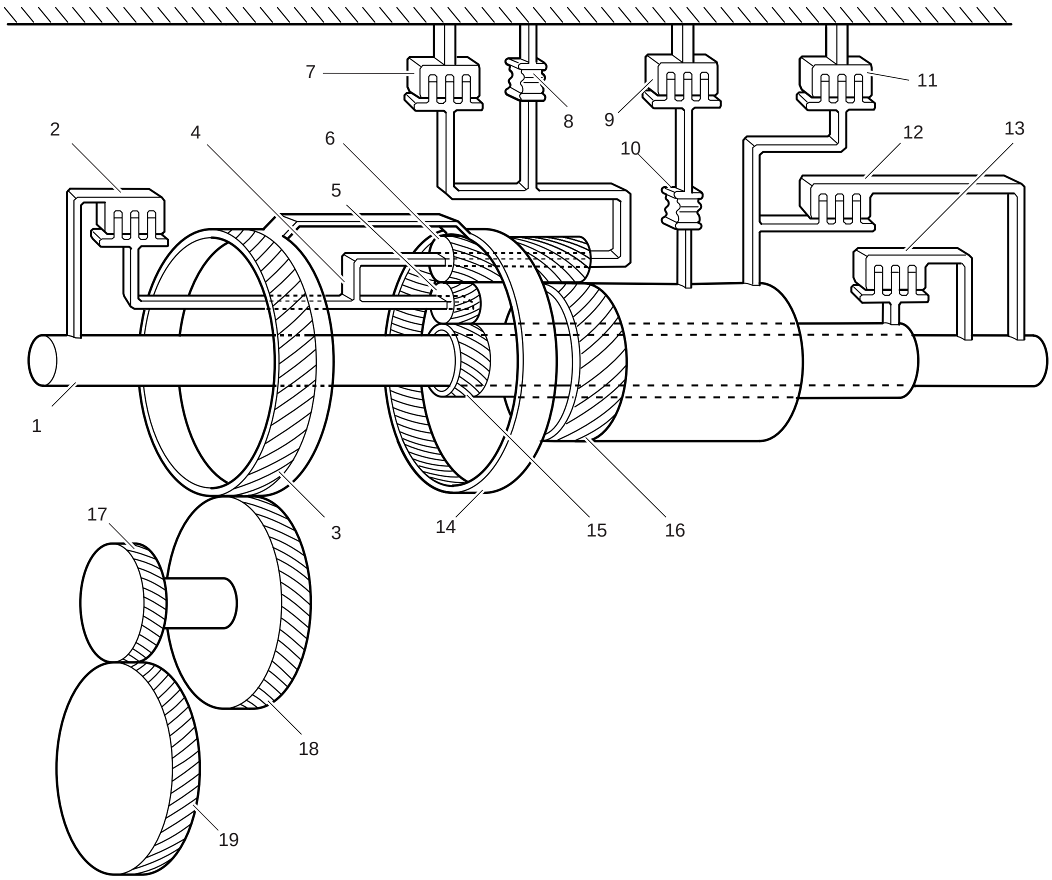
1. Drive plate	11. 1st and reverse brake	21. Rear sun gear
2. Torque converter clutch (TCC)	12. Ring gear	22. Front sun gear
3. Torque converter	13. Long planet pinion	23. Short planet pinion
4. Input shaft	14. One-way No.2 clutch	24. Countershaft
5. Oil pump	15. 2nd brake	25. Reduction driven gear
6. Direct clutch drum (double as sensor rotor for input shaft speed sensor)	16. One-way No.1 clutch	26. Differential case assembly
7. Direct clutch	17. O/D and 2nd coast brake	27. Final gear
8. Parking lock gear	18. Intermediate shaft	28. Output shaft speed sensor drive gear
9. Reduction drive gear	19. Forward clutch	
10. Planet carrier	20. Reverse clutch	

Specifications

<table>
<tr><th colspan="3">Item</th><th colspan="2">Specifications</th></tr>
<tr><td rowspan="2">Torque converter</td><td colspan="2">Type</td><td colspan="2">3-element, 1-step, 2-phase type (with TCC (lock-up) mechanism)</td></tr>
<tr><td colspan="2">Stall torque ratio</td><td colspan="2">2.0 – 2.2</td></tr>
<tr><td rowspan="2">Oil pump</td><td colspan="2">Type</td><td colspan="2">Internal involute gear type oil pump (non crescent type)</td></tr>
<tr><td colspan="2">Drive system</td><td colspan="2">Engine driven</td></tr>
<tr><td rowspan="17">Gear change device</td><td colspan="2">Type</td><td colspan="2">Forward 4-step, reverse 1-step planetary gear type</td></tr>
<tr><td colspan="2" rowspan="7">Shift position</td><td>“P” range</td><td>Gear in neutral, output shaft fixed, engine start</td></tr>
<tr><td>“R” range</td><td>Reverse</td></tr>
<tr><td>“N” range</td><td>Gear in neutral, engine start</td></tr>
<tr><td>“D” range</td><td>Forward 1st ↔ 2nd ↔ 3rd ↔ 4th automatic gear change</td></tr>
<tr><td>“3” range</td><td>Forward 1st ↔ 2nd ↔ 3rd ← 4th automatic gear change</td></tr>
<tr><td>“2” range</td><td>Forward 1st ↔ 2nd ← 3rd automatic gear change</td></tr>
<tr><td>“L” range</td><td>Forward 1st ← 2nd ← 3rd reduction, and fixed at 1st gear</td></tr>
<tr><td rowspan="5">Gear ratio</td><td>1st</td><td>2.875</td><td rowspan="5">Number of teeth Front sun gear: 24
Rear sun gear: 30
Long planet pinion: 20
Short planet pinion: 19
Ring gear: 69</td></tr>
<tr><td>2nd</td><td>1.568</td></tr>
<tr><td>3rd</td><td>1.000</td></tr>
<tr><td>4th (overdrive gear)</td><td>0.697</td></tr>
<tr><td>Reverse (reverse gear)</td><td>2.300</td></tr>
<tr><td colspan="2">Control elements</td><td colspan="2">Wet type multiple-disc clutch... 3 sets
Wet type multiple-disc brake... 3 sets
One-way clutch... 2 sets</td></tr>
<tr><td colspan="2">Reduction gear ratio</td><td colspan="2">1.023</td></tr>
<tr><td colspan="2">Final gear reduction ratio</td><td colspan="2">4.277</td></tr>
<tr><td>Lubrication</td><td colspan="2">Lubrication system</td><td colspan="2">Force feed system by oil pump</td></tr>
<tr><td>Cooling</td><td colspan="2">Cooling system</td><td colspan="2">Radiator assisted cooling (water-cooled)</td></tr>
<tr><td colspan="3">Fluid used</td><td colspan="2">SUZUKI ATF 3317 or Mobil ATF 3309</td></tr>
</table>

Clutch / Brake / Planetary Gear Function of Automatic Transaxle

S7RS0B5101002



I4RS0A510001-01

1. Input shaft and intermediate shaft	6. Long planet pinion	11. O/D and 2nd coast brake	16. Rear sun gear
2. Direct clutch	7. 1st and reverse brake	12. Reverse clutch	17. Final drive gear
3. Reduction drive gear	8. One-way No.2 clutch	13. Forward clutch	18. Reduction driven gear
4. Planet carrier	9. 2nd brake	14. Ring gear	19. Final driven gear
5. Short planet pinion	10. One-way No.1 clutch	15. Front sun gear	

Functions

Part name	Function
Forward clutch	Meshes intermediate shaft and front sun gear
Direct clutch	Meshes input shaft and planet carrier
Reverse clutch	Meshes intermediate shaft and rear sun gear
O/D and 2nd coast brake	Fixes rear sun gear
2nd brake	Fixes rear sun gear
1st and reverse brake	Fixes planet carrier
One-way No.1 clutch	Prevents rear sun gear from turning counterclockwise
One-way No.2 clutch	Prevents planet carrier from turning counterclockwise

Table of Component Operation

S7RS0B5101003

Selector position	Gear position	Part					
		Shift solenoid valve-A (No.1)	Shift solenoid valve-B (No.2)	TCC solenoid valve	Forward clutch	Direct clutch	Reverse clutch
P	Parking	○	○	×	×	×	×
R	Reverse	○	○	×	×	×	○
N	Neutral	○	○	×	×	×	×
D	1st	○	○	×	○	×	×
	2nd	○	×	×	○	×	×
	3rd	×	×	△	○	○	×
	4th	×	○	△	×	○	×
2	1st	○	○	×	○	×	×
	2nd	○	×	×	○	×	×
L	1st	○	○	×	○	×	×

Selector position	Gear position	Part				
		O/D and 2nd coast brake	2nd brake	1st and reverse brake	One-way No.1 clutch	One-way No.2 clutch
P	Parking	×	×	×	×	×
R	Reverse	×	×	○	×	×
N	Neutral	×	×	×	×	×
D	1st	×	×	×	×	○
	2nd	×	○	×	○	×
	3rd	×	○	×	×	×
	4th	○	○	×	×	×
2	1st	×	×	×	×	○
	2nd	○	○	×	○	×
L	1st	×	×	○	×	○

○: ON
×: OFF
△: ON only when TCC is operating

Brake Interlock System Construction

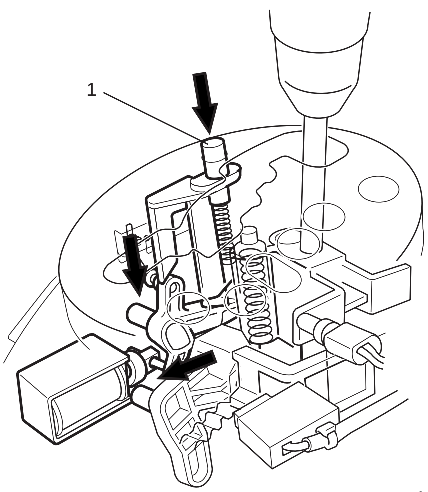
S7RS0B5101004

Shift Lock Solenoid Control

This system consists of shift lock solenoid control system and interlock cable control system.
The shift lock solenoid control system is so designed that the select lever can not be shifted from "P" range position unless ignition switch is turned to "ON" or "ACC" position and the brake pedal is depressed.
And interlock cable control system is so designed that select lever cannot be shifted from "P" range position unless ignition switch is turned to "ACC" or "ON" position. Also, ignition key cannot be pulled out of key slot unless select lever is in "P" range.

Shift Lock Solenoid Manual Release

When push down shift lock solenoid valve release button (1), select lever can be moved from "P" range position to another range even without depressing the brake pedal. (To shift select lever from "P" range to any other position, turn ignition switch to ACC or ON position.)



I6RS0C510001-01

A/T Diagnosis General Description

S7RS0B5101005

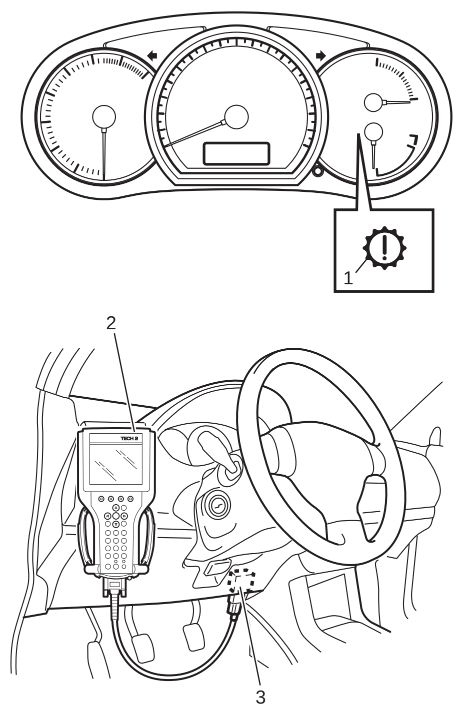
This vehicle is equipped with an electronic transaxle control system, which controls the automatic shift up and shift down timing, TCC operation, etc. suitably to vehicle driving conditions.
TCM has an On-Board Diagnosis System which detects a malfunction in this system.
When diagnosing a trouble in transaxle including this system, be sure to have full understanding of the outline of "On-Board Diagnostic System Description" and each item in "Precautions in Diagnosing Trouble" and execute diagnosis according to "A/T System Check" to obtain correct result smoothly.

On-Board Diagnostic System Description

S7RS0B5101006

For automatic transaxle control system, TCM has the following functions. Refer to "Inspection of TCM and Its Circuits".

- When ignition switch is turned ON with no malfunction in A/T control system is detected, transmission warning light (1) lights for about 2 seconds after ignition switch is turned ON and then goes OFF for bulb check.
- When TCM detects a malfunction in A/T control system, it indicates transmission warning light (1) and stores malfunction DTC in its memory.
- It is possible to communicate with TCM through data link connector (DLC) (3) by using SUZUKI scan tool (2). Diagnostic information can be checked and erased by using SUZUKI scan tool.
- For information about the following items, refer to "On-Board Diagnostic System Description in Section 1A"
  - Warm up cycle
  - Driving cycle
  - 2 Driving cycle detection logic
  - Pending DTC
  - Freeze frame data



I6RS0C510002-01

CAN Communication System Description

S7RS0B5101007

Refer to “CAN Communication System Description in Section 1A” for CAN communication System description. TCM communicates control data with each control module as follows.

TCM Transmission Data

				ECM	Combination meter	BCM
TCM	Transmit	DATA	Transmission oil temperarure signal	○		
			Torque request signal	○		
			Vehicle speed pulse signal	○		
			Transmission warning light signal		○	
			Transmission actual gear position signal	○		
			A/T select lever position signal	○	○	○

I7RS0B510001-03

TCM Reception Data

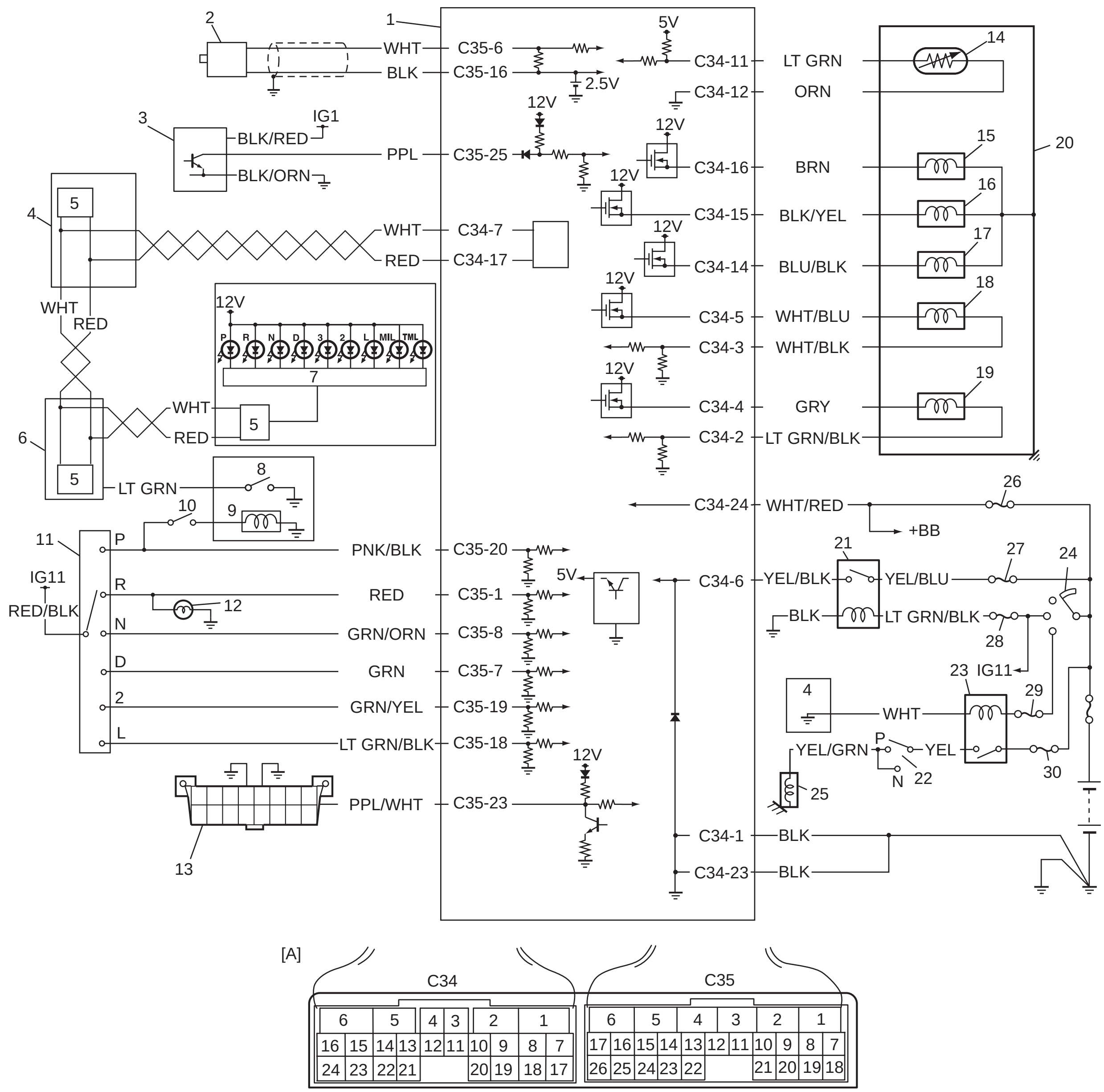
Reception data from ECM	Engine torque signal
	Engine speed signal
	Throttle position signal
	A/C compressor clutch signal
	Engine coolant temperature signal
	Brake pedal switch signal
	Accelerator pedal position signal

I7RS0B510002-03

Schematic and Routing Diagram

Transmission Control Module (TCM) Wiring Diagram

S7RS0B5102001



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1. TCM	12. Backup lamp	23. Starter motor relay
2. Input shaft speed sensor	13. Data link connector DLC	24. Ignition switch
3. Output shaft speed sensor	14. Transmission fluid temperature sensor	25. Starter motor
4. ECM	15. Shift solenoid valve-A (No.1)	26. “DOME” fuse
5. CAN driver	16. Shift solenoid valve-B (No.2)	27. “AT ETM” fuse
6. BCM	17. Timing solenoid valve	28. “IG SIG” fuse
7. Meter driver	18. TCC lock-up pressure control solenoid valve	29. “ST SIG” fuse
8. “3” position switch	19. Pressure control solenoid valve	30. “ST MOT” fuse
9. Shift lock solenoid	20. A/T	[A]: Terminal arrangement of TCM connector (viewed from harness side)
10. Brake light switch	21. A/T relay	
11. Transmission range sensor	22. Inhibitor switch (including transmission range sensor)	

Operation of Shift Solenoid Valves, Timing Solenoid Valve and TCC Solenoid Valve

Select lever position	Gear position	Solenoid				Condition
		Shift solenoid valve-A (No.1)	Shift solenoid valve-B (No. 2)	Timing solenoid valve	TCC solenoid valve	
P	Parking	○	○	×	×	
R	Reverse	○	○	×	×	When vehicle is travelling forwards in less than 9 km/h, 6 mile/h vehicle speed
		○	○	○	×	When vehicle is travelling forwards in 9 km/h, 6 mile/h or more vehicle speed
	(Reverse)	×	×	×	×	When fail-safe function is operating
N	Neutral	○	○	×	×	
D	Neutral → 1st	—	—	○	—	Timing solenoid is turned ON for about 0.5 sec. while on gear shifting
	1st	○	○	×	×	
	2nd	○	×	×	×	
	3rd	×	×	×	△	
	3rd ↔ 4th	—	—	○	—	Timing solenoid is turned ON for about 0.5 sec. while on gear shifting
	4th	×	○	×	△	
	(3rd)	×	×	×	×	When fail-safe function is operating
2	1st	○	○	×	×	
	2nd	○	×	×	×	
	(3rd)	×	×	×	×	When fail-safe function is operating
L	1st	○	○	×	×	
	(3rd)	×	×	×	×	When fail-safe function is operating

○: ON (Turn power ON)
×: OFF (Turn power OFF)
△: ON only when TCC is operating

	Valve status	
	Turn power ON	**Turn power OFF**
Shift solenoid valve-A (No.1)	Close	Open
Shift solenoid valve-B (No.2)	Close	Open
Timing solenoid	Open	Close
TCC (lock-up) pressure control solenoid	Close	Open

Automatic Gear Shift Table

S7RS0B5102002

Automatic gear shift schedule is shown in the following table. Test-drive the vehicle on a flat road in the D, 3, 2 position.

1. Shift Point in D, 3 or 2 position

	Throttle opening (%)	Shift	Vehicle speed km/h (mph)	Remark
UP shift	Over 85%	1st → 2nd	43 – 48 (27 – 30)	D, 3, 2 range
		2nd → 3rd	91 – 96 (57 – 60)	D, 3 range
		3rd → 4th	154 – 159 (96 – 99)	D range
	50%	1st → 2nd	36 – 41 (22 – 25)	D, 3, 2 range
		2nd → 3rd	64 – 69 (40 – 43)	D, 3 range
		3rd → 4th	95 – 100 (59 – 62)	D range
	10%	1st → 2nd	14 – 19 (9 – 12)	D, 3, 2 range
		2nd → 3rd	31 – 36 (19 – 22)	D, 3 range
		3rd → 4th	46 – 51 (29 – 32)	D range
DOWN shift	Over 90%	4th → 3rd	151 – 156 (94 – 97)	D range
		3rd → 2nd	81 – 86 (50 – 53)	D, 3 range
		2nd → 1st	31 – 36 (19 – 22)	D, 3, 2 range
	50%	4th → 3rd	51 – 56 (32 – 35)	D range
		3rd → 2nd	25 – 30 (16 – 19)	D, 3 range
		2nd → 1st	8 – 13 (5 – 8)	D, 3, 2 range
	0%	4th → 3rd	27 – 32 (17 – 20)	D range
		3rd → 2nd	16 – 21 (10 – 13)	D, 3 range
		2nd → 1st	8 – 13 (5 – 8)	D, 3, 2 range

2. Lock-up point in D or 3 position

	Lock-up clutch status	Throttle opening (%)	Vehicle speed km/h (mph)	Remark
3rd gear lock-up	ON	Over 90%	125 – 130 (78 – 81)	D, 3 range
		50%	95 – 100 (59 – 62)	D, 3 range
	OFF	Over 95%	103 – 108 (64 – 67)	D, 3 range
		50%	66 – 71 (41 – 44)	D, 3 range
4th gear lock-up	ON	Over 90%	154 – 159 (96 – 99)	D range
		50%	145 – 150 (90 – 93)	D range
	OFF	Over 95%	151 – 156 (94 – 97)	D range
		50%	114 – 119 (71 – 74)	D range

3. Slip lock-up point in D or 3 position

	Slip Lock-up clutch status	Throttle opening (%)	Vehicle speed km/h (mph)	Remark
2nd gear	Slip ON	15%	34 – 39 (21 – 24)	• D, 3 range • Without lock-up condition
	Slip OFF	15%	19 – 24 (12 – 15)	
3rd gear	Slip ON	15%	34 – 39 (21 – 24)	• D, 3 range • Without lock-up condition
	Slip OFF	15%	31 – 36 (19 – 22)	
4th gear	Slip ON	15%	51 – 56 (32 – 35)	• D range • Without lock-up condition
	Slip OFF	15%	46 – 51 (29 – 32)	

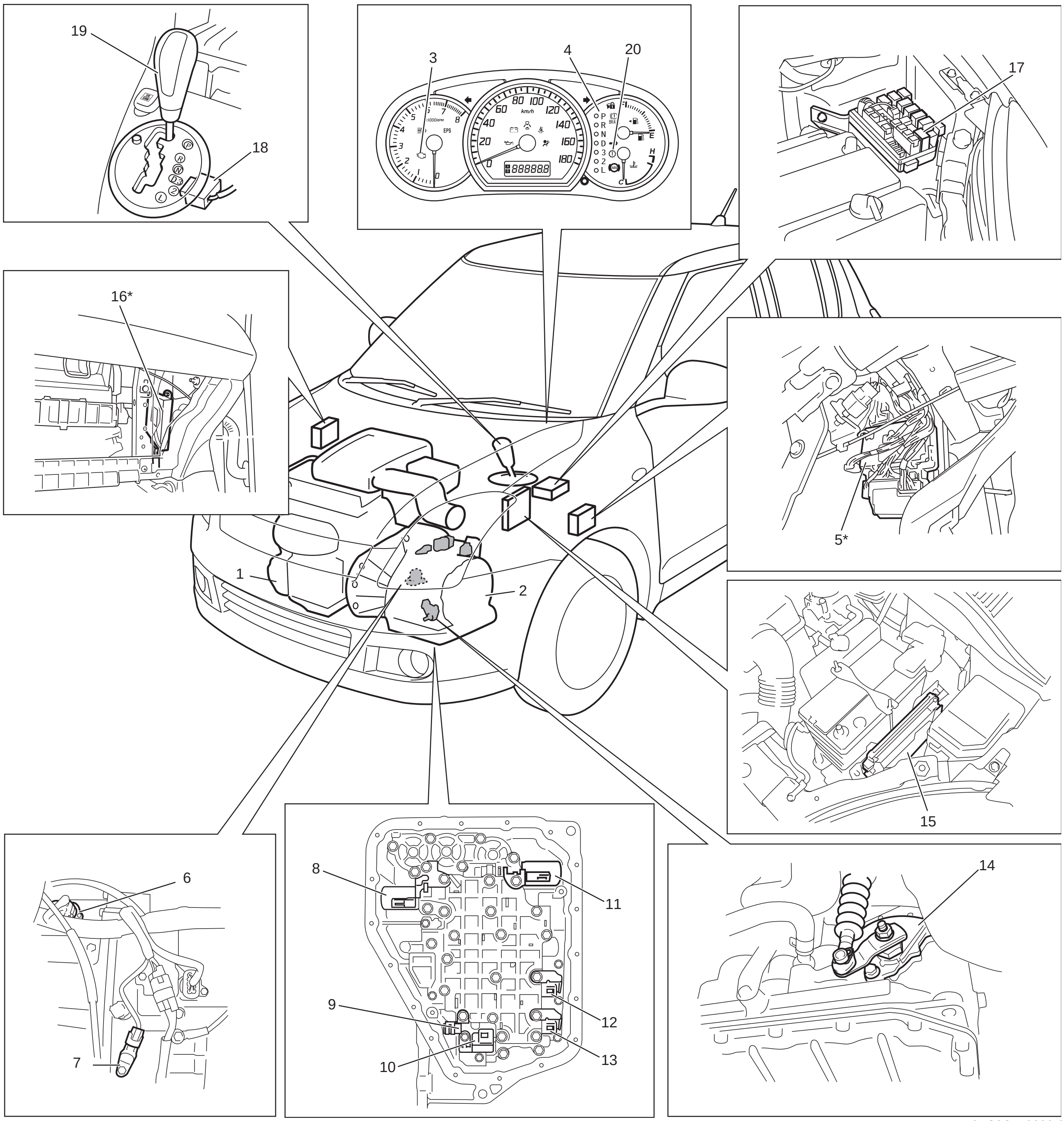
Component Location

Electronic Shift Control System Components Location

S7RS0B5103001

NOTE

The figure shows left-hand steering vehicle. For right-hand steering vehicle, parts with (*) are installed at the opposite side.



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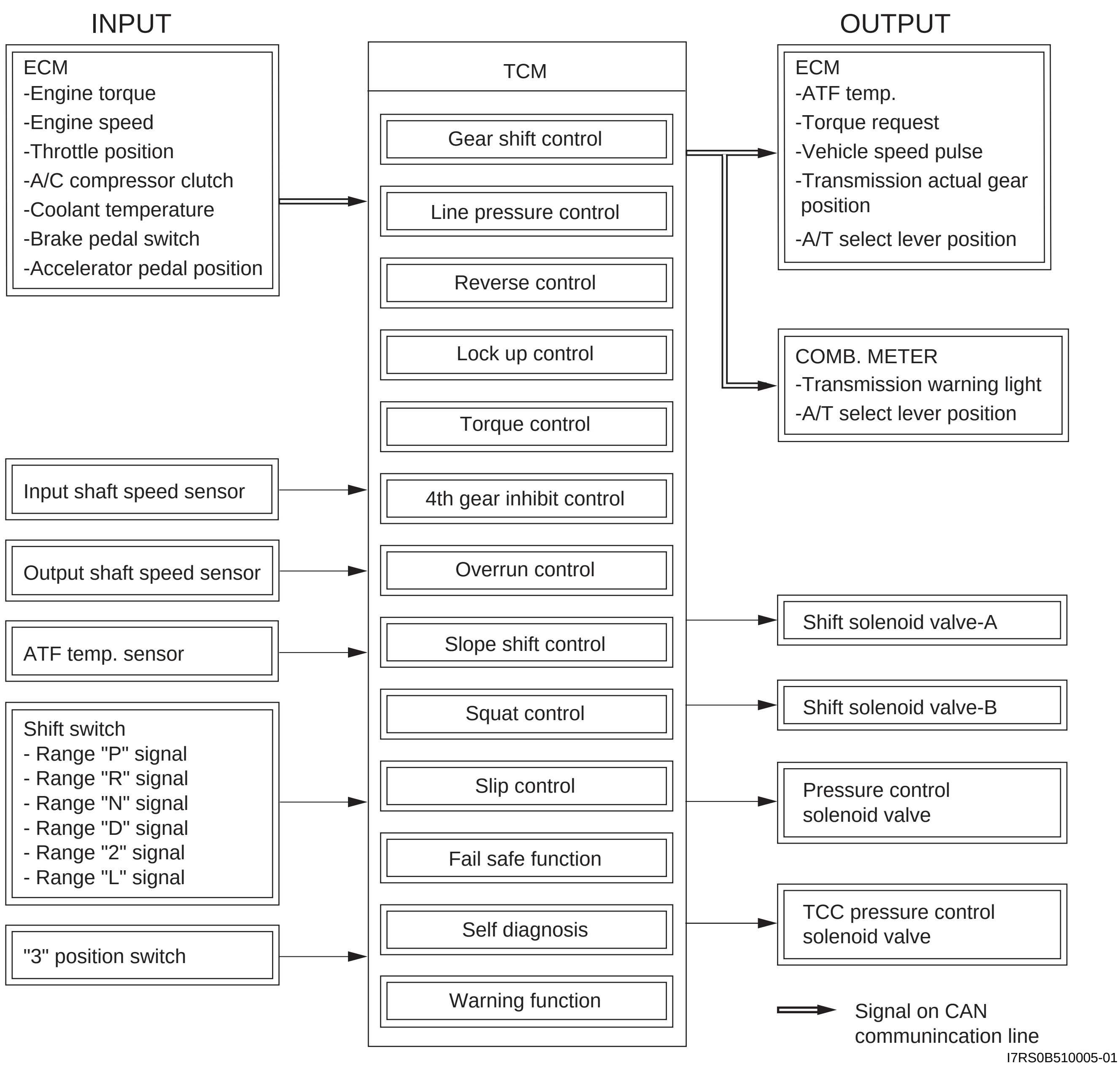
1. Engine	8. TCC pressure control solenoid valve (TCC solenoid valve)	15. ECM
2. Transaxle	9. Transmission fluid temperature sensor	16. TCM
3. MIL	10. Timing solenoid valve	17. AT relay
4. Shift position indicator light	11. Pressure control solenoid valve	18. “3” position switch
5. Junction block assembly (included in BCM)	12. Shift solenoid valve-B (No.2)	19. Select lever

6. Output shaft speed sensor	13. Shift solenoid valve-A (No.1)	20. Transmission warning light
7. Input shaft speed sensor	14. Transmission range sensor	



Diagnostic Information and Procedures

A/T System Check

S7RS0B5104001

Refer to the following items for the details of each step.

Step	Action	Yes	No
1	☞ **Customer complaint analysis** 1) Perform customer complaint analysis. *Was customer complaint analysis performed?*	Go to Step 2.	Perform customer complaint analysis.
2	☞ **DTC / freeze frame data check, record and clearance** 1) Check for DTC. *Is there any DTC(s)?*	Print DTC or write them down and clear them by referring to “DTC Clearance”. Go to Step 3.	Go to Step 4.
3	☞ **Visual inspection** 1) Perform visual inspection. *Is there any faulty condition?*	Repair or replace malfunction part. Go to Step 11.	Go to Step 5.
4	☞ **Visual inspection** 1) Perform visual inspection. *Is there any faulty condition?*	Repair or replace malfunction part. Go to Step 11.	Go to Step 8.
5	☞ **Trouble symptom confirmation** 1) Confirm trouble symptom. *Is trouble symptom identified?*	Go to Step 6.	Go to Step 7.
6	☞ **Rechecking and record of DTC / freeze frame data** 1) Recheck for DTC referring to “DTC Check”. *Is there any DTC(s)?*	Go to Step 9.	Go to Step 8.
7	☞ **Rechecking and record of DTC / freeze frame data** 1) Recheck for DTC referring to “DTC Check”. *Is there any DTC(s)?*	Go to Step 9.	Go to Step 10.
8	☞ **A/T basic check and A/T symptom diagnosis** 1) Check and repair according to “A/T Basic Check” and “A/T Symptom Diagnosis”. *Are check and repair complete?*	Go to Step 11.	Check and repair malfunction part(s). Go to Step 11.
9	☞ **Troubleshooting for DTC** 1) Check and repair according to applicable DTC flow. *Are check and repair complete?*	Go to Step 11.	Check and repair malfunction part(s). Go to Step 11.
10	☞ **Check for intermittent problems** 1) Check for intermittent problems. *Is there any faulty condition?*	Repair or replace malfunction part(s). Go to Step 11.	Go to Step 11.
11	☞ **Final confirmation test** 1) Clear DTC if any. 2) Perform final confirmation test. *Is there any problem symptom, DTC or abnormal condition?*	Go to Step 6.	End.

Step 1. Customer Complaint Analysis

Record details of the problem such as failure, complaint and how it occurred as described by the customer.
For this purpose, use of such an inspection form will facilitate collecting information to the point required for proper analysis and diagnosis.

Customer problem inspection form (Example)

User name:	Model:	VIN:	
Date of issue:	Date of Reg.:	Date of problem:	Mileage:

PROBLEM SYMPTOMS
☐ Vehicle does not move (R, D, 3, 2, L or any range)
☐ No upshift automatically (☐ 1st to 2nd ☐ 2nd to 3rd ☐ 3rd to 4th ☐ 3 range ☐ 2 range ☐ D range)
☐ No downshift automatically (☐ 3rd to 2nd ☐ 2nd to 1st ☐ 4th to 3rd ☐ 3 range ☐ 2 range ☐ D range)
☐ No gear change manually (☐ 1st ↔ 3rd ☐ 3rd ↔ 4th)
☐ TCC no lock-up ☐ TCC no lock-up off
☐ Automatic shift point too high or too low
☐ Excessive gear change shock (1st/2nd/3rd/4th/Reverse)
☐ No kickdown
☐ Transmission slipping in (1st/2nd/3rd/4th/Reverse)
☐ Others ____________________

VEHICLE/ENVIRONMENTAL CONDITION WHEN PROBLEM OCCURS	
Environmental Condition	
Weather	☐ Fair ☐ Cloudy ☐ Rain ☐ Always ☐ Other ____________________
Temperature	(°F/ °C) ☐ Hot ☐ Warm ☐ Cool ☐ Cold ☐ always
Frequency	☐ Always ☐ Sometimes (times/ day, month) ☐ Only once ☐ Under certain condition
Read	☐ Urban ☐ Suburb ☐ Highway ☐ Mountainous ☐ Uphill ☐ Downhill ☐ Tarmacadam ☐ Gravel ☐ Other ________
Vehicle Condition	
Engine & transmission condition	☐ Cold/ ☐ Warming up phase/ ☐ Warmed up Engine speed (r/min.) Throttle opening (☐ Idle/ ☐ About % ☐ full) "3 position" switch (☐ ON/ ☐ OFF)
Vehicle condition	☐ At stop/ ☐ During driving (☐ Constant speed ☐ Accelerating ☐ Decelerating ☐ Braking) ☐ Right hand corner ☐ Left hand corner ☐ Vehicle speed (km/h mile/h) ☐ Other ____________________

Transmission warning light	☐ Blink ☐ Always ON ☐ Sometimes ON ☐ Always OFF ☐ Good condition	
Malfunction indicator lamp	☐ Blink ☐ Always ON ☐ Sometimes ON ☐ Always OFF ☐ Good condition	
Diagnostic trouble code	First check: ☐ No code ☐ Malfunction code ( )	
	Second check: ☐ No code ☐ Malfunction code ( )	

I6RS0C510015-01

NOTE

The form is a standard sample. It should be modified according to conditions characteristic of each market.

Step 2. DTC / Freeze Frame Data Check, Record and Clearance

First, referring to “DTC Check”, check DTC and pending DTC. If DTC exists, print or write down DTC and freeze frame data and then clear malfunction DTC(s) by referring to “DTC Clearance”. Malfunction DTC indicates malfunction in the system but it is not possible to know from it whether the malfunction is occurring now or it occurred in the past and normal condition has been restored. In order to know that, check symptom in question according to Step 5 and then recheck DTC according to Step 6.

Diagnosing a trouble based on the DTC in this step only or failure to clear the DTC in this step may result in an faulty diagnosis, trouble diagnosis of a normal circuit or difficulty in troubleshooting which is otherwise unnecessary.

Step 3 and 4. Visual Inspection

As a preliminary step, be sure to perform visual check of the items that support proper function of the engine and automatic transaxle referring to “Visual Inspection”.

Step 5. Trouble Symptom Confirmation

Check trouble symptoms based on information obtained in “Step 1. Customer Complaint Analysis: ” and “Step 2. DTC / Freeze Frame Data Check, Record and Clearance: ”.

Also, reconfirm DTC according to “DTC Confirmation Procedure” described in each DTC flow.

Step 6 and 7. Rechecking and Record of DTC and Freeze Frame Data

Refer to “DTC Check” for checking procedure.

Step 8. A/T Basic Check and A/T Symptom Diagnosis

Perform basic check of A/T according to “A/T Basic Check” first. When the end of the flow has been reached, check the parts of the system suspected as a possible cause referring to “A/T Symptom Diagnosis” and based on symptoms appearing on the vehicle (symptoms obtained through steps of customer complaint analysis, trouble symptom confirmation and/or A/T basic check) and repair or replace faulty parts, if any.

Step 9. Troubleshooting for DTC

Based on the DTC indicated in Step 6 / 7 and referring to “applicable DTC flow”, locate the cause of the trouble, namely in a sensor, switch, wire harness, connector, actuator, TCM or other part and repair or replace faulty parts.

Step 10. Check for Intermittent Problem

Check parts where an intermittent trouble is easy to occur (e.g. wire harness, connector, etc.), referring to “Intermittent and Poor Connection Inspection in Section 00” and related circuit of DTC recorded in Step 2.

Step 11. Final Confirmation Test

Confirm that the problem symptom has gone and the vehicle is free from any abnormal conditions. If what has been repaired is related to the malfunction DTC, clear the DTC once and check to ensure that no malfunction DTC is indicated.

Visual Inspection

S7RS0B5104002

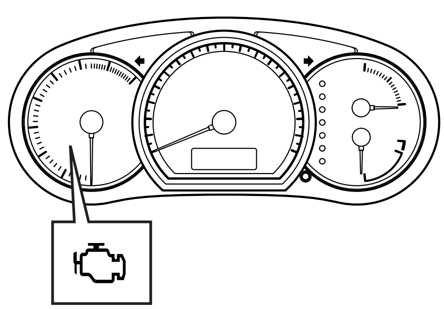
Visually check the following parts and systems.

Inspection item	Referring
• A/T fluid ----- level, leakage, color	“Automatic Transaxle Fluid Level Inspection in Section 0B”
• A/T fluid hoses ----- disconnection, looseness, deterioration	“A/T Fluid Cooler Hoses Replacement”
• A/T select cable ----- installation	“Select Cable Removal and Installation”
• Engine oil ----- level, leakage	“Engine Oil and Filter Change in Section 0B”
• Engine coolant ----- level, leakage	“Engine Coolant Change in Section 0B”
• Engine mountings ----- play, looseness, damage	“Engine Assembly Removal and Installation in Section 1D”
• Suspension ----- play, looseness	“Suspension, Wheels and Tires Symptom Diagnosis in Section 2A”
• Drive shafts ----- damage	“Front Drive Shaft Assembly On-Vehicle Inspection in Section 3A”
• Battery ----- indicator condition, corrosion of terminal	“Battery Inspection in Section 1J”
• Connectors of electric wire harness ----- disconnection, friction	“Electronic Shift Control System Components Location”
• Fuses ----- burning	
• Parts ----- installation, damage	
• Bolts ----- looseness	
• Other parts that can be checked visually	
Also check the following items at engine start, if possible.	
• Transmission warning light (if equipped) ----- Operation	“Transmission Warning Light Check”
• Malfunction indicator lamp ----- Operation	“Malfunction Indicator Lamp (MIL) Check”
• Charge warning lamp ----- Operation	“Generator Symptom Diagnosis in Section 1J”
• Engine oil pressure warning lamp ----- Operation	“Oil Pressure Warning Light Symptom Diagnosis in Section 9C”
• Engine coolant temp. meter ----- Operation	“Engine Coolant Temperature (ECT) Meter Symptom Diagnosis in Section 9C”
• Other parts that can be checked visually	

Malfunction Indicator Lamp (MIL) Check

S7RS0B5104003

Refer to the same item in “Malfunction Indicator Lamp (MIL) Check in Section 1A” for checking procedure.



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Transmission Warning Light Check

S7RS0B5104004

1) Turn ignition switch ON.
2) Check that transmission warning light lights for about 2 – 4 sec. and then goes OFF.
   If anything faulty is found, advance “Transmission Warning Light Circuit Check – Light Does Not Come “ON” at Ignition Switch ON” or “Transmission Warning Light Circuit Check – Light Remains “ON” at Ignition Switch ON”.

DTC Table

S7RS0B5104005

NOTE

- **A: Driving cycles when transmission warning light lighting and storing DTC in TCM memory.**
- ***1: Transmission warning light does not light up but TCM detects and stores DTC.**
- **For details of driving cycle, refer to “On-Board Diagnostic System Description”.**

DTC No.	Detecting item	Detecting condition (DTC will set when detecting)	A
☞ P0602	Control module programming error	Data programming error.	*1, 1 driving cycle
☞ P0705	Transmission range sensor circuit malfunction (PRNDL input)	Multiple signals are inputted simultaneously.	1 driving cycle
☞ P0707	Transmission range sensor circuit low	No sensor signal is inputted.	2 driving cycles
☞ P0712	Transmission fluid temperature sensor “A” circuit low	Sensor output voltage is too low.	1 driving cycle
☞ P0713	Transmission fluid temperature sensor “A” circuit high	Sensor output voltage is too high.	1 driving cycle
☞ P0717	Input / Turbine speed sensor circuit no signal	No sensor signal is detected although output speed sensor signal is inputted.	1 driving cycle
☞ P0722	Output speed sensor circuit no signal	No sensor signal is inputted although input speed sensor signal is inputted.	1 driving cycle
☞ P0787	Shift / Timing solenoid low	Voltage of timing solenoid terminal is low although TCM is commanding timing solenoid to turn ON.	1 driving cycle
☞ P0788	Shift / Timing solenoid high	Voltage of timing solenoid terminal is high although TCM is commanding timing solenoid to turn OFF.	1 driving cycle
☞ P0961	Pressure control solenoid “A” control circuit range / performance	Difference between target current of control solenoid valve circuit and monitor current of control solenoid valve circuit is more than specification.	1 driving cycle
☞ P0962	Pressure control solenoid “A” control circuit low	No electric flow is detected on pressure control solenoid circuit.	1 driving cycle
☞ P0963	Pressure control solenoid “A” control circuit high	Too much electric flow is detected on pressure control solenoid circuit.	1 driving cycle
☞ P0973	Shift solenoid “A” control circuit low	Voltage of shift solenoid terminal is low although TCM is commanding shift solenoid to turn ON.	1 driving cycle
☞ P0974	Shift solenoid “A” control circuit high	Voltage of shift solenoid terminal is high although TCM is commanding shift solenoid to turn OFF.	1 driving cycle
☞ P0976	Shift solenoid “B” control circuit low	Voltage of shift solenoid terminal is low although TCM is commanding shift solenoid to turn ON.	1 driving cycle
☞ P0977	Shift solenoid “B” control circuit high	Voltage of shift solenoid terminal is high although TCM is commanding shift solenoid to turn OFF.	1 driving cycle
☞ P1702	Internal control module memory check sum error	Calculation of current data stored in TCM is not correct comparing with pre-stored checking data in TCM.	1 driving cycle
☞ P1703	CAN invalid data - TCM	TCM receives malfunction signal of throttle position, engine coolant temperature, engine revolution and engine torque from ECM.	*1, 1 driving cycle
☞ P1723	Range select switch malfunction	“3” position switch ON signal is inputted although transmission range switch signal is inputted P, R, N or L. range.	*1, 1 driving cycle
☞ P1774	Control module communication bus off	Transmitting and receiving error detected to TCM for specified time continuously.	1 driving cycle

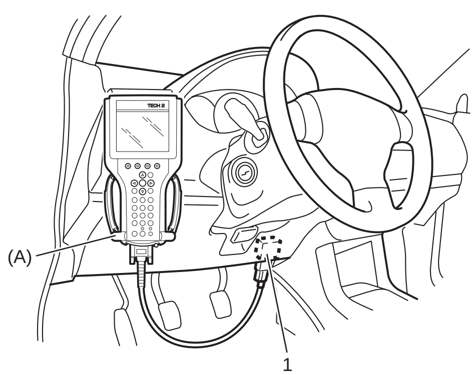
DTC No.	Detecting item	Detecting condition (DTC will set when detecting)	A
☞ P1777	TCM lost communication with ECM (Reception error)	Receiving error from ECM detected to TCM for specified time continuously.	1 driving cycle
☞ P1778	TCM lost communication with BCM (Reception error)	Receiving error from BCM detected to TCM for specified time continuously.	*1, 1 driving cycle
☞ P1878	Torque converter clutch shudder	Variation in the output revolution speed of the specified amplitude and specified cycle is detected under slip lock-up condition.	*1, 20 driving cycle
☞ P2762	Torque converter clutch pressure control solenoid control circuit range / performance	Difference between target current of TCC solenoid valve circuit and monitor current of TCC solenoid valve circuit is more than specification.	1 driving cycle
☞ P2763	Torque converter clutch pressure control solenoid control circuit high	Too much electric flow is detected on TCC solenoid circuit.	1 driving cycle
☞ P2764	Torque converter clutch pressure control solenoid control circuit range / performance	Difference between target current of TCC solenoid valve circuit and current of TCC solenoid valve circuit is more than specification.	1 driving cycle

DTC Check

S7RS0B5104006

1) Turn ignition switch OFF.
2) Connect SUZUKI scan tool to DLC (1).

Special tool
(A): SUZUKI scan tool



I4RS0B510004-01

3) Read DTC according to instructions displayed on SUZUKI scan tool and write it down. Refer to SUZUKI scan tool operator's manual for further details.
4) After completing the check, turn ignition switch OFF and disconnect SUZUKI scan tool from DLC.

DTC Clearance

S7RS0B5104007

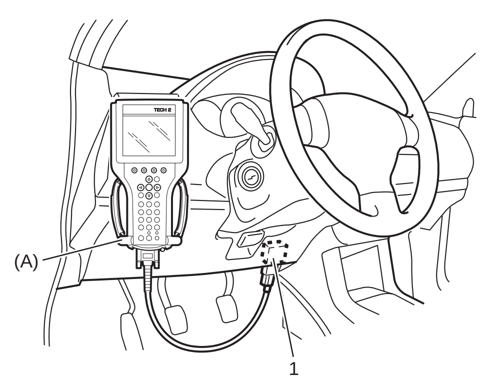
NOTE

DTC and freeze frame data stored in TCM memory are also cleared in following cases. Be careful not to clear them before keeping their record.

- **When power to TCM is cut off (by disconnecting battery cable, removing fuse or disconnecting TCM connector).**
- **When the same malfunction (DTC) is not detected again during 40 engine warm-up cycles.**

1) Turn ignition switch OFF.
2) Connect SUZUKI scan tool to data link connector (DLC) (1).

Special tool
(A): SUZUKI scan tool



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3) Clear DTC according to instructions displayed on SUZUKI scan tool. Refer to SUZUKI scan tool operator's manual for further details.
4) After completing the clearance, turn ignition switch OFF and disconnected SUZUKI scan tool from data link connector (DLC).

Fail-Safe Table

S7RS0B5104008

This function is provided by the safe mechanism that assures safe driveability even when the solenoid valve, sensor or its circuit fails. The following table shows the fail-safe function for each fail condition of sensor, solenoid or its circuit.

DTC No.	Trouble area	Fail-safe operation
☞ P0705	Transmission range sensor circuit malfunction (PRNDL input)	• Selected range is set in priority order shown below. D> 2> L> R> N> P • Slip controlled lock-up function is inhibited to operate. • Learning control is inhibited.
☞ P0707	Transmission range sensor circuit low	• Selected range is assumed to be “D” range. • Slip controlled lock-up function is inhibited to operate. • Learning control is inhibited.
☞ P0712	Transmission fluid temperature sensor “A” circuit low	• A/T fluid temperature is assumed to be 200 °C (392 °F). • Upshifting to 4th gear is inhibited. • Lock-up function is inhibited to operate. • Garage shift control is inhibited. • Learning control is inhibited.
☞ P0713	Transmission fluid temperature sensor “A” circuit high	
☞ P0717	Input / Turbine speed sensor “A” circuit no signal	• Upshifting to 4th gear is inhibited. • Lock-up function is inhibited to operate. • Line pressure control at gear shifting is inhibited. • Torque reducing request to ECM (torque reduction control) is inhibited. • Garage shift control is inhibited. • Learning control is inhibited.
☞ P0722	Output speed sensor circuit no signal	• Vehicle speed which is calculated by input shaft speed sensor signal is used for gear shifting control instead of vehicle speed calculated by output shaft speed sensor signal. • Upshifting to 4th gear is inhibited. • Lock-up function is inhibited to operate. • Line pressure control at gear shifting is inhibited. • Torque reducing request to ECM (torque reduction control) is inhibited. • Garage shift control is inhibited. • Learning control is inhibited.
☞ P0787	Shift / Timing solenoid Low	• Power supply for all solenoid valves is cut. • Gear position is fixed in 3rd gear. • Line pressure control at gear shifting is inhibited. • Look-up function is inhibited to operate. • Garage shift control is inhibited. • Torque reducing request to ECM (torque reduction control) is inhibited.
☞ P0788	Shift / Timing solenoid High	
☞ P0962	Pressure control solenoid “A” control circuit low	
☞ P0963	Pressure control solenoid “A” control circuit high	
☞ P0973	Shift solenoid “A” control circuit low	
☞ P0974	Shift solenoid “A” control circuit high	
☞ P0976	Shift solenoid “B” control circuit low	
☞ P0977	Shift solenoid “B” control circuit high	
☞ P0961	Pressure control solenoid “A” control circuit range / performance	• Gear position is fixed in 3rd gear. • Lock-up function is inhibited to operate. • Slip controlled lock-up function is inhibited to operate. • Line pressure control at gear shifting is inhibited. • Torque reducing request to ECM (torque reduction control) is inhibited. • Garage shift control is inhibited. • Leaning control is inhibited.

DTC No.	Trouble area	Fail-safe operation
☞ P1702	Internal control module memory check sum error	• Power supply for all solenoid valves is cut. • Gear position is fixed in 3rd gear. • Line pressure control at gear shifting is inhibited. • Lock-up function is inhibited to operate.
☞ P1703	CAN invalid data - TCM	In case of throttle position signal malfunction: • Throttle opening used for line pressure control is assumed to be 100%. • Throttle opening used for gear shifting control is assumed to be 0%. • Upshifting to 4th gear is inhibited. • Lock-up function is inhibited to operate. Line pressure control at gear shifting is inhibited. • Garage shift control is inhibited. • Learning control is inhibited. In case of engine coolant temperature signal malfunction: • Slip controlled lock-up function is inhibited to operate. • After 15 minutes pass from detecting malfunction, engine coolant temperature is assumed to be normal operating temperature, and controls of overdrive and lock-up is released from inhibition. In case of engine revolution signal malfunction: • Upshifting to 4th gear is inhibited. • Lock-up function is inhibited to operate. • Line pressure control at gear shifting is inhibited. • Torque reducing request to ECM (torque reduction control) is inhibited. • Garage shift control is inhibited. • Learning control is inhibited. In case of engine torque signal malfunction: • Line pressure control at gear shifting is inhibited. • Torque reducing request to ECM (torque reduction control) is inhibited. • Upshifting to 4th gear is inhibited. • Learning control is inhibited.
☞ P1723	Range select switch malfunction	“3” position switch is assumed to be OFF.
☞ P1774	Control module communication bus off	• Throttle opening used for line pressure control is assumed to be 100%. • Throttle opening used for gear shifting control is assumed to be 0%. • Engine revolution is assumed to be 0 RPM. • After 15 minutes pass from detecting malfunction, engine coolant temperature is assumed to be 90 °C (194 °F). • Lock-up function is inhibited to operate. • Line pressure control at gear shifting is inhibited. • Torque reducing request to ECM (torque reduction control) is inhibited. • Upshifting to 4th gear is inhibited. • Garage shift control is inhibited. • Learning control is inhibited.

DTC No.	Trouble area	Fail-safe operation
☞ P1777	TCM lost communication with ECM (Reception error)	• Throttle opening used for line pressure control is assumed to be 100%. • Throttle opening used for gear shifting control is assumed to be 0%. • Engine revolution is assumed to be 0 RPM. • After 15 minutes pass from detecting malfunction, engine coolant temperature is assumed to be 90 °C (194 °F). • Lock-up function is inhibited to operate. • Line pressure control at gear shifting is inhibited. • Torque reducing request to ECM (torque reduction control) is inhibited. • Upshifting to 4th gear is inhibited. • Garage shift control is inhibited. • Learning control is inhibited.
☞ P1778	TCM lost communication with BCM (Reception error)	"3" position switch is assumed to be OFF.
☞ P1878	Torque converter clutch shudder	Slip controlled lock-up function is inhibited to operate.
☞ P2762	Torque converter clutch pressure control solenoid control circuit range / performance	• Lock-up function is inhibited to operate. • Slip controlled lock-up function is inhibited to operate. • Upshifting to 4th gear is inhibited when transmission fluid temperature is 150 °C (302 °F) or more. • Gear position is fixed in 1st gear when vehicle speed is 10 km/h (6 mile/h) or less.
☞ P2763	Torque converter clutch pressure control solenoid control circuit high	• Lock-up function is inhibited to operate. • Upshifting to 4th gear is inhibited when A/T fluid temperature is more than 150 °C (302 °F). • Vehicle speed is slower than 10 km/h (6 mile/h), gear position is fixed in 1st gear for prevention of engine stall.
☞ P2764	Torque converter clutch pressure control solenoid control circuit low	• Lock-up function is inhibited to operate. • Upshifting to 4th gear is inhibited when A/T fluid temperature is more than 150 °C (302 °F).

Scan Tool Data

S7RS0B5104009

As the data values given in the following table are standard values estimated on the basis of values obtained from the normally operating vehicles by using a scan tool, use them as reference values. Even when the vehicle is in good condition, there may be cases where the checked value does not fall within each specified data range. Therefore, judgment as abnormal should not be made by checking with these data alone.

Also, condition in the following table that can be checked by the scan tool are those detected by TCM and output from TCM as commands and there may be cases where the automatic transaxle or actuator is not operating (in the condition) as indicated by the scan tool.

NOTE

The following scan tool data related to automatic transaxle can be checked only by communicating with TCM.

Scan tool data	Vehicle condition		Normal condition / reference values
☞ GEAR POSITION	Ignition switch ON	Select lever is in "P" position	P or N
		Select lever is in "R" position	R
		Select lever is in "N" position	P or N
		Select lever is in "D" position	1
		Select lever is in "3" position	1
		Select lever is in "2" position	1
		Select lever is in "L" position	1

Scan tool data	Vehicle condition		Normal condition / reference values
☞ ENGINE SPEED	At engine idle speed		Engine idle speed is displayed
☞ INPUT SHAFT REVOLUTION	Ignition switch ON and engine stop		0 RPM
	At 60 km/h (37.5 mile/h) constant speed, 20% or less throttle opening and 3rd gear (“3” range)		2300 RPM (displayed in increments of 50 rpm)
☞ OUTPUT SHAFT REVOLUTION	At vehicle stop		0 RPM
	At 60 km/h (37.5 mile/h) constant speed, 20% or less throttle opening and 3rd gear (“3” range)		2300 RPM (displayed in increments of 50 rpm)
☞ BATTERY VOLTAGE	Ignition switch ON and engine stop		Battery voltage is displayed (8 – 16 V)
☞ ATF TEMPERATURE	After driving at 60 km/h (37.5 mile/h) for 15 minutes or more, and A/T fluid temperature around sensor reaches 70 – 80 °C (158 – 176 °F)		70 – 80 °C (158 – 176 °F)
☞ SHIFT SOLENOID-A COMMAND	At vehicle stop		ON
	At 60 km/h (37.5 mile/h) constant speed, 20% or less throttle opening and 3rd gear (“3” range)		OFF
☞ SHIFT SOLENOID-A MONITOR	At vehicle stop		ON
	At 60 km/h (37.5 mile/h) constant speed, 20% or less throttle opening and 3rd gear (“3” range)		OFF
☞ SHIFT SOLENOID-B COMMAND	At vehicle stop		ON
	At 60 km/h (37.5 mile/h) constant speed, 20% or less throttle opening and 3rd gear (“3” range)		OFF
☞ SHIFT SOLENOID-B MONITOR	At vehicle stop		ON
	At 60 km/h (37.5 mile/h) constant speed, 20% or less throttle opening and 3rd gear (“3” range)		OFF
☞ TIMING SOLENOID COMMAND	Ignition switch ON and select lever is in “N” range		OFF
	For about 0.5 sec. while on gear shifting between 3rd and 4th or gear shifting “N” to “D”		ON
☞ TIMING SOLENOID MONITOR	Ignition switch ON and select lever is in “N” range		OFF
	For about 0.5 sec. while on gear shifting between 3rd and 4th or gear shifting “N” to “D”		ON
☞ TCC SOLENOID	At vehicle stop, closed throttle, engine idle speed and 1st gear		0%
☞ PRESSURE CONTROL SOLENOID	At vehicle stop, closed throttle, engine idle speed and 1st gear		0%
☞ VEHICLE SPEED	At vehicle stop		0 km/h, 0 MPH
☞ O/D OFF SWITCH	Ignition switch ON	Shift select lever to “3” or “2” range	ON
		Shift select lever to other above range	OFF
☞ TRANSAXLE RANGE	Ignition switch ON	Select lever is in “P” position	P
		Select lever is in “R” position	R
		Select lever is in “N” position	N
		Select lever is in “D” position	D
		Select lever is in “3” position	D
		Select lever is in “2” position	2
		Select lever is in “L” position	L
☞ D RANGE SIGNAL	Ignition switch ON	Select lever is in “P” position	OFF
		Select lever is in “R” position	ON
		Select lever is in “N” position	OFF
		Select lever is in “D” position	ON
		Select lever is in “3” position	ON
		Select lever is in “2” position	ON
		Select lever is in “L” position	ON
☞ THROTTLE POSITION	Ignition switch ON	Accelerator pedal is depressed	0 – 100% (Varies depending on depressed value)
		Accelerator pedal is released	0%
☞ BRAKE SWITCH	Ignition switch ON	Brake pedal is depressed	ON
		Brake pedal is released	OFF

Scan tool data	Vehicle condition	Normal condition / reference values
☞ TORQUE REDUCTION SIGNAL	While on gear upshifting with 25% or more throttle opening	ON
	Under condition of not shifting gear	OFF
☞ ENGINE COOLANT TEMPERATURE	Ignition switch ON	Engine coolant temperature is displayed
☞ AIR CONDITIONER SIGNAL	Ignition switch ON and air conditioner switch OFF	OFF
☞ ENGINE TORQUE SIGNAL	Ignition switch ON and engine stop	0 N·m
☞ SLIP RPM	Engine running at idle speed and select lever is in “P” range	0 RPM
	Engine running, vehicle stop and select lever is in “D” range	Engine speed is displayed
☞ MIL REQUEST	Ignition switch ON	OFF
☞ FUEL CUT FLAG	Ignition switch ON	OFF

Scan Tool Data Definitions:

GEAR POSITION
Current gear position computed by throttle position coming from ECM and vehicle speed.

ENGINE SPEED (RPM)
Engine speed computed by reference pulses from crankshaft position sensor.

INPUT SHAFT REVOLUTION (RPM)
Input shaft revolution computed by reference pulses coming from input shaft speed sensor on transaxle case.

OUTPUT SHAFT REVOLUTION (RPM)
Output shaft revolution computed by reference pulses coming from output shaft speed sensor on transaxle case.

BATTERY VOLTAGE (V)
Battery voltage read by TCM as analog input signal by TCM.

ATF TEMPERATURE (°C, °F)
ATF temperature decided by signal from transmission fluid temperature sensor installed on valve body.

SHIFT SOLENOID-A COMMAND
ON: ON command being outputted to shift solenoid valve-A (No.1)
OFF: ON command not being outputted to shift solenoid valve-A (No.1)

SHIFT SOLENOID-A MONITOR
ON: Electricity being passed to shift solenoid valve-A (No.1)
OFF: Electricity not being passed to shift solenoid valve-A (No.1)

SHIFT SOLENOID-B COMMAND
ON: ON command being outputted to shift solenoid valve-B (No.2)
OFF: ON command not being outputted to shift solenoid valve-B (No.2)

SHIFT SOLENOID-B MONITOR
ON: Electricity being passed to shift solenoid valve-B (No.2)
OFF: Electricity not being passed to shift solenoid valve-B (No.2)

TIMING SOLENOID COMMAND
ON: ON command being outputted to timing solenoid valve
OFF: ON command not being outputted to timing solenoid valve

TIMING SOLENOID MONITOR
ON: Electricity being passed to timing solenoid valve
OFF: Electricity not being passed to timing solenoid valve

TCC SOLENOID
Electric current value ratio between electric current value being outputted from TCM to solenoid and maximum value can be outputted by TCM.

PRESSURE CONTROL SOLENOID
Electric current value ratio between electric current value being outputted from TCM to solenoid and maximum value can be outputted by TCM.

VEHICLE SPEED (KPH/MPH)
Vehicle speed computed by reference pulse signals coming from vehicle speed sensor on transaxle case.

O/D OFF SWITCH (“3” position switch)
Inputted signal from “3” position switch in select lever assembly.
ON: Shift select lever to “3” or “2” range
OFF: Shift select lever to other above range

TRANSAXLE RANGE
Transaxle range detected by signal fed from transmission range sensor.

D RANGE SIGNAL
ON: Signal which TCM require ECM to increase idle speed
OFF: Signal which TCM does not require ECM to increase idle speed

THROTTLE POSITION (%)
Throttle opening ratio computed by CAN signal from ECM.

BRAKE SWITCH
Inputted signal from brake light switch on pedal bracket.
ON: Brake pedal depressed
OFF: Brake pedal released

TORQUE REDUCTION SIGNAL
ON: Signal which TCM require ECM to reduce output torque at shifting gear
OFF: Signal which TCM does not require ECM to reduce output torque

ENGINE COOLANT TEMPERATURE (°C, °F)
Engine coolant temperature computed by CAN signal from ECM.

AIR CONDITIONER SIGNAL
ON: Signal which inform that air conditioner compressor is turned ON.
OFF: Signal which inform that air conditioner compressor is not turned ON.

ENGINE TORQUE SIGNAL (N·m)
Engine torque computed by duty pulse signal outputted from ECM.

SLIP RPM (RPM)
This parameter indicates slipping rotation in the torque converter (difference between input shaft rotation and engine rotation)

MIL REQUEST
ON: Signal which TCM requires combination meter to turn on malfunction indicator lamp.
OFF: Signal which TCM does not require combination meter to turn on malfunction indicator lamp.

FUEL CUT FLAG
ON: Signal which inform that fuel cut is operating.
OFF: Signal which inform that fuel cut is not operating.

A/T Basic Check

S7RS0B5104010

This check is important for troubleshooting when TCM has detected no DTC and no abnormality has been noted in “Visual Inspection”. Follow the flow carefully.

Step	Action	Yes	No
1	*Was “A/T System Check” preformed?*	Go to Step 2.	Go to “A/T System Check”.
2	Perform “Road Test”. *Is it OK?*	Go to Step 3.	Proceed to “Troubleshooting” in “Road Test”.
3	Perform “Manual Road Test”. *Is it OK?*	Go to Step 4.	Proceed to “Troubleshooting” in “Manual Road Test”.
4	Perform “Engine Brake Test”. *Is it OK?*	Go to Step 5.	Proceed to “Troubleshooting” in “Engine Brake Test”.
5	Perform “Stall Test”. *Is it OK?*	Go to Step 6.	Proceed to “Troubleshooting” in “Stall Test”.
6	Perform “Time Lag Test”. *Is it OK?*	Go to Step 7.	Proceed to “Troubleshooting” in “Time Lag Test”.
7	Perform “Line Pressure Test”. *Is it OK?*	Go to Step 8.	Proceed to “Troubleshooting” in “Line Pressure Test”.
8	Proceed to “Trouble Diagnosis 1” in “A/T Symptom Diagnosis”. *Is trouble identified?*	Repair or replace faulty parts.	Go to Step 9.

Step	Action	Yes	No
9	Proceed to “Trouble Diagnosis 2” in “A/T Symptom Diagnosis”. *Is trouble identified?*	Repair or replace faulty parts.	Proceed to “Trouble Diagnosis 3” in “A/T Symptom Diagnosis”.

Road Test

S7RS0B5104011

This test is to check if upshift, downshift and lock-up take place at specified speeds while actually driving vehicle on a level road.

⚠ WARNING

- **Carry out test in very little traffic area to prevent an accident.**
- **Test requires 2 persons, a driver and a tester.**

1) Warm up engine.
2) With engine running at idle, shift select lever “D” range.
3) Accelerate vehicle speed by depressing accelerator pedal gradually.
4) While driving in “D” range, check if gear shift and lock-up occur properly as shown in “Automatic Gear Shift Table”.

Troubleshooting

Condition	Possible cause	Correction / Reference Item
Unable to run in all range	Faulty valve body component	*Replace valve body assembly.*
	Faulty oil pump	*Inspect. If NG, replace.*
	Seized or broken planetary gear	*Inspect. If NG, replace.*
	Faulty one-way No.2 clutch	*Inspect. If NG, replace.*
	Faulty forward clutch	*Inspect. If NG, replace.*
	Faulty reverse clutch	*Inspect. If NG, replace.*
	Faulty 1st and reverse brake	*Inspect. If NG, replace.*
	Damaged drive plate	*Inspect. If NG, replace.*
	Faulty torque converter	*Replace.*
No gear shift as 3rd gear	Malfunction of shift solenoid valve-A and/or -B	*Inspect. If NG, replace.*
	Malfunction of timing solenoid valve	*Inspect. If NG, replace.*
	Malfunction of pressure control solenoid valve	*Inspect. If NG, replace valve body assembly.*
1 → 2 upshift fails to occur	Malfunction of shift solenoid valve-B	*Inspect. If NG, replace.*
	Malfunction of output shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of throttle position sensor	*Inspect. If NG, replace.*
	Malfunction of transmission range sensor	*Inspect. If NG, replace.*
	Faulty valve body component	*Replace valve body assembly.*
	Faulty 2nd brake	*Inspect. If NG, replace.*
	Faulty one-way No.1 clutch	*Inspect. If NG, replace.*
2 → 3 upshift fails to occur	Malfunction of shift solenoid valve-A	*Inspect. If NG, replace.*
	Malfunction of output shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of throttle position sensor	*Inspect. If NG, replace.*
	Malfunction of transmission range sensor	*Inspect. If NG, replace.*
	Faulty valve body component	*Replace valve body assembly.*
	Faulty direct clutch	*Inspect. If NG, replace.*

Condition	Possible cause	Correction / Reference Item
3 → 4 upshift fails to occur	Malfunction of shift solenoid valve-B	*Inspect. If NG, replace.*
	Malfunction of "3" position switch	*Inspect. If NG, replace.*
	Malfunction of engine coolant temperature sensor	*Inspect. If NG, replace.*
	Malfunction of output shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of input shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of throttle position sensor	*Inspect. If NG, replace.*
	Malfunction of transmission range sensor	*Inspect. If NG, replace.*
	Malfunction of crankshaft position sensor	*Inspect. If NG, replace.*
	Malfunction of timing solenoid valve	*Inspect. If NG, replace.*
	Malfunction of transmission fluid temperature sensor	*Inspect. If NG, replace.*
	Malfunction of pressure control solenoid valve	*Inspect. If NG, replace valve body assembly.*
	Faulty valve body component	*Replace valve body assembly.*
	Faulty O/D and 2nd coast brake	*Inspect. If NG, replace.*
Gear shift point is incorrect	Abnormal engine condition	*Inspect and repair engine.*
	Malfunction of output shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of throttle position sensor	*Inspect. If NG, replace.*
	Malfunction of pressure control solenoid valve	*Inspect. If NG, replace valve body assembly.*
O/D → 3 downshift fails to occur	Malfunction of shift solenoid valve-A	*Inspect. If NG, replace.*
	Malfunction of "3" position switch	*Inspect. If NG, replace.*
	Malfunction of output shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of input shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of throttle position sensor	*Inspect. If NG, replace.*
	Malfunction of timing solenoid valve	*Inspect. If NG, replace.*
	Malfunction of pressure control solenoid valve	*Inspect. If NG, replace valve body assembly.*
	Faulty valve body component	*Replace valve body assembly.*
	Faulty forward clutch	*Inspect. If NG, replace.*
3 → 2 downshift fails to occur	Malfunction of shift solenoid valve-A	*Inspect. If NG, replace.*
	Malfunction of output shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of throttle position sensor	*Inspect. If NG, replace.*
	Faulty valve body component	*Replace valve body assembly.*
	Faulty one-way No.1 clutch	*Inspect. If NG, replace.*
2 → 1 downshift fails to occur	Malfunction of shift solenoid valve-B	*Inspect. If NG, replace.*
	Malfunction of output shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of throttle position sensor	*Inspect. If NG, replace.*
	Faulty valve body component	*Replace valve body assembly.*
	Faulty one-way No.2 clutch	*Inspect. If NG, replace.*

Condition	Possible cause	Correction / Reference Item
TCC (lock-up) function pressure control does not operate	Malfunction of TCC pressure control solenoid valve	*Inspect. If NG, replace.*
	Malfunction of shift solenoid valve-A and/or -B	*Inspect. If NG, replace.*
	Malfunction of brake light switch	*Inspect. If NG, replace.*
	Malfunction of engine coolant temperature sensor	*Inspect. If NG, replace.*
	Malfunction of output shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of input shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of throttle position sensor	*Inspect. If NG, replace.*
	Malfunction of transmission range sensor	*Inspect. If NG, replace.*
	Malfunction of transmission fluid temperature sensor	*Inspect. If NG, replace.*
	Malfunction of pressure control solenoid valve	*Inspect. If NG, replace valve body assembly.*
	Faulty valve body component	*Replace valve body assembly.*
	Faulty torque converter	*Replace.*

Manual Road Test

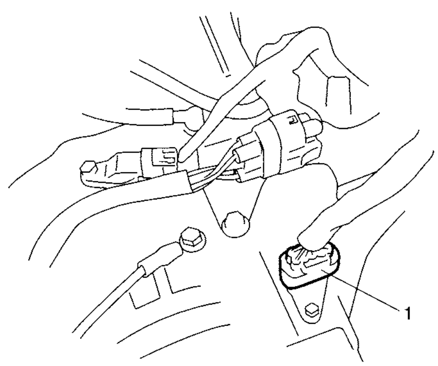
S7RS0B5104012

⚠ WARNING

Carry out test in very little traffic area to prevent an accident.
Test requires 2 persons, a driver and a tester.

The purpose of this test is to judge whether causal factor of trouble which occurred in automatic transaxle is electrical or mechanical by disconnecting valve body harness connector (1) and fixing automatic transaxle gear position.

1) Start engine and warm it up to normal operating temperature.
2) Turn ignition switch to OFF position and disconnect valve body harness connector (1).



I3RM0B510010-01

3) Turn OFF all electrical loads.
   With select lever shifted to each range (“L”, “2”, “3” and “D”), drive vehicle at 1,000 rpm engine speed and then check vehicle speed by referring to “Fixed gear position”.
   If vehicle speed is not as specified in “Fixed gear position” table, go to troubleshooting.
4) Connect valve body harness connector and clear DTC.

Fixed gear position

Select lever position	Fixed gear position	Vehicle speed
L range	3rd gear	Approx. 25.0 km/h (15.5 mile/h)
2 range		
3 range		
D range		
R range	Reverse gear	Approx. 10.9 km/h (6.8 mile/h)

Troubleshooting

Condition	Possible cause	Correction / Reference Item
Operated gear is not correct	Faulty valve body component	*Replace valve body assembly.*
	Faulty clutch or brake	*Inspect clutch and brake. If any parts are faulty, replace them.*

Engine Brake Test

S7RS0B5104013

WARNING

Before test, make sure that there is no vehicle behind so as to prevent rear-end collision.

1) While driving vehicle in 3rd gear of “D” range, shift select lever down to “2” range and check if engine brake operates.
2) In the same way as in Step 1), check engine brake for operation when select lever is shifted down to “L” range.
3) Engine brake should operate in the test.

Troubleshooting

Condition	Possible cause	Correction / Reference Item
Failure to operate when shifted down to “2” range	Faulty valve body component	*Replace valve body assembly.*
	Faulty O/D and 2nd coast brake	*Inspect. If NG, replace.*
Failure to operate when shifted down to “L” range	Faulty valve body component	*Replace valve body assembly.*
	Faulty 1st and reverse brake	*Inspect. If NG, replace.*

Stall Test

S7RS0B5104014

This test is to check overall performance of automatic transaxle and engine by measuring stall speed at “D” and “R” ranges. Be sure to perform this test only when transaxle fluid is at normal operating temperature and its level is between FULL and LOW marks.

CAUTION

- **Do not run engine at stall more than 5 seconds continuously, or fluid temperature may rise excessively high.**
- **After performing stall test, be sure to leave engine running at idle for longer than 1 minute before another stall test.**

1) Apply parking brake and block wheels.
2) Install tachometer.
3) Start engine with select lever shifted to “P” range.
4) Depress brake pedal fully.
5) Shift select lever to “D” range and depress accelerator pedal fully while watching tachometer. Read engine rpm quickly when it has become constant (stall speed).
6) Release accelerator pedal immediately after stall speed is checked.
7) In the same way, check stall speed in “R” range.
8) Stall speed should be within the following specification.

Engine stall speed
Standard: 2100 – 2400 rpm

Troubleshooting

Condition	Possible cause	Correction / Reference Item
Lower than standard level in both "D" and "R" range	Engine output torque failure	*Inspect and repair engine.*
	Faulty one-way clutch of torque converter	*Replace torque converter.*
Higher than standard level in "D" range	Malfunction of pressure control solenoid valve (Low line pressure)	*Inspect. If NG, replace valve body assembly.*
	Faulty valve body component	*Replace valve body assembly.*
	Slippery forward clutch	*Inspect. If NG, replace.*
	Faulty one-way No.2 clutch	*Inspect. If NG, replace.*
	Leakage from "D" range fluid pressure circuit	*Replace valve body assembly.*
Higher than standard level in "R" range	Malfunction of pressure control solenoid valve (Low line pressure)	*Inspect. If NG, replace valve body assembly.*
	Faulty valve body component	*Replace valve body assembly.*
	Slippery reverse clutch	*Inspect. If NG, replace.*
	Slippery 1st and reverse brake	*Inspect. If NG, replace.*
	Leakage from "R" range fluid pressure circuit	*Replace valve body assembly.*
Higher than standard level in both "D" and "R" range	Malfunction of pressure control solenoid valve (Low line pressure)	*Inspect. If NG, replace valve body assembly.*
	Faulty valve body component	*Replace valve body assembly.*
	Clogged oil strainer	*Replace.*
	Faulty oil pump	*Inspect. If NG, replace.*
	Leakage from both "D" and "R" range fluid pressure circuit	*Replace valve body assembly.*

Time Lag Test

S7RS0B5104015

This test is to check conditions of clutch, brake and fluid pressure. "Time lag" means time elapsed since select lever is shifted with engine idling till shock is felt.

1) With chocks placed before and behind front and rear wheels respectively, depress brake pedal.
2) Start engine.
3) With stop watch ready, shift select lever from "N" to "D" range and measure time from that moment till shock is felt.
4) Similarly measure time lag by shifting select lever from "N" to "R" range.

<u>Gear shifting time lag</u>
"N" → "D": Less than 0.7 sec.
"N" → "R": Less than 1.2 sec.

NOTE

- **When repeating this test, be sure to wait at least one minute after select lever is shifted back to "N" range.**
- **Engine should be warmed up fully for this test.**
- **Repeat test 3 times and take average of those data for final time lag data.**

Troubleshooting

Condition	Possible cause	Correction / Reference Item
"N" → "D" time lag exceeds specification	Malfunction of transmission fluid temperature sensor	*Inspect. If NG, replace.*
	Malfunction of pressure control solenoid valve (Low line pressure)	*Inspect. If NG, replace valve body assembly.*
	Faulty valve body component	*Replace valve body assembly.*
	Clogged oil strainer	*Replace.*
	Faulty oil pump	*Inspect. If NG, replace.*
	Faulty forward clutch	*Inspect. If NG, replace.*
	Faulty one-way No.2 clutch	*Inspect. If NG, replace.*
	Leakage from "D" range fluid pressure circuit	*Replace valve body assembly.*
"N" → "R" time lag exceeds specification	Malfunction of transmission fluid temperature sensor	*Inspect. If NG, replace.*
	Malfunction of pressure control solenoid valve (Low line pressure)	*Inspect. If NG, replace valve body assembly.*
	Faulty valve body component	*Replace valve body assembly.*
	Clogged oil strainer	*Replace.*
	Faulty oil pump	*Inspect. If NG, replace.*
	Faulty reverse clutch	*Inspect. If NG, replace.*
	Faulty 1st and reverse brake	*Inspect. If NG, replace.*
	Leakage from "R" range fluid pressure circuit	*Replace valve body assembly.*

Line Pressure Test

S7RS0B5104016

Purpose of this test is to check operating conditions of each part by measuring fluid pressure in fluid pressure line.
Line pressure test requires the following conditions.

- Automatic fluid is at normal operating temperature (70 – 80 °C / 158 – 176 °F).
- Fluid is replenished to proper level (between FULL and LOW on dipstick).
- Air conditioner switch is turned OFF.

1) Apply parking brake securely and place chocks against wheels.
2) Remove fluid pressure check hole plug bolt.
3) Attach oil pressure gauge to fluid pressure check hole in transaxle case.

Special tool
(A): 09925-37811-001

⚠ CAUTION

After attaching oil pressure gauge, check that no fluid leakage exists.

4) Depress foot brake fully, run engine at idle and stall then check fluid pressure in "D" or "R" range.

⚠ CAUTION

- **Do not continue running engine at stall speed longer than 5 seconds.**
- **After performing line pressure test, be sure to leave engine running at idle for longer than one minute before performing another line pressure test.**

<u>**Automatic transaxle line pressure**</u>

	"D" range	**"R" range**
At idle speed	**3.8 – 4.2 kg/cm^2, 54 – 60psi**	**5.9 – 6.9 kg/cm^2, 84 – 98 psi**
At stall speed	**12.1 – 13.4 kg/cm^2, 172 – 191 psi**	**16.8 – 19.5 kg/cm^2, 239 – 277 psi**

Troubleshooting

Condition	Possible cause	Correction / Reference Item
Higher than standard level in each range	Malfunction of pressure control solenoid valve (Low line pressure)	*Inspect. If NG, replace valve body assembly.*
	Faulty valve body component	*Replace valve body assembly.*
Lower than standard level in each range	Malfunction of pressure control solenoid valve (Low line pressure)	*Inspect. If NG, replace valve body assembly.*
	Faulty valve body component	*Replace valve body assembly.*
	Clogged oil strainer	*Replace.*
	Faulty oil pump	*Inspect. If NG, replace.*
	Leakage from both “D” and “R” range fluid pressure circuit	*Replace valve body assembly.*
Lower than standard level only in “D” range	Leakage from “D” range fluid pressure circuit	*Replace valve body assembly.*
Lower than standard level only in “R” range	Leakage from “R” range fluid pressure circuit	*Replace valve body assembly.*

“P” Range Test

S7RS0B5104017

1) Stop vehicle on a slope of 5 degrees or more, shift select lever to “P” range and at the same time apply parking brake.
2) After stopping engine, depress brake pedal and release parking brake.
3) Then, release brake pedal gradually and check that vehicle remains stationary.
4) Depress brake pedal and shift select lever to “N” range.
5) Then, release brake pedal gradually and check that vehicle moves.

⚠ WARNING

Before test, make sure no one is around vehicle or down on a slope and keep watchful for safety during test.

Troubleshooting

Condition	Possible cause	Correction / Reference Item
Vehicle moves at “P” range or remains stationary at “N” range	Defective parking lock pawl or spring	*Inspect. If NG, repair.*

A/T Symptom Diagnosis

S7RS0B5104018

Trouble Diagnosis 1

Electrical repair

Condition	Possible cause	Correction / Reference Item
Excessive shift shock	Shift solenoid valve-A and/or -B circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Pressure control solenoid valve circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Timing solenoid valve circuit faulty only when N $\rightarrow$ D or 3 $\leftrightarrow$ 4 shifting	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Output shaft speed sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Input shaft speed sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Transmission fluid temperature sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	CAN communication circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Throttle position sensor circuit faulty	*Inspect circuit for open, short and intermittent referring to “Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”. If NG, repair.*
	Crankshaft position sensor circuit faulty	*Inspect circuit for open, short and intermittent referring to “DTC P0335: Crankshaft Position (CKP) Sensor “A” Circuit in Section 1A”. If NG, repair.*
	TCM	*Substitute a known-good TCM and recheck.*
	ECM	*Substitute a known-good ECM and recheck.*
No gear shift as 3rd gear	Shift solenoid valve-A and/or -B circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Pressure control solenoid valve circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Timing solenoid valve circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	TCM	*Substitute a known-good TCM and recheck.*
Poor 1 $\rightarrow$ 2 shift	Shift solenoid valve-B circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Output shaft speed sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Transmission range sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	CAN communication circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Throttle position sensor circuit faulty	*Inspect circuit for open, short and intermittent referring to “Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”. If NG, repair.*
	TCM	*Substitute a known-good TCM and recheck.*
	ECM	*Substitute a known-good ECM and recheck.*

Condition	Possible cause	Correction / Reference Item
Poor 2 → 3 shift	Shift solenoid valve-A circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Output shaft speed sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Transmission range sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	CAN communication circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Throttle position sensor circuit faulty	*Inspect circuit for open, short and intermittent referring to "Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C". If NG, repair.*
	TCM	*Substitute a known-good TCM and recheck.*
	ECM	*Substitute a known-good ECM and recheck.*
Poor 3 → 4 shift	Shift solenoid valve-B circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Pressure control solenoid valve circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Timing solenoid valve circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Output shaft speed sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Input shaft speed sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Transmission range sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Transmission fluid temperature sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	CAN communication circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Throttle position sensor circuit faulty	*Inspect circuit for open, short and intermittent referring to "Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C". If NG, repair.*
	Engine coolant temperature sensor circuit faulty	*Inspect circuit for open, short and intermittent referring to "DTC P0117: Engine Coolant Temperature Circuit Low in Section 1A" and/or "DTC P0118: Engine Coolant Temperature Circuit High in Section 1A". If NG, repair.*
	Crankshaft position sensor circuit faulty	*Inspect circuit for open, short and intermittent referring to "DTC P0335: Crankshaft Position (CKP) Sensor "A" Circuit in Section 1A". If NG, repair.*
	"3" position switch circuit faulty	*Refer to "No Gear Shift to 4th gear".*
	TCM	*Substitute a known-good TCM and recheck.*
	ECM	*Substitute a known-good ECM and recheck.*

Condition	Possible cause	Correction / Reference Item
Poor 4 → 3 shift	Shift solenoid valve-B circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Pressure control solenoid valve circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Timing solenoid valve circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Output shaft speed sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Input shaft speed sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	CAN communication circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Throttle position sensor circuit faulty	*Inspect circuit for open, short and intermittent referring to "Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C". If NG, repair.*
	"3" position switch circuit faulty	*Refer to "No Gear Shift to 4th gear".*
	TCM	*Substitute a known-good TCM and recheck.*
	ECM	*Substitute a known-good ECM and recheck.*
Poor 3 → 2 shift	Shift solenoid valve-A circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Output shaft speed sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	CAN communication circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Throttle position sensor circuit faulty	*Inspect circuit for open, short and intermittent referring to "Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C". If NG, repair.*
	TCM	*Substitute a known-good TCM and recheck.*
	ECM	*Substitute a known-good ECM and recheck.*
Poor 2 → 1 shift	Shift solenoid valve-A circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Output shaft speed sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	CAN communication circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Throttle position sensor circuit faulty	*Inspect circuit for open, short and intermittent referring to "Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C". If NG, repair.*
	TCM	*Substitute a known-good TCM and recheck.*
	ECM	*Substitute a known-good ECM and recheck.*
Incorrect gear shift point	Output shaft speed sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Pressure control solenoid valve circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	CAN communication circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Throttle position sensor circuit faulty	*Inspect circuit for open, short and intermittent referring to "Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C". If NG, repair.*
	TCM	*Substitute a known-good TCM and recheck.*
	ECM	*Substitute a known-good ECM and recheck.*

Condition	Possible cause	Correction / Reference Item
Non operate TCC (lock-up) system	TCC pressure control solenoid valve circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Shift solenoid valve-A and/or-B circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Pressure control solenoid valve circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Output shaft speed sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Input shaft speed sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Transmission range sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Transmission fluid temperature sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	CAN communication circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Throttle position sensor circuit faulty	*Inspect circuit for open, short and intermittent referring to "Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C". If NG, repair.*
	Engine coolant temperature sensor circuit faulty	*Inspect circuit for open, short and intermittent referring to "DTC P0117: Engine Coolant Temperature Circuit Low in Section 1A" and/or "DTC P0118: Engine Coolant Temperature Circuit High in Section 1A". If NG, repair.*
	Brake light switch circuit faulty	*Refer to "No Lock-Up Occurs".*
	TCM	*Substitute a known-good TCM and recheck.*
	ECM	*Substitute a known-good ECM and recheck.*
Higher or lower stall speed	Pressure control solenoid valve circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	TCM	*Substitute a known-good TCM and recheck.*
Excessive "N" → "D" or "N" → "R" time lag	Pressure control solenoid valve circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	Transmission fluid temperature sensor circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	TCM	*Substitute a known-good TCM and recheck.*
Higher or lower line pressure	Pressure control solenoid valve circuit faulty	*Inspect circuit for open, short and intermittent. If NG, repair.*
	TCM	*Substitute a known-good TCM and recheck.*

Trouble Diagnosis 2

On-vehicle repair

Condition	Possible cause	Correction / Reference Item
Unable to run in all range	Faulty valve body component	*Replace valve body assembly.*
Excessive shift shock	Engine abnormal condition	*Inspect and repair engine.*
	Malfunction of shift solenoid valve-A and/or -B	*Inspect. If NG, replace.*
	Malfunction of output shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of input shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of transmission range sensor	*Inspect. If NG, replace.*
	Malfunction of transmission fluid temperature sensor	*Inspect. If NG, replace.*
	Malfunction of timing solenoid valve only when N $\rightarrow$ D or 3 $\leftrightarrow$ 4 shifting	*Inspect. If NG, replace.*
	Malfunction of pressure control solenoid valve	*Inspect. If NG, replace valve body assembly.*
	Malfunction of brake light switch except N $\rightarrow$ D or N $\rightarrow$ R shifting	*Inspect referring to "Brake Light Switch Inspection in Section 9B". If NG, replace.*
	Malfunction of crankshaft position sensor	*Inspect referring to "CKP Sensor Inspection in Section 1C". If NG, replace.*
	Malfunction of throttle position sensor	*Inspect referring to "Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C". If NG, replace.*
	Faulty valve body component	*Replace valve body assembly.*
Poor 1 $\rightarrow$ 2 shift	Malfunction of shift solenoid valve-B	*Inspect. If NG, replace.*
	Malfunction of output shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of transmission range sensor	*Inspect. If NG, replace.*
	Malfunction of throttle position sensor	*Inspect referring to "Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C". If NG, replace.*
	Faulty valve body component	*Replace valve body assembly.*
Poor 2 $\rightarrow$ 3 shift	Malfunction of shift solenoid valve-A	*Inspect. If NG, replace.*
	Malfunction of output shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of transmission range sensor	*Inspect. If NG, replace.*
	Malfunction of throttle position sensor	*Inspect referring to "Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C". If NG, replace.*
	Faulty valve body component	*Replace valve body assembly.*

Condition	Possible cause	Correction / Reference Item
Poor 3 → 4 shift	Malfunction of shift solenoid valve-B	*Inspect. If NG, replace.*
	Malfunction of timing solenoid valve	*Inspect. If NG, replace.*
	Malfunction of output shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of input shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of transmission range sensor	*Inspect. If NG, replace.*
	Malfunction of transmission fluid temperature sensor	*Inspect. If NG, replace.*
	Malfunction of “3” position switch	*Inspect. If NG, replace.*
	Malfunction of engine coolant temperature sensor	*Inspect referring to “ECT Sensor Inspection in Section 1C”. If NG, replace.*
	Malfunction of throttle position sensor	*Inspect referring to “Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”. If NG, replace.*
	Malfunction of pressure control solenoid valve	*Inspect. If NG, replace valve body assembly.*
	Faulty valve body component	*Replace valve body assembly.*
Poor 4 → 3 shift	Malfunction of shift solenoid valve-B	*Inspect. If NG, replace.*
	Malfunction of timing solenoid valve	*Inspect. If NG, replace.*
	Malfunction of output shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of input shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of “3” position off switch	*Inspect. If NG, replace.*
	Malfunction of throttle position sensor	*Inspect referring to “Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”. If NG, replace.*
	Malfunction of pressure control solenoid valve	*Inspect. If NG, replace valve body assembly.*
	Faulty valve body component	*Replace valve body assembly.*
Poor 3 → 2 shift	Malfunction of shift solenoid valve-A	*Inspect. If NG, replace.*
	Malfunction of output shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of throttle position sensor	*Inspect referring to “Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”. If NG, replace.*
	Faulty valve body component	*Replace valve body assembly.*
Poor 2 → 1 shift	Malfunction of shift solenoid valve-B	*Inspect. If NG, replace.*
	Malfunction of output shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of throttle position sensor	*Inspect referring to “Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”. If NG, replace.*
	Faulty valve body component	*Replace valve body assembly.*
Incorrect shift point	Engine abnormal condition	*Inspect and repair engine.*
	Malfunction of output shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of throttle position sensor	*Inspect referring to “Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C”. If NG, replace.*

Condition	Possible cause	Correction / Reference Item
Non operate TCC (lock-up) system	Malfunction of TCC solenoid valve	*Inspect. If NG, replace.*
	Malfunction of shift solenoid valve-A and/or -B	*Inspect. If NG, replace.*
	Malfunction of output shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of input shaft speed sensor	*Inspect. If NG, replace.*
	Malfunction of transmission range sensor	*Inspect. If NG, replace.*
	Malfunction of transmission fluid temperature sensor	*Inspect. If NG, replace.*
	Malfunction of pressure control solenoid valve	*Inspect. If NG, replace valve body assembly.*
	Malfunction of throttle position sensor	*Inspect referring to "Electric Throttle Body Assembly On-Vehicle Inspection in Section 1C". If NG, replace.*
	Malfunction of engine coolant temperature sensor	*Inspect referring to "ECT Sensor Inspection in Section 1C". If NG, replace.*
	Malfunction of brake light switch	*Inspect referring to "Brake Light Switch Inspection in Section 9B". If NG, replace.*
	Faulty valve body component	*Replace valve body assembly.*
Excessive "N" → "D" or "N" → "R" time lag	Malfunction of transmission fluid temperature sensor	*Inspect. If NG, replace.*
	Pressure control solenoid valve circuit faulty	*Inspect. If NG, replace valve body assembly.*
	Clogged oil strainer	*Replace.*
	Faulty valve body component	*Replace valve body assembly.*

Trouble Diagnosis 3
Off-vehicle repair

Condition	Possible cause	Correction / Reference Item
Unable to run in all range	Faulty oil pump	*Inspect. If NG, replace.*
	Seized or broken planetary gear	*Inspect. If NG, replace.*
	Faulty one-way No.2 clutch	*Inspect. If NG, replace.*
	Damaged drive plate	*Inspect. If NG, replace.*
	Faulty forward clutch	*Inspect. If NG, replace.*
	Faulty reverse clutch	*Inspect. If NG, replace.*
	Faulty 1st and reverse brake	*Inspect. If NG, replace.*
	Faulty torque converter	*Replace.*
Excessive "N" → "D" shift shock	Faulty forward clutch	*Inspect. If NG, replace.*
Excessive "N" → "R" shift shock	Faulty reverse clutch	*Inspect. If NG, replace.*
	Faulty 1st and reverse brake	*Inspect. If NG, replace.*
Poor 1 → 2 shift, excessive shock or slippage	Faulty 2nd brake	*Inspect. If NG, replace.*
	Faulty one-way No.1 clutch	*Inspect. If NG, replace.*
Poor 2 → 3 shift, excessive shock or slippage	Faulty direct clutch	*Inspect. If NG, replace.*
Poor 3 ↔ O/D shift, excessive shock or slippage	Faulty forward clutch	*Inspect. If NG, replace.*
	Faulty O/D and 2nd coast brake	*Inspect. If NG, replace.*
Poor 3 → 2 shift, excessive shock or slippage	Faulty direct clutch	*Inspect. If NG, replace.*
	Faulty one-way No.1 clutch	*Inspect. If NG, replace.*
Poor 2 → 1 shift, excessive shock or slippage	Faulty 2nd brake	*Inspect. If NG, replace.*
	Faulty one-way No.2 clutch	*Inspect. If NG, replace.*

Condition	Possible cause	Correction / Reference Item
Non operate TCC (lock-up) system	Faulty torque converter	*Replace.*
Excessive "N" → "D" time lag	Faulty oil pump	*Inspect. If NG, replace.*
	Faulty forward clutch	*Inspect. If NG, replace.*
	Faulty one-way No.2 clutch	*Inspect. If NG, replace.*
	Leakage from "D" range fluid pressure circuit	*Replace valve body assembly.*
Excessive "N" → "R" time lag	Faulty oil pump	*Inspect. If NG, replace.*
	Faulty reverse clutch	*Inspect. If NG, replace.*
	Faulty 1st and reverse brake	*Inspect. If NG, replace.*
	Leakage from "R" range fluid pressure circuit	*Replace valve body assembly.*
Poor engine brake in downshift to "2" range	Faulty O/D and 2nd coast brake	*Inspect. If NG, replace.*
Poor engine brake in downshift to "L" range	Faulty 1st and reverse brake	*Inspect. If NG, replace.*

No Gear Shift to 4th gear

S7RS0B5104019

System Description

TCM does not shift to 4th gear under any of the following condition.

- "3" position switch is turned ON.
- Engine coolant temperature is less than 50 °C (122 °F).
- A/T fluid temperature is less than 20 °C (68 °F).
- A/T fluid temperature is more than 130 °C (266 °F) while TCM is detecting P2762, P2763 and P2764.
- TCM detects the following DTCs.
  P0712 / P0713 / P0717 / P0722 / P0787 / P0788 / P0961 / P0962 / P0963 / P0973 / P0974 / P0976 / P0977 / P1702 / P1703 / P1774 / P1777

Troubleshooting

⚠ 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 with 2 persons, a driver and a tester, on a level road.**

Step	Action	Yes	No
1	*Was "A/T System Check" performed?*	Go to Step 2.	Go to "A/T System Check".
2	**Check DTC** *Is DTC P0712, P0713, P0717, P0722, P0961, P0962, P0963, P0973, P0974, P0976, P0977, P1702, P1703, P1774 and/or P1777 detected?*	Go to applicable DTC diag. flow.	Go to Step 3.

Step	Action	Yes	No
3	1) Perform running test under the following conditions and measure voltage between terminal “C34-16” of TCM connector and ground, terminal “C34-15” of TCM connector and ground. • Engine coolant temperature is in normal operating temperature. • Select lever is in “D” range. • Drive vehicle with 4th gear condition referring to “Automatic Gear Shift Table”. **Voltage between TCM connector and ground** **Between terminal “C34-16” of TCM connector and ground: 0 – 1 V** **Between terminal “C34-15” of TCM connector and ground: 8 – 14 V** *Do results satisfy the value?*	Faulty shift solenoid valve, circuit or transaxle.	“BRN” circuit shorted to power circuit or open, or “BLK/YEL” circuit shorted to ground. If wire is OK, go to Step 4.
4	**“3” position switch signal inspection** 1) With ignition switch turned ON, check voltage between “L01-8” terminal of BCM coupler and ground. **“3” position switch signal specification** **Shift select lever to “3” or “2” range: 8 – 14 V** **Shift select lever to other above range: 0 – 1 V** *Is result as specified?*	Substitute a known-good TCM and recheck.	Faulty “3” position switch or its circuit.

No Lock-Up Occurs

S7RS0B5104020

System Description

TCM turns TCC solenoid OFF under any of the following conditions.

- Brake light switch is turned ON (Brake pedal is depressed).
- Transmission fluid temperature is less than 60 °C (140 °F).
- Throttle opening is as much as 0%.
- TCM detects the following DTCs.
  P0705 / P0707 / P0712 / P0713 / P0717 / P0722 / P0787 / P0788 / P0961 / P0962 / P0963 / P0973 / P0974 / P0976 / P0977 / P1702 / P1703 / P1774 / P1777 / P2762 / P2763 / P2764

Troubleshooting

⚠ 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 with 2 persons, a driver and a tester, on a level road.**

Step	Action	Yes	No
1	*Was "A/T System Check" performed?*	Go to Step 2.	Go to "A/T System Check".
2	**Check DTC** *Is DTC P0705, P0707, P0712, P0713, P0717, P0722, P0787, P0788, P0961, P0962, P0963, P0973, P0974, P0976, P0977, P1702, P1703, P1774, P1777, P2762, P2763 and/or P2764 detected?*	Go to applicable DTC diag. flow.	Go to Step 3.
3	**Brake light switch signal inspection** 1) With ignition switch turned ON, check voltage between terminal "C35-20" of ECM connector and ground. **Brake light switch signal specification** **Brake pedal is released: 0 – 1 V** **Brake pedal is depressed: 8 – 14 V** *Is result as specified?*	Substitute a known-good TCM and recheck.	Mis-adjusted brake light switch or faulty brake light switch.

Transmission Warning Light Circuit Check – Light Does Not Come "ON" at Ignition Switch ON

S7RS0B5104021

Troubleshooting

Step	Action	Yes	No
1	**Combination meter power supply check** 1) Turn ignition switch ON. *Does other indicator / warning lights in combination meter comes ON?*	Go to Step 2.	Repair combination meter power supply circuit referring to "C-1 Combination Meter Circuit Diagram (Meter) in Section 9A".
2	**TCM power and ground circuit check** 1) Check referring to "TCM Power and Ground Circuit Check". *Is it in good condition?*	Go to Step 3.	Repair or replace.
3	**DTC check** 1) Check DTC referring to "DTC Check". *Is there DTC P1774?*	Go to applicable DTC diag. flow.	Go to Step 4.
4	**Combination meter function check** 1) Turn ignition switch ON. *Does A/T selector position indicator show correct select lever position?*	Replace combination meter.	Substitute a known-good TCM and recheck.

Transmission Warning Light Circuit Check – Light Remains "ON" at Ignition Switch ON

S7RS0B5104022

Troubleshooting

Step	Action	Yes	No
1	**Diagnostic Trouble Code (DTC) Check** 1) Check DTC referring to "DTC Check". *Is there any DTC(s)?*	Perform DTC Flow to repair and retry.	Substitute a known-good TCM and recheck. If OK, substitute a known-good combination meter and recheck.

DTC P0602: Control Module Programming Error

S7RS0B5104048

System Description

Internal control module is installed in ECM.

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Data programming error (1 driving cycle detection logic)	TCM

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Clear DTC, pending DTC and freeze frame data by using scan tool.
3) Start engine and run it at idle if possible.
4) Check DTC.

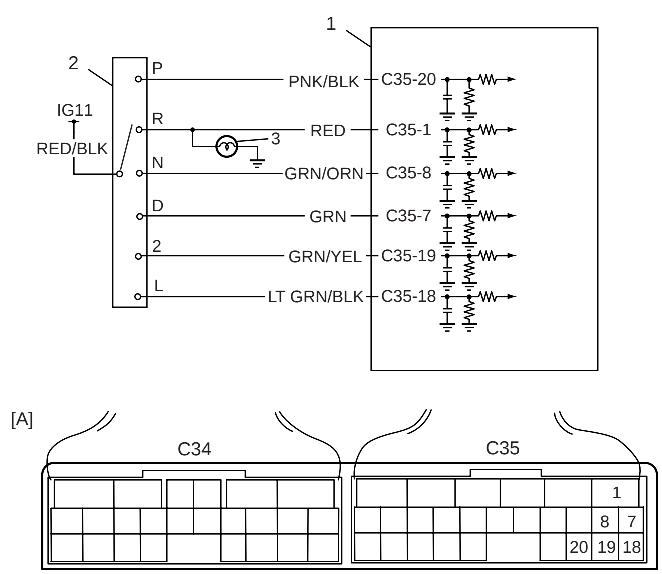
DTC Troubleshooting

Step	Action	Yes	No
1	**DTC check** 1) Clear DTC referring to "DTC Clearance". 2) Turn ignition switch to OFF position. 3) Turn ignition switch to ON position and check DTC. *Is DTC P0602 still indicated?*	Go to Step 2.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection in Section 00".
2	**TCM reprogramming check** *Was reprogramming of TCM executed?*	Execute reprogramming of TCM correctly once again.	Go to Step 3.
3	**TCM power ground circuit check** 1) Check TCM power supply circuit and ground circuit referring to "TCM Power and Ground Circuit Check". *Are check results OK?*	Substitute a known-good TCM and recheck.	Repair TCM power or ground circuit.

DTC P0705: Transmission Range Sensor Circuit Malfunction (PRNDL input)

S7RS0B5104023

Wiring Diagram



I4RS0A510010-01

1. TCM	3. Backup lamp
2. Transmission range sensor	[A]: Terminal arrangement of TCM connector (viewed from harness side)

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Multiple or more signals are inputted simultaneously for 10 seconds.	• Select cable maladjusted • Transmission range sensor (switch) maladjusted • Transmission range sensor (switch) or its circuit malfunction • TCM

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch OFF.
2) Clear DTCs in TCM memory by using scan tool.
3) Start engine and shift select lever to “D” range.
4) Keep engine running at idle speed for 25 seconds or more.
5) Stop vehicle and check DTC.

DTC Troubleshooting

Step	Action	Yes	No
1	*Was “A/T System Check” performed?*	Go to Step 2.	Go to “A/T System Check”.
2	*Do you have SUZUKI scan tool?*	Go to Step 3.	Go to Step 4.
3	**Check transmission range sensor (switch) circuit for operation** Check by using SUZUKI scan tool: 1) Connect SUZUKI scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON and check transmission range signal (“P”, “R”, “N”, “D”, “3”, “2” or “L”) on display when shifting select lever to each range. *Is applicable range indicated?*	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”.	Go to Step 5.
4	**Check transmission range sensor (switch) circuit for operation** Check by not using SUZUKI scan tool: 1) Turn ignition switch ON. 2) Check voltage at terminals “C35-1”, “C35-7”, “C35-8”, “C35-18”, “C35-19” and “C35-20” respectively with select lever shifted to each range. Taking terminal “C35-19” as an example, is battery voltage indicated only when select lever is shifted to “2” range and 0 V for other ranges as shown in the following table. Check voltage at other terminals likewise, referring to the following table. *Are check results satisfactory?*	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”.	Go to Step 5.
5	1) Check select cable for adjustment referring to “Select Cable Adjustment”. *Is it adjusted correctly?*	Go to Step 6.	Adjust.
6	**Check transmission range sensor (switch) for installation position** 1) Shift select lever to “N” range. 2) Check that “N” reference line on sensor and needle direction shaped on lock washer are aligned. *Are they aligned?*	Go to Step 7.	Adjust.

Step	Action	Yes	No
7	1) Check transmission range sensor (switch) referring to "Transmission Range Sensor (Shift Switch) Inspection and Adjustment". *Are check results satisfactory?*	"RED/BLK", "PNK/BLK", "RED", "GRN/ORN", "GRN", "GRN/YEL" or "LT GRN/BLK" circuit shorted to power circuit or shorted each other. If wires and connections are OK, substitute a know-good TCM and recheck.	Replace transmission range sensor.

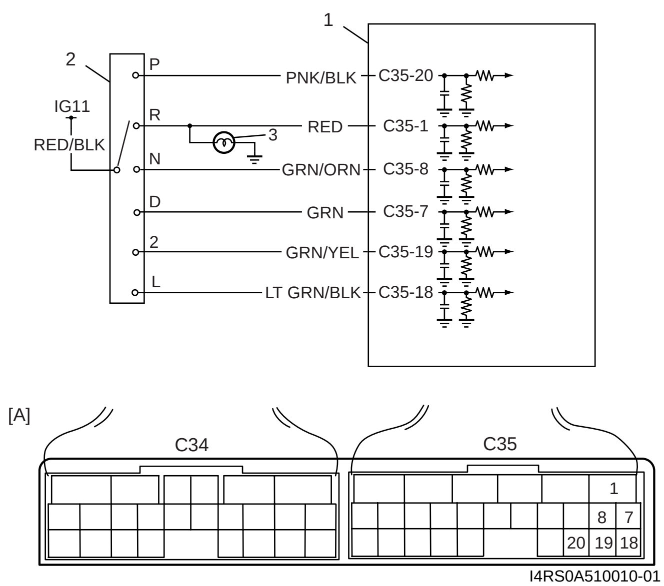
Table for Step 4

		Terminal					
		C35-20	C35-1	C35-8	C35-7	C35-19	C35-18
Select lever position	P	8 – 14 V	0 V	0 V	0 V	0 V	0 V
	R	0 V	8 – 14 V	0 V	0 V	0 V	0 V
	N	0 V	0 V	8 – 14 V	0 V	0 V	0 V
	D or 3	0 V	0 V	0 V	8 – 14 V	0 V	0 V
	2	0 V	0 V	0 V	0 V	8 – 14 V	0 V
	L	0 V	0 V	0 V	0 V	0 V	8 – 14 V

DTC P0707: Transmission Range Sensor Circuit Low

S7RS0B5104024

Wiring Diagram



1.	TCM	3.	Backup lamp
2.	Transmission range sensor	[A]:	Terminal arrangement of TCM connector (viewed from harness side)

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Transmission range switch signal (P, R, N, D, 2, or L) is not inputted for more than 30 seconds when vehicle speed is faster than 30 km/h (19 mile/h) and engine speed is faster than 1500 rpm.	• Select cable maladjusted • Transmission range sensor (switch) maladjusted • Transmission range sensor (switch) or its circuit malfunction • TCM

DTC Confirmation Procedure

⚠ 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 with 2 persons, a driver and a tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF.
2) Clear DTCs in TCM memory by using scan tool.
3) Start engine and shift select lever to “D” range.
4) Start vehicle and increase vehicle speed to 40 km/h (25 mile/h) or more for 1 minutes.
5) Stop vehicle and turn ignition switch OFF.
6) Repeat Step 3) to 4) one time.
7) Stop vehicle and check DTC.

DTC Troubleshooting

Step	Action	Yes	No
1	*Was “A/T System Check” performed?*	Go to Step 2.	Go to “A/T System Check”.
2	*Do you have SUZUKI scan tool?*	Go to Step 3.	Go to Step 4.
3	**Check transmission range sensor (switch) circuit for operation** Check by using SUZUKI scan tool: 1) Connect SUZUKI scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON and check transmission range signal (P, R, N, D, 3, 2 or L) on display when shifting select lever to each range. *Is applicable range indicated?*	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”	Go to Step 5.
4	**Check transmission range sensor (switch) circuit for operation** Check by not using SUZUKI scan tool: 1) Turn ignition switch ON. 2) Check voltage at terminals “C35-1”, “C35-7”, “C35-8”, “C35-18”, “C35-19” and “C35-20” respectively with select lever shifted to each range. Taking terminal “C35-19” as an example, is battery voltage indicated only when select lever is shifted to “2” range and 0 V for other ranges as shown in the following table. Check voltage at other terminals likewise, referring to the following table. *Are check results satisfactory?*	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”.	Go to Step 5.
5	1) Check select cable for adjustment referring to “Select Cable Adjustment”. *Is it adjusted correctly?*	Go to Step 6.	Adjust.
6	**Check transmission range sensor (switch) for installation position** 1) Shift select lever to “N” range. 2) Check that “N” reference line on sensor and needle direction shaped on lock washer are aligned. *Are they aligned?*	Go to Step 7.	Adjust.

Step	Action	Yes	No
7	1) Check transmission range sensor (switch) referring to "Transmission Range Sensor (Shift Switch) Inspection and Adjustment". *Are check results satisfactory?*	"RED/BLK", "PNK/BLK", "RED", "GRN/ORN", "GRN", "GRN/YEL" or "LT GRN/BLK" circuit open or short to ground. If wires and connections are OK, substitute a know-good TCM and recheck.	Replace transmission range sensor.

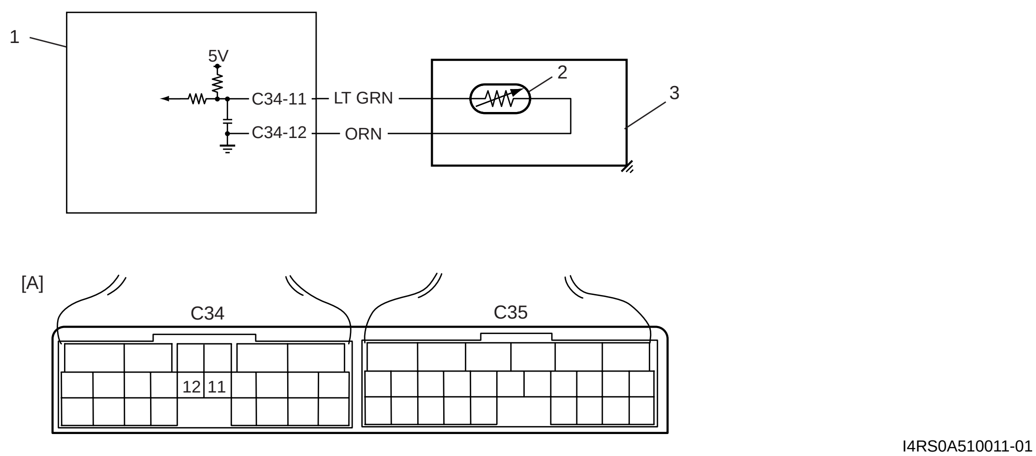
Table for Step 4

		Terminal					
		C35-20	**C35-1**	**C35-8**	**C35-7**	**C35-19**	**C35-18**
Select lever position	P	8 – 14 V	0 V	0 V	0 V	0 V	0 V
	R	0 V	8 – 14 V	0 V	0 V	0 V	0 V
	N	0 V	0 V	8 – 14 V	0 V	0 V	0 V
	D or 3	0 V	0 V	0 V	8 – 14 V	0 V	0 V
	2	0 V	0 V	0 V	0 V	8 – 14 V	0 V
	L	0 V	0 V	0 V	0 V	0 V	8 – 14 V

DTC P0712: Transmission Fluid Temperature Sensor "A" Circuit Low

S7RS0B5104025

Wiring Diagram



1. TCM	3. A/T
2. Transmission fluid temperature sensor	4. Terminal arrangement of TCM connector (viewed from harness side)

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Transmission temperature sensor terminal voltage is less than specified value for 5 minutes or more after turning ignition switch ON.	• Transmission fluid temperature sensor or its circuit malfunction • TCM

DTC Confirmation Procedure

⚠ 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 with 2 persons, a driver and a tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF, if available.
2) Clear DTC in TCM memory and start engine.
3) Keep engine running at idle speed for 10 minutes or more.
4) Stop vehicle and check DTC.

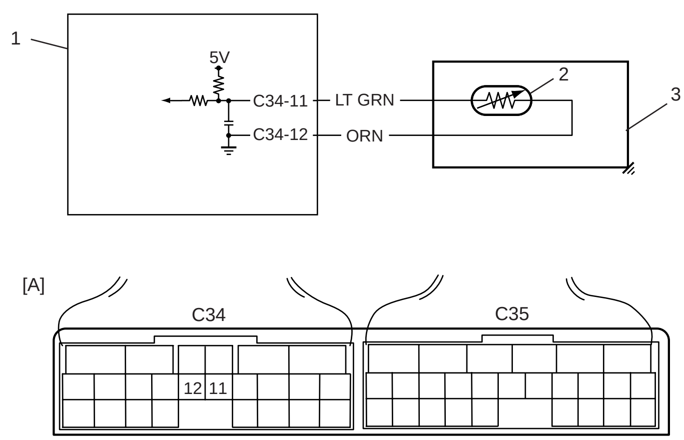
DTC Troubleshooting

Step	Action	Yes	No
1	*Was "A/T System Check" performed?*	Go to Step 2.	Go to "A/T System Check".
2	**Check transmission fluid temperature circuit for ground short** 1) Check continuity between terminal "C34-11" of disconnected harness side TCM connector and ground. *Is continuity indicated?*	"LT GRN" circuit shorted to ground.	Go to Step 3.
3	**Inspect transmission fluid temperature sensor** 1) Inspect transmission fluid temperature sensor referring to "Transmission Fluid Temperature Sensor Inspection". *Is result satisfactory?*	Intermittent trouble or faulty TCM. Check for intermittent referring to "Intermittent and Poor Connection Inspection in Section 00". If OK, substitute a known-good TCM and recheck.	Replace transmission fluid temperature sensor.

DTC P0713: Transmission Fluid Temperature Sensor "A" Circuit High

S7RS0B5104026

Wiring Diagram



I4RS0A510011-01

1. TCM	3. A/T
2. Transmission fluid temperature sensor	[A]: Terminal arrangement of TCM connector (viewed from harness side)

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Transmission fluid temperature sensor terminal voltage is more than specified value and sensor variation is less than specified value even though engine was running in "R", "D", "3", "2" or "L" range for 15 minutes after starting engine.	• Transmission fluid temperature sensor or its circuit malfunction • TCM

DTC Confirmation Procedure

⚠ 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 with 2 persons, a driver and a tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF, if available.
2) Clear DTC in TCM memory and start engine.
3) Start vehicle and increase vehicle speed to about 40 km/h (25 mile/h) for 20 minutes or more.
4) Stop vehicle and check DTC.

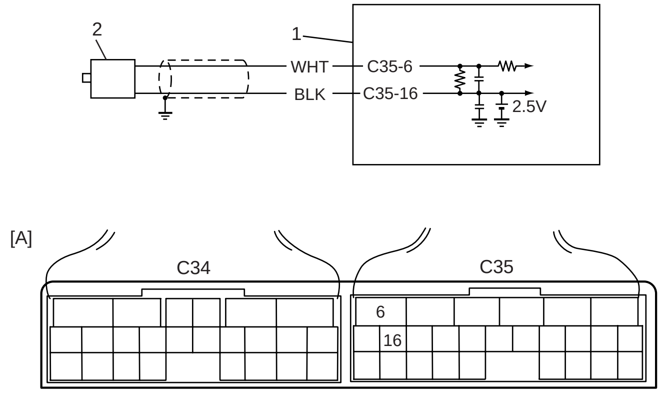
DTC Troubleshooting

Step	Action	Yes	No
1	*Was "A/T System Check" performed?*	Go to Step 2.	Go to "A/T System Check".
2	**Check transmission fluid temperature circuit for open** 1) Turn ignition switch OFF. 2) Disconnect TCM connectors from TCM. 3) Check for proper connection to transmission fluid temperature sensor at terminals "C34-11" and "C34-12". 4) If OK, check continuity between terminals "C34-11" and "C34-12" of disconnected harness side TCM connector. *Is continuity indicated?*	Go to Step 3.	"LT GRN" or "ORN" circuit open.
3	**Check transmission fluid temperature circuit for IG short** 1) Cool down A/T fluid temperature under ambient temperature. 2) Connect TCM connectors to TCM with ignition switch OFF. 3) Turn ignition switch ON. 4) Measure voltage between terminal "C34-11" of TCM connector and ground. *Is it 4.6 V or more?*	"LT GRN" circuit shorted to power circuit. If circuit is OK, go to Step 4.	Intermittent trouble or faulty TCM. Check for intermittent referring to "Intermittent and Poor Connection Inspection in Section 00". If OK, substitute a known-good TCM and recheck.
4	**Inspect transmission fluid temperature sensor** 1) Inspect transmission fluid temperature sensor referring to "Transmission Fluid Temperature Sensor Inspection". *Is result satisfactory?*	Intermittent trouble or faulty TCM. Check for intermittent referring to "Intermittent and Poor Connection Inspection in Section 00". If OK, substitute a known-good TCM and recheck.	Replace transmission fluid temperature sensor.

DTC P0717: Input / Turbine Speed Sensor “A” Circuit Malfunction

S7RS0B5104027

Wiring Diagram



I4RS0A510012-01

1. TCM	2. Input shaft speed sensor	[A]: Terminal arrangement of TCM connector (viewed from harness side)

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
No input shaft speed sensor signal is detected although output shaft speed sensor signals are detected.	• Input shaft speed sensor or its circuit malfunction • Improper input shaft speed sensor installation • Damaged direct clutch drum • Foreign material attachment to sensor or drum • TCM

DTC Confirmation Procedure

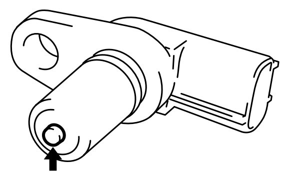
⚠ WARNING

- **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 with 2 persons, a driver and a tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF, if available.
2) Clear DTC in TCM memory and start engine.
3) Shift select lever to “D” range and drive vehicle at 50 km/h (31 mile/h) or more with 3rd gear at least for 5 minutes.
4) Stop vehicle and check DTC.

DTC Troubleshooting

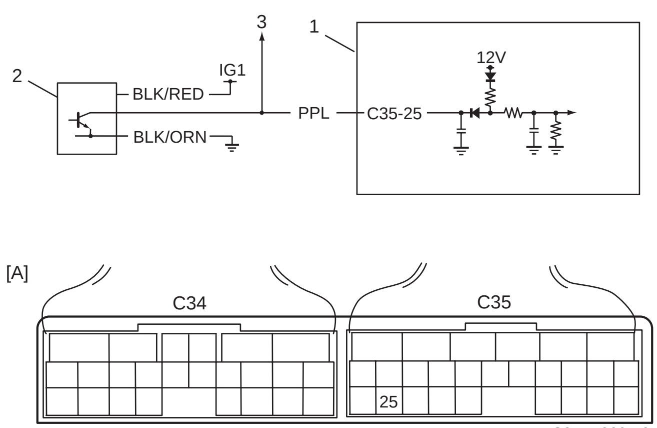
Step	Action	Yes	No
1	*Was “A/T System Check” performed?*	Go to Step 2.	Go to “A/T System Check”.
2	**Check input shaft speed sensor circuit** 1) Disconnect TCM connectors with ignition switch OFF. 2) Check for proper connection to input shaft speed sensor at “C35-6” and “C35-16” terminals. 3) If OK, check resistance of sensor circuit. <u>**Input shaft speed sensor specification**</u> **Between terminals “C35-6” and “C35-16”: 560 – 680 Ω at 20 °C (68 °F)** **Between terminal “C35-6” / “C35-16” and ground: No continuity** *Are check result satisfactory?*	Go to Step 4.	Go to Step 3.

Step	Action	Yes	No
3	**Inspect input shaft speed sensor** 1) Inspect input shaft speed sensor referring to “Input Shaft Speed Sensor Inspection”. *Is result satisfactory?*	“WHT” or “BLK” circuit open or short.	Replace input shaft speed sensor.
4	**Check visually input shaft speed sensor and direct clutch drum for the following** • No damage • No foreign material attached • Correct installation  I2RH0B510020-01 *Are they in good condition?*	Intermittent trouble or faulty TCM. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”. If OK, substitute a known-good TCM and recheck.	Clean, repair or replace.

DTC P0722: Output Speed Sensor Circuit No Signal

S7RS0B5104028

Wiring Diagram



I4RS0B510005-01

1. TCM	3. To ECM
2. Output shaft speed sensor	[A]: Terminal arrangement of TCM connector (viewed from harness side)

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
No output shaft speed sensor signal is detected although input shaft speed sensor signals are detected while vehicle is running at 5 km/h (3 mile/h) or more in vehicle speed with “D”, “2” or “L” range.	• Output shaft speed sensor or its circuit malfunction • Damaged sensor gear (driven gear) • Damaged output shaft speed sensor drive gear • TCM

DTC Confirmation Procedure

⚠ 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 with 2 persons, a driver and a tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF, if available.
2) Clear DTC in TCM memory and start engine.
3) Shift select lever to “D” range and drive vehicle at 50 km/h (31 mile/h) or more vehicle speed at least for 3 minutes.
4) Stop vehicle and check DTC.

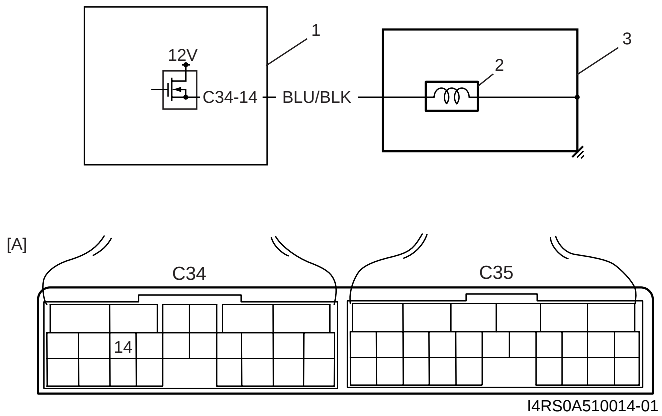
DTC Troubleshooting

Step	Action	Yes	No
1	*Was “A/T System Check” performed?*	Go to Step 2.	Go to “A/T System Check”.
2	**Check output shaft speed sensor power circuit** 1) Turn ignition switch OFF. 2) Disconnect output shaft speed sensor connector. 3) Turn ignition switch ON. 4) Measure voltage between “BLK/RED” wire terminal of disconnected output shaft speed sensor harness side connector and ground. *Is it 10 – 14 V?*	Go to Step 3.	“BLK/RED” wire open or shorted to ground.
3	**Check output shaft speed sensor ground circuit** 1) Turn ignition switch OFF. 2) Check continuity between “BLK/ORN” wire terminal of disconnected output shaft speed sensor harness side connector and ground. *Is continuity indicated?*	Go to Step 4.	“BLK/ORN” wire open.
4	**Check output shaft speed sensor signal circuit for short** 1) Disconnect TCM connectors. 2) Check continuity between “PPL” wire terminal of disconnected output shaft speed sensor harness side connector and ground. *Is continuity indicated?*	“PPL” wire shorted to ground.	Go to Step 5.
5	**Check output shaft speed sensor signal circuit for open** 1) Check continuity between “PPL” wire terminal of disconnected output shaft speed sensor harness side connector and terminal “C35-25” of disconnected harness side TCM connector. *Is continuity indicated?*	Go to Step 6.	“PPL” wire open.
6	**Inspect output shaft speed sensor** 1) Inspect output shaft speed sensor referring to “Output Shaft Speed Sensor Inspection”. *Is check result satisfactory?*	Go to Step 7.	Replace output shaft speed sensor.
7	**Check output shaft speed sensor gears visually** 1) Check output shaft speed sensor gears for the followings. • No damage in drive gear on differential case • No damage in driven gear in output shaft speed sensor *Is result satisfactory?*	Intermittent trouble or faulty TCM. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”. If OK, substitute a known-good TCM and recheck.	Replace drive gear and/or driven gear of output shaft speed sensor.

DTC P0787: Shift / Timing Solenoid Low

S7RS0B5104029

Wiring Diagram



1. TCM	3. A/T
2. Timing solenoid valve	[A]: Terminal arrangement of TCM connector (viewed from harness side)

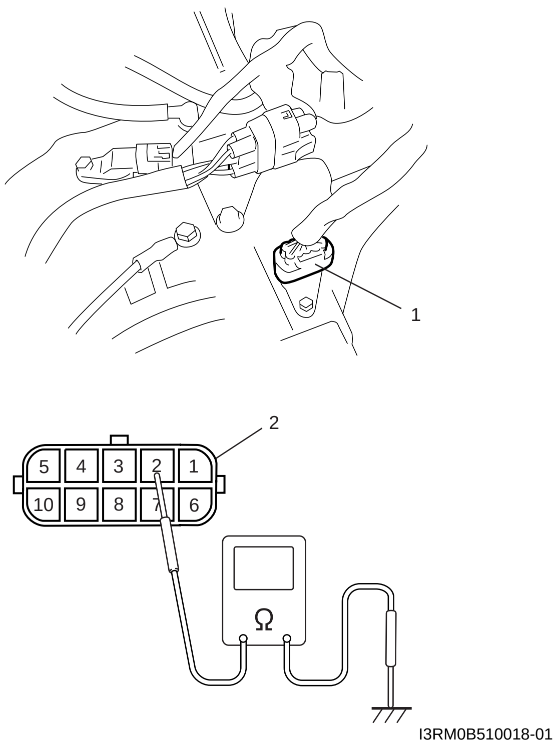
DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Voltage of timing solenoid valve TCM terminal is low although TCM is commanding timing solenoid valve to turn ON.	• Timing solenoid valve circuit shorted to ground • Timing solenoid valve malfunction • TCM

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch OFF, if available.
2) Clear DTC in TCM memory.
3) Start engine and shift select lever to “N” range.
4) Repeat shifting select lever from “N” range to “D” range and vice versa for 3 times.
5) Check DTC.

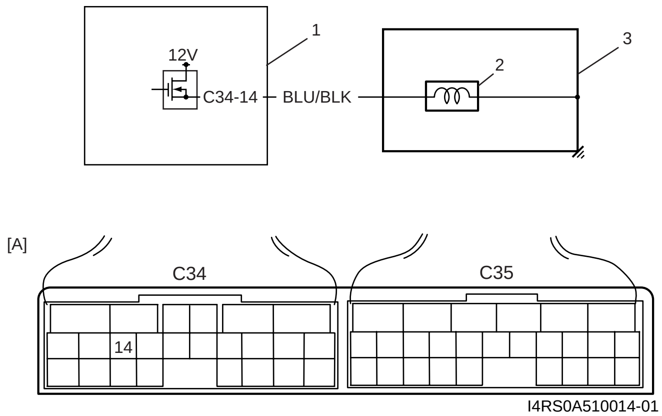
DTC Troubleshooting

Step	Action	Yes	No
1	*Was “A/T System Check” performed?*	Go to Step 2.	Go to “A/T System Check”.
2	**Check timing solenoid valve resistance** 1) Turn ignition switch OFF. 2) Disconnect valve body harness connector (1), (2) on transaxle. 3) Check for proper connection to solenoid valve at “BLU/BLK” circuit. 4) Check resistance of solenoid valve. <u>**Timing solenoid valve resistance**</u> **Between terminal of transaxle side valve body harness connector and transaxle: 11 – 15 Ω at 20 °C (68 °F)**  *Is check result satisfactory?*	Go to Step 3.	Replace timing solenoid valve or lead wire.
3	**Check timing solenoid valve circuit for ground short** 1) Connect valve body harness connector. 2) Disconnect TCM connectors. 3) Measure resistance between terminal “C34-14” of disconnected harness side TCM connector and ground. *Is it 11 – 15 Ω at 20 °C (68 °F)?*	Intermittent trouble or faulty TCM. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”. If OK, substitute a known-good TCM and recheck.	“WHT/GRN” circuit shorted to ground.

DTC P0788: Shift / Timing Solenoid High

S7RS0B5104030

Wiring Diagram



1. TCM	3. A/T
2. Timing solenoid valve	[A]: Terminal arrangement of TCM connector (viewed from harness side)

DTC Detecting Condition and Trouble Area

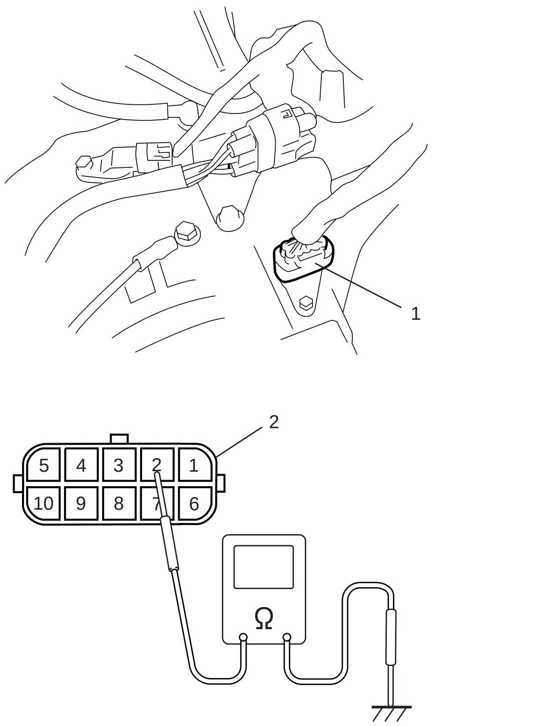
DTC detecting condition	Trouble area
Voltage of timing solenoid valve TCM terminal is high although TCM is commanding timing solenoid valve to turn OFF.	• Timing solenoid valve circuit open or shorted to power circuit • Timing solenoid valve malfunction • TCM

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch OFF, if available.
2) Clear DTC in TCM memory.
3) Start engine and shift select lever to “N” range.
4) Repeat shifting select lever from “N” range to “D” range and vice versa for 3 times.
5) Check DTC.

DTC Troubleshooting

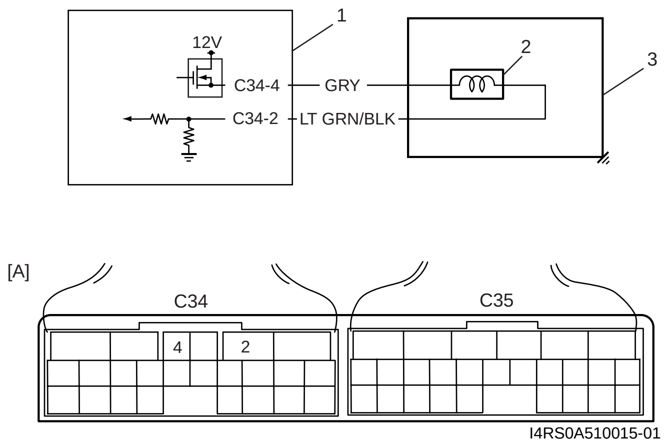
Step	Action	Yes	No
1	*Was “A/T System Check” performed?*	Go to Step 2.	Go to “A/T System Check”.
2	**Check timing solenoid valve circuit for IG short** 1) Disconnect TCM connectors. 2) Turn ignition switch ON and measure voltage between terminal “C34-14” of harness side TCM connector and ground. *Is it 0 – 1 V?*	Go to Step 3.	“BLU/BLK” circuit shorted to power circuit.
3	**Check timing solenoid valve circuit for open** 1) Measure resistance between terminal “C34-14” of disconnected harness side TCM connector and ground. *Is it 11 – 15 Ω at 20 °C (68 °F)?*	Intermittent trouble or faulty TCM. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”. If OK, substitute a known-good TCM and recheck.	Go to Step 4.

Step	Action	Yes	No
4	**Check timing solenoid valve resistance** 1) Turn ignition switch OFF. 2) Disconnect valve body harness connector (1), (2) on transaxle. 3) Check for proper connection to solenoid valve at "BLU/BLK" circuit. 4) Check resistance of solenoid valve. **<u>Timing solenoid valve resistance</u>** **Between terminal of transaxle side valve body harness connector and transaxle: 11 – 15 Ω at 20 °C (68 °F)**  I3RM0B510018-01 *Is check result satisfactory?*	"BLU/BLK" circuit open.	Replace timing solenoid valve or lead wire.

DTC P0961: Pressure Control Solenoid "A" Control Circuit Range / Performance

S7RS0B5104049

Wiring Diagram



1. TCM	3. A/T
2. Pressure control solenoid valve	[A]: Terminal arrangement of TCM connector (viewed from harness side)

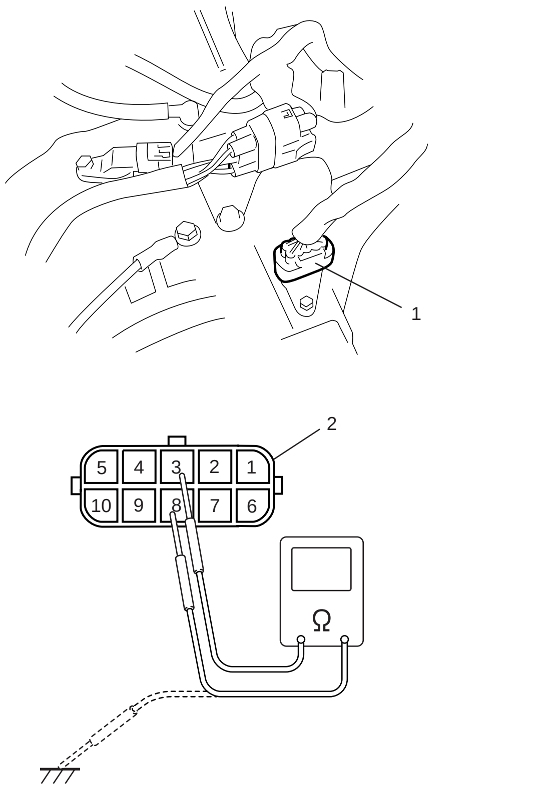
DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Difference between target current of control solenoid valve circuit and monitor current of control solenoid valve circuit is more than specification.	• Malfunction of pressure control solenoid valve or its circuit malfunction • TCM

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Clear DTC in TCM memory.
3) Start engine.
4) Keep engine running at idle speed for 30 seconds or more.
5) Stop vehicle and check DTC.

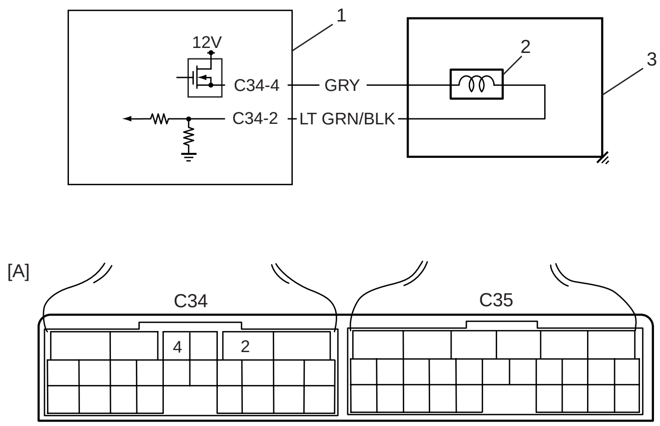
DTC Troubleshooting

Step	Action	Yes	No
1	*Was “A/T System Check” performed?*	Go to Step 2.	Go to “A/T System Check”.
2	**Check pressure control solenoid valve resistance** 1) Turn ignition switch OFF position. 2) Disconnect valve body harness connector (1), (2) on automatic transaxle. 3) Check for proper connection to terminal of valve body harness connector at “GRY” and “LT GRN/BLK” circuit. 4) Check resistance of pressure control solenoid valve. <u>**Pressure control solenoid valve resistance**</u> **Between terminals of transaxle side valve body harness connector: 5.0 – 5.6 Ω at 20 °C (68 °F)** **Between terminals of transaxle side valve body harness connector and Transaxle: Infinity**  I3RM0B510020-01 *Is check results satisfactory?*	Go to Step 3.	Replace pressure control solenoid valve or valve body harness.
3	**Check for pressure control solenoid valve circuit** 1) Disconnect TCM connectors. 2) Disconnect valve body harness connector and TCM connectors. 3) Check for proper connection to TCM at terminals “C34-2” and “C34-4”. If connection is OK, check circuit for open, short, and high resistance for the following circuit. • Between “C34-2” terminal of TCM connector and “LT GRN/BLK” terminal of valve body harness connector. • Between “C34-4” terminal of TCM connector and “GRY” terminal of valve body harness connector. *Are they in good condition?*	Intermittent trouble or faulty TCM. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00” If OK, substitute a known-good TCM and recheck.	Repair “LT GRN/BLK” and/or “GRY” circuit.

DTC P0962: Pressure Control Solenoid "A" Control Circuit Low

S7RS0B5104031

Wiring Diagram



I4RS0A510015-01

1. TCM	3. A/T
2. Pressure control solenoid valve	[A]: Terminal arrangement of TCM connector (viewed from harness side)

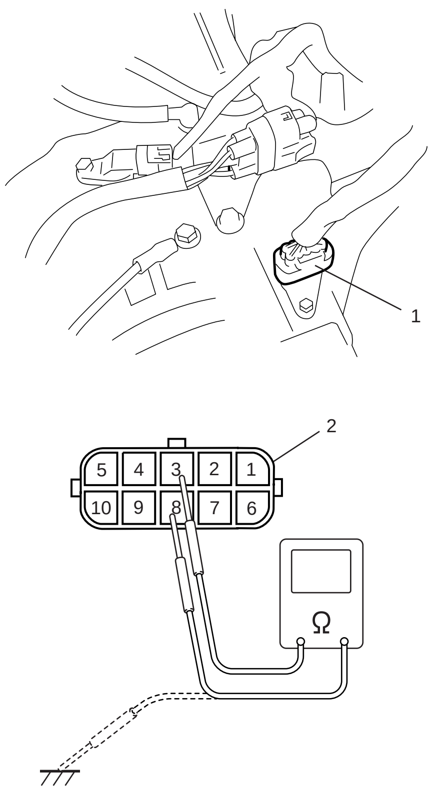
DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Pressure control solenoid valve output voltage is too low comparing with TCM command value.	• Pressure control solenoid valve circuit open or shorted to ground • Malfunction of pressure control solenoid valve • TCM

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch OFF, if available.
2) Clear DTC in TCM memory.
3) Start engine.
4) Keep engine running at idle speed for 30 seconds or more.
5) Stop vehicle and check DTC.

DTC Troubleshooting

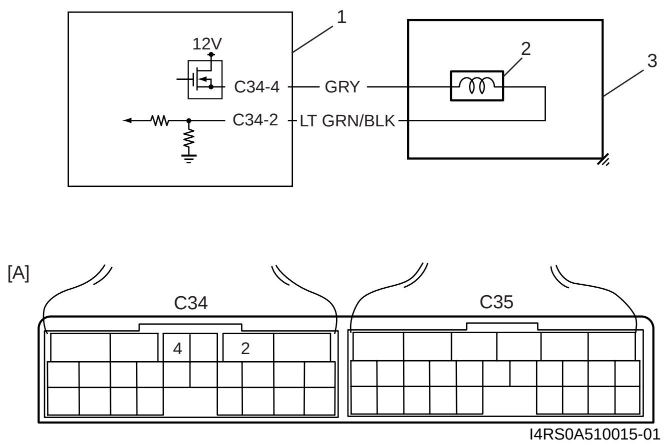
Step	Action	Yes	No
1	*Was "A/T System Check" performed?*	Go to Step 2.	Go to "A/T System Check".
2	**Check pressure control solenoid valve resistance** 1) Turn ignition switch OFF. 2) Disconnect valve body harness connector (1), (2) on automatic transaxle. 3) Check for proper connection to solenoid at "GRY" and "LT GRN/BLK" circuit. 4) Check resistance of pressure control solenoid. **<u>Pressure control solenoid valve resistance</u>** **Between terminals of transaxle side valve body harness connector: 5.0 – 5.6 Ω at 20 °C (68 °F)** **Between terminals of transaxle side valve body harness connector and Transaxle: Infinity**  I3RM0B510020-01 *Is check results satisfactory?*	Go to Step 3.	Replace pressure control solenoid valve or valve body harness.
3	**Check pressure control solenoid valve circuit for ground short** 1) Connect valve body harness connector. 2) Disconnect TCM connectors. 3) Check for proper connection to TCM at terminals "C34-2" and "C34-4". If connection is OK, check continuity between terminal "C34-4" of disconnected harness side TCM connector and ground. *Is continuity indicated?*	"GRY" or "LT GRN/BLK" circuit shorted to ground.	Go to Step 4.

Step	Action	Yes	No
4	**Check pressure control solenoid valve circuit for open** 1) Check resistance continuity between terminals "C34-2" and "C34-4" of disconnected harness side TCM connector. *Is it infinite?*	"GRY" or "LT GRN/BLK" circuit open.	Intermittent trouble or faulty TCM. Check for intermittent referring to "Intermittent and Poor Connection Inspection in Section 00". If OK, substitute a known-good TCM and recheck.

DTC P0963: Pressure Control Solenoid "A" Control Circuit High

S7RS0B5104032

Wiring Diagram



1. TCM	3. A/T
2. Pressure control solenoid valve	[A]: Terminal arrangement of TCM connector (viewed from harness side)

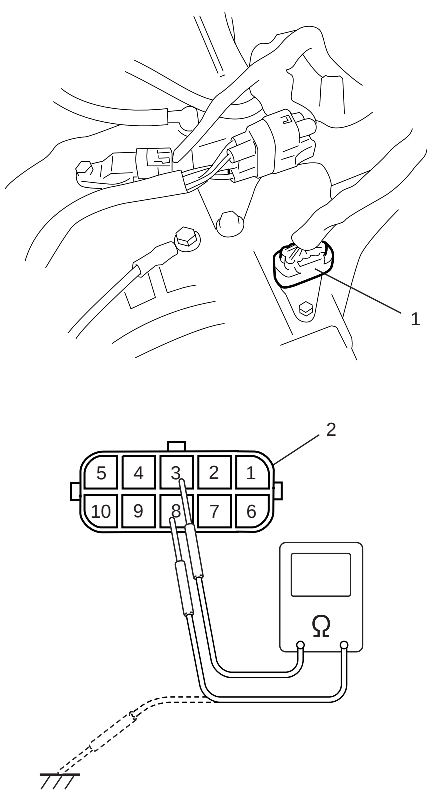
DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Pressure control solenoid valve output voltage is too high comparing with TCM command value.	• Pressure control solenoid valve circuit shorted to power circuit • Pressure control solenoid valve malfunction • TCM

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch OFF, if available.
2) Clear DTC in TCM memory.
3) Start engine.
4) Keep engine running at idle speed for 10 seconds or more.
5) Check DTC.

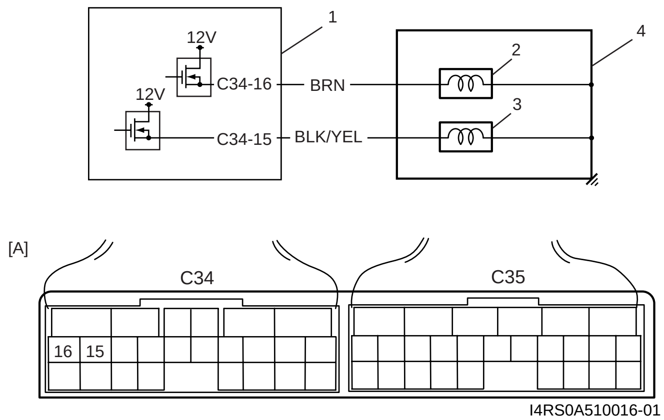
DTC Troubleshooting

Step	Action	Yes	No
1	*Was “A/T System Check” performed?*	Go to Step 2.	Go to “A/T System Check”.
2	**Check pressure control solenoid circuit for IG short** 1) Connect valve body harness connector. 2) Disconnect TCM connectors. 3) Check for proper connection to TCM at terminal “C34-2” and “C34-4”. 4) If connection is OK, turn ignition switch ON and measure voltage between terminal “C34-4” of disconnected harness side TCM connector and ground. *Is it 0 – 2 V?*	Go to Step 3.	“GRY” or “LT GRN/BLK” circuit shorted to power circuit.
3	**Check pressure control solenoid valve resistance** 1) Turn ignition switch OFF. 2) Disconnect valve body harness connector (1), (2) on automatic transaxle. 3) Check for proper connection to solenoid at “GRY” and “LT GRN/BLK” circuit. 4) Check resistance of pressure control solenoid. **<u>Pressure control solenoid valve resistance</u>** **Between terminals of transaxle side valve body harness connector: 5.0 – 5.6 Ω at 20 °C (68 °F)** **Between terminals of transaxle valve body harness connector and transaxle: Infinity**  I3RM0B510020-01 *Is check results satisfactory?*	Intermittent trouble or faulty TCM. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”. If OK, substitute a known-good TCM and recheck.	Replace pressure control solenoid valve or valve body harness.

DTC P0973 / P0976: Shift Solenoid "A" Control Circuit Low / Shift Solenoid "B" Control Circuit Low

S7RS0B5104033

Wiring Diagram



1. TCM	3. Shift solenoid valve-B (No.2)	[A]: Terminal arrangement of TCM connector (Viewed from harness side)
2. Shift solenoid valve-A (No.1)	4. A/T	

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Voltage of shift solenoid valve TCM terminal is low although TCM is commanding shift solenoid to turn ON	• Shift solenoid valve circuit shorted to ground • Malfunction of shift solenoid valve • TCM

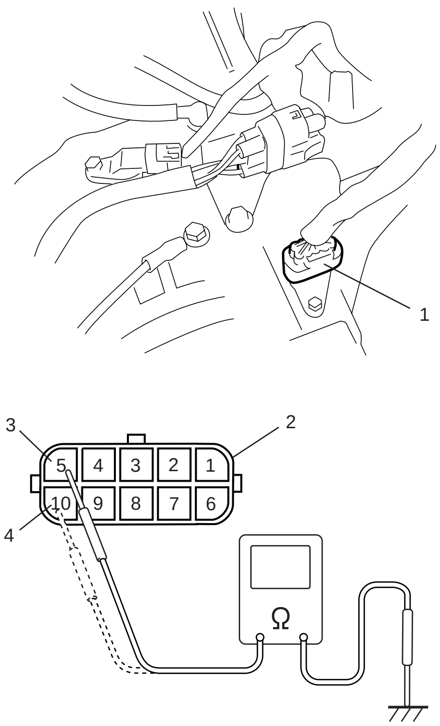
DTC Confirmation Procedure

⚠ 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 with 2 persons, a driver and tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF, if available.
2) Clear DTC in TCM memory.
3) Start engine shift select lever to "D" range.
4) Start vehicle and increase vehicle speed until gear position reaches 3rd or 4th gear.
5) Decrease vehicle speed and stop vehicle.
6) Check DTC.

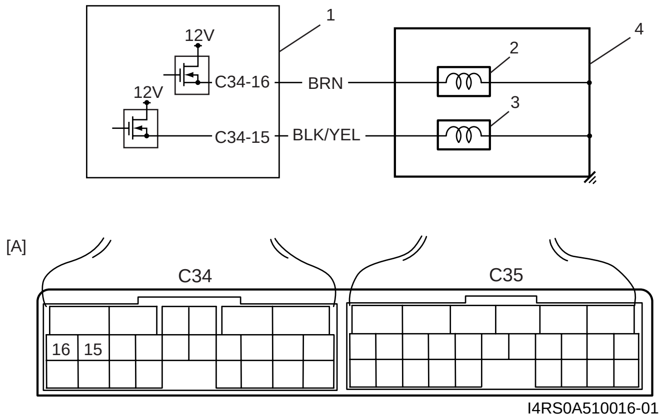
DTC Troubleshooting

Step	Action	Yes	No
1	*Was "Automatic Transaxle Diagnostic Flow Table" performed?*	Go to Step 2.	Go to "A/T System Check".
2	**Check shift solenoid valve resistance** 1) Turn ignition switch OFF. 2) Disconnect valve body harness connector (1), (2) on automatic transmission. 3) Check for proper connection to solenoid at "BRN" (for shift solenoid valve-A (No.1)) or "BLK/YEL" (for shift solenoid valve-B (No.2)) circuit. Check resistance of solenoid valve. **<u>Shift solenoid valve resistance</u>** **Between shift solenoid valve-A (No.1) terminal (3) and transaxle: 11 – 15 Ω at 20 °C (68 °F)** **Between shift solenoid valve-B (No.2) terminal (4) and transaxle: 11 – 15 Ω at 20 °C (68 °F)**  I3RM0B510022-01 *Is check results satisfactory?*	Go to Step 3.	Replace applicable shift solenoid valve or valve body harness.
3	**Check shift solenoid valve circuit for ground short** 1) Disconnect TCM connectors. 2) Check for proper connection to TCM at terminals "C34-16" (for shift solenoid valve-A (No.1)) or "C34-15" (for shift solenoid valve-B (No.2)). 3) If connection is OK, check continuity between terminal "C34-16" (for shift solenoid valve-A (No.1)) or "C34-15" (for shift solenoid valve-B (No.2)) of disconnected harness side TCM connector and ground. *Is continuity indicated?*	DTC P0973: "BRN" circuit shorted to ground. DTC P0976: "BLK/YEL" circuit shorted to ground.	Intermittent trouble or faulty TCM. Check for intermittent referring to "Intermittent and Poor Connection Inspection in Section 00". If OK, substitute a known-good TCM and recheck.

DTC P0974 / P0977: Shift Solenoid “A” / Shift Solenoid “B” Control Circuit High

S7RS0B5104034

Wiring Diagram



1. TCM	3. Shift solenoid valve-B (No.2)	[A]: Terminal arrangement of TCM connector (viewed from harness side)
2. Shift solenoid valve-A (No.1)	4. A/T	

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Voltage of shift solenoid valve TCM terminal is high although TCM is commanding shift solenoid to turn OFF	• Shift solenoid valve circuit open or shorted to power circuit • Malfunction of shift solenoid valve • TCM

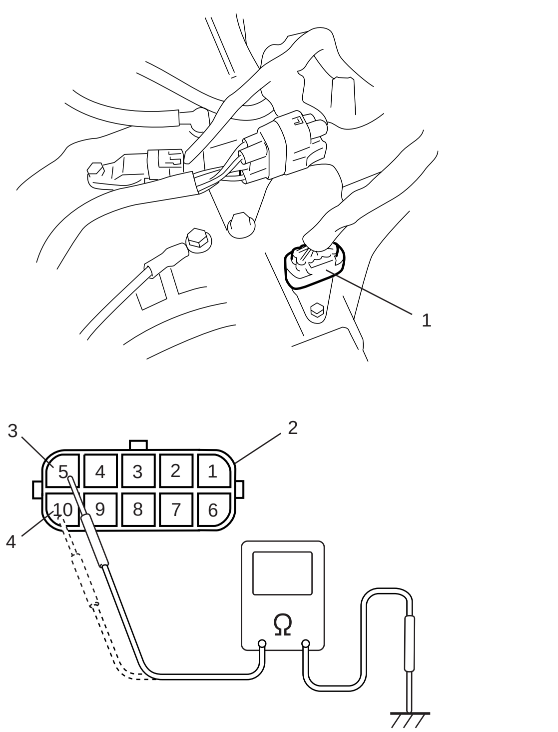
DTC Confirmation Procedure

⚠ 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 with 2 persons, a driver and a tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF, if available.
2) Clear DTC in TCM memory.
3) Start engine and shift select lever to “D” range.
4) Start vehicle and increase vehicle speed until gear position reaches 3rd or 4th gear.
5) Decrease vehicle speed and stop vehicle.
6) Check DTC.

DTC Troubleshooting

Step	Action	Yes	No
1	*Was “A/T System Check” performed?*	Go to Step 2.	Go to “A/T System Check”.
2	**Check shift solenoid valve circuit for IG short** 1) Connect valve body harness connector. 2) Disconnect TCM connectors. 3) Check for proper connection to TCM at terminal “C34-16” (for shift solenoid valve-A (No.1)) or “C34-15” (for shift solenoid valve-B (No.2)). 4) If connection is OK, turn ignition switch ON and measure voltage between terminal “C34-16” (for shift solenoid valve-A (No.1)) or “C34-15” (for shift solenoid valve-B (No.2)) of disconnected harness side TCM connector and ground. *Is it 0 – 2 V?*	Go to Step 3.	DTC P0974: “BRN” circuit shorted to power circuit. DTC P0977: “BLK/YEL” circuit shorted to power circuit.
3	**Check shift solenoid valve resistance** 1) Turn ignition switch OFF. 2) Disconnect valve body harness connector (1), (2) on automatic transaxle. 3) Check for proper connection to solenoid at “BRN” (for shift solenoid valve-A (No.1)) or “BLK/YEL” (for shift solenoid valve-B (No.2)) circuit. Check resistance of solenoid valve. **<u>Shift solenoid valve resistance</u>** **Between shift solenoid valve-A (No.1) terminal (3) and transaxle: 11 – 15 Ω at 20 °C (68 °F)** **Between shift solenoid valve-B (No.2) terminal (4) and transaxle: 11 – 15 Ω at 20 °C (68 °F)**  I3RM0B510022-01 *Is check results satisfactory?*	Intermittent trouble or faulty TCM. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”. If OK, substitute a known-good TCM and recheck.	Replace applicable shift solenoid valve or valve body harness.

DTC P1702: Internal Control Module Memory Check Sum Error

S7RS0B5104035

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Calculation of current data stored in TCM is not correct comparing with pre-stored checking data in TCM.	TCM

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch OFF.
2) Clear DTC in TCM memory.
3) After 10 seconds passed from turning ignition switch ON, check DTC.

DTC Troubleshooting

Step	Action	Yes	No
1	*Is DTC P1702 detected after performing “DTC Confirmation Procedure”?*	Faulty TCM. Replace TCM.	Could be a temporary malfunction of TCM.

DTC P1703: Can Invalid Data - TCM

S7RS0B5104036

DTC Detecting Condition and Trouble Area

When abnormality either on the gear shift control signal from ECM is detected by TCM, TCM sets DTC P1703.

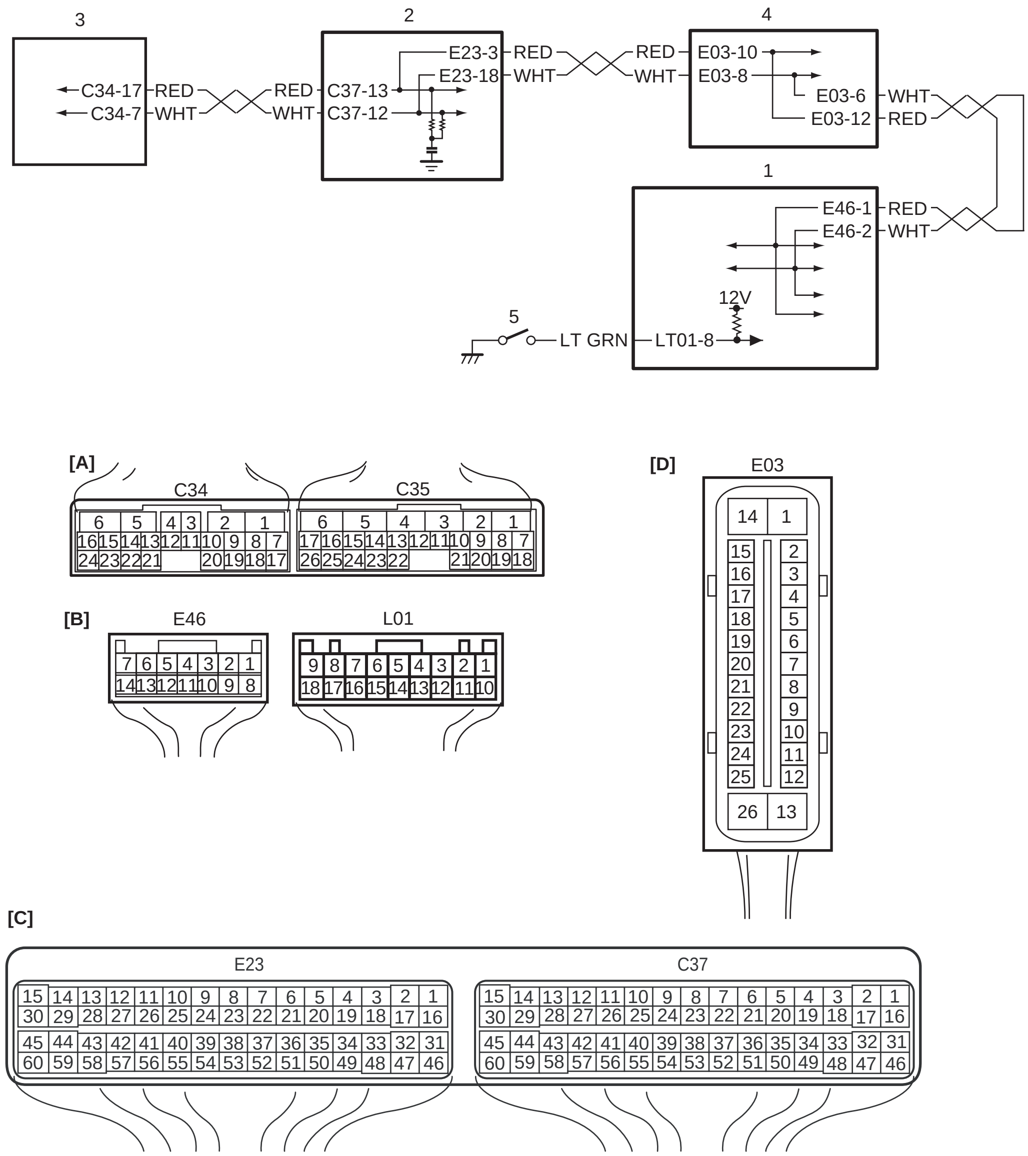
DTC Troubleshooting

Step	Action	Yes	No
1	*Was “A/T System Check” performed?*	Go to Step 2.	Go to “A/T System Check”.
2	**DTC check** 1) Check DTC of ECM referring to “DTC Check in Section 1A”. *Is there any DTC(s)?*	Go to applicable DTC diag. flow.	Substitute a known-good TCM and recheck. If OK, substitute a known-good ECM and recheck.

DTC P1723: Range Select Switch Malfunction

S7RS0B5104037

Wiring Diagram



I6RS0C510007-01

1. BCM	4. ABS control module	[B]: BCM connector (viewed from harness side)
2. ECM	5. “3” position switch	[C]: ECM connector (viewed from harness side)
3. TCM	[A]: TCM connector (viewed from harness side)	[D]: ABS control module connector (viewed from harness side)

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
"3" position switch ON signal is inputted although transmission range switch signal is inputted P, R, N or L. range.	• "3" position switch or its circuit malfunction • BCM • TCM

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch OFF.
2) Clear DTCs in TCM and ECM memories by using scan tool and turn ignition switch ON.
3) Shift select lever to each of "L", "2", "3", "D", "N", "R" and "P" ranges for 20 seconds each.
4) Check DTC, pending DTC and freeze-frame data.

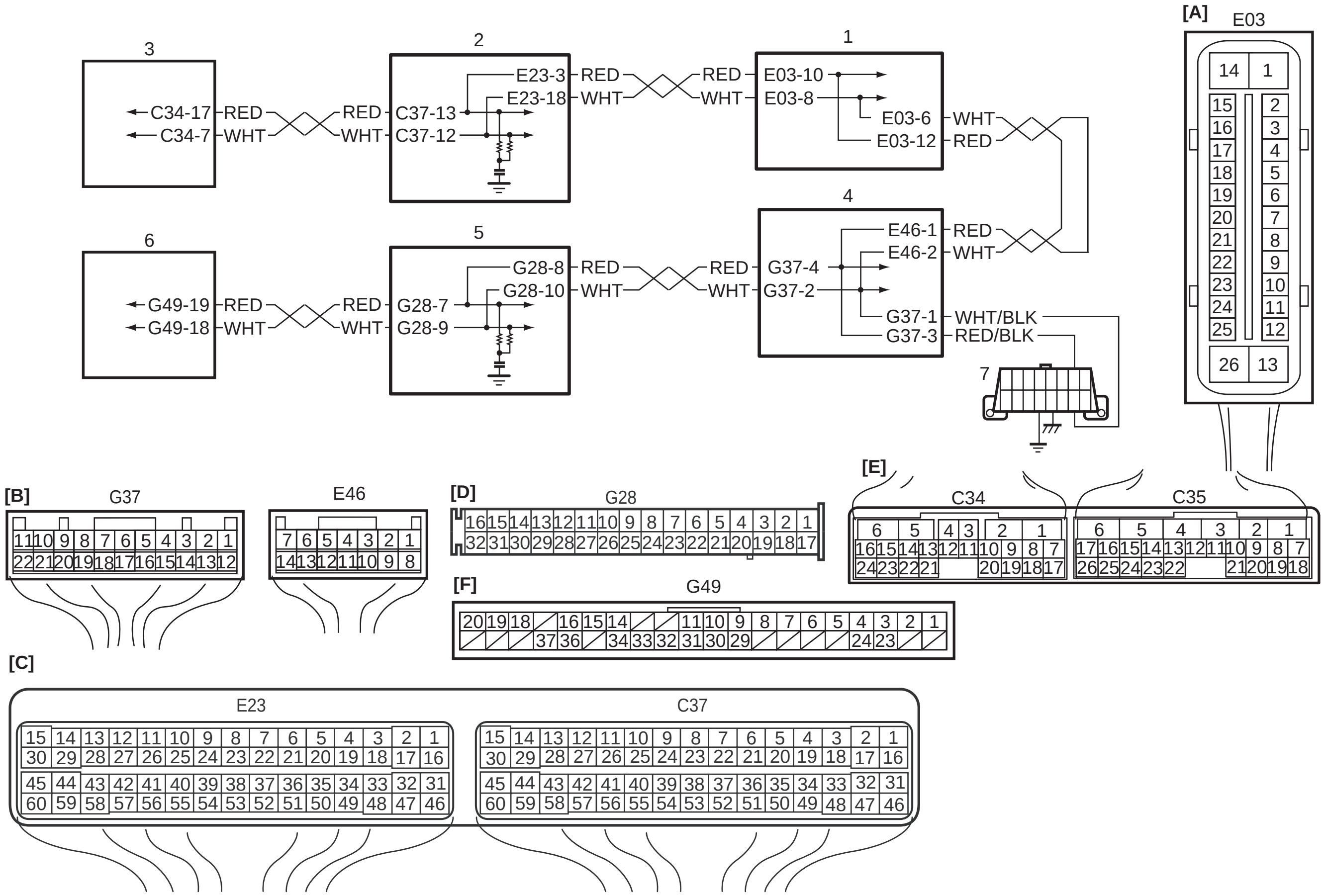
DTC Troubleshooting

Step	Action	Yes	No
1	*Was "A/T System Check" performed?*	Go to Step 2.	Go to "A/T System Check".
2	**"3" position switch circuit for operation** 1) Connect SUZUKI scan tool to DLC with ignition switch OFF. 2) Turn ignition switch ON and check "3" position switch signal on scan tool data display when shifting select lever to each range. *Does indicate "3" position switch (O/D OFF switch) condition OFF when shifting select lever to "P", "R", "N" and "L" range?*	Substitute a known-good TCM and recheck.	Go to Step 3.
3	**"3" position switch signal inspection** With ignition switch ON, check voltage between "L01-8" terminal of BCM coupler and ground. **<u>"3" position switch specifications</u>** **Shift select lever to "3" or "2" range: Battery voltage** **Shift select lever to other above range: 0 V** *Is the result as specified?*	Substitute a known-good BCM and recheck.	Go to Step 4.
4	**Check "3" position switch operation** *Is it in good condition?*	"LT GRN" wire shorted to ground.	Replace "3" position switch.

DTC P1774: CAN Communication Bus Off

S7RS0B5104038

Wiring Diagram



I6RS0C510008-01

1.	ABS control module	[A]:	Terminal arrangement of ABS control module connector (viewed from terminal side)
2.	ECM	[B]:	Terminal arrangement of BCM connector (viewed from harness side)
3.	TCM	[C]:	Terminal arrangement of ECM connector (viewed from harness side)
4.	BCM	[D]:	Terminal arrangement of combination meter connector (viewed from harness side)
5.	Combination meter	[E]:	Terminal arrangement of TCM connector (viewed from harness side)
6.	Keyless start control module	[F]:	Terminal arrangement of Keyless start control module connector (viewed from harness side)
7.	DLC		

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Transmission error that is inconsistent between transmission data and transmission monitor (CAN bus monitor) data is detected more than 7 times continuously.	• ECM • BCM • TCM • ABS control module • Combination meter • Keyless start control module • CAN circuit

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Clear DTC.
3) Start engine and run it for 1 min. or more.
4) Check DTC.

DTC Troubleshooting

NOTE

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 "A/T System Check" performed?*	Go to Step 2.	Go to "A/T System Check".
2	**Control module connector check** 1) Check connection of connectors of all control modules communicating by means of CAN. 2) Recheck DTC. *Is there DTC P1774?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection in Section 00"
3	**CAN communication circuit check** 1) Turn ignition switch to OFF position. 2) Disconnect connectors of all control modules communicating by means of CAN. 3) Check CAN communication circuit between control modules for open, short and high resistance. *Is each CAN communication circuit in good condition?*	Go to Step 4.	Repair circuit.
4	**DTC check** 1) Turn ignition switch to OFF position. 2) Connect connectors of disconnected control modules communicating by means of CAN. 3) Disconnect connector from any one of control modules other than BCM and TCM. 4) Recheck TCM for DTC. *Is DTC P1774 detected?*	Disconnect connectors of control modules other than the one whose connector is disconnected in Step 3) one by one and check that DTC P1774 is detected by TCM each time connector is disconnected. When DTC P1774 is not detected by TCM while checking in this way, go to description under "NO" below. If DTC P1774 is detected by TCM, go to Step 5.	Check power and ground circuit of control module disconnect in Step 3). If circuit is OK, substitute a known-good control module disconnected in Step 3) and recheck.
5	**DTC check of BCM** 1) Turn ignition switch to OFF position. 2) Disconnect connector from all control modules other than BCM. 3) Check BCM for DTC referring to "DTC Check in Section 10B" *Is DTC U1073 (No. 1073) detected?*	Substitute a known good BCM and recheck.	Substitute a known good TCM and recheck.

DTC P1777: TCM Lost Communication with ECM (Reception Error)

S7RS0B5104040

Wiring Diagram

Refer to “DTC P1774: CAN Communication Bus Off”

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Reception error of communication data for ECM is detected more than specified time continuously.	• ECM • TCM • CAN circuit

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch OFF.
2) Clear DTC.
3) Start engine and run it for 1 min. or more.
4) Check DTC.

DTC Troubleshooting

NOTE

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 “A/T System Check” performed?*	Go to Step 2.	Go to “A/T System Check”.
2	**Control module connector check** 1) Check connection of connectors of all control modules communicating by means of CAN. 2) Recheck DTC. *Is there DTC P1777?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”.
3	**DTC check** 1) Check ECM for DTC referring to “DTC Check in Section 1A”. *Is there DTC P1674?*	Go to “DTC P1674: CAN Communication (Bus Off Error) in Section 1A”.	Check ECM power and ground circuit. If circuit is OK, CAN communication circuit between ECM and ABS hydraulic unit / control module is open circuit.
4	**CAN communication circuit check** 1) Turn ignition switch to OFF position. 2) Disconnect connectors of all control modules communicating by means of CAN. 3) Check CAN communication circuit between control modules for open, short and high resistance. *Is each CAN communication circuit in good condition?*	Check TCM power and ground circuit. If circuit is OK, substitute a known-good TCM and recheck.	Repair circuit.

DTC P1778: TCM Lost Communication with BCM (Reception Error)

S7RS0B5104041

Wiring Diagram

Refer to "DTC P1774: CAN Communication Bus Off".

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Reception error of communication data for BCM is detected more than specified time continuously.	• ECM • TCM • BCM • ABS control module • CAN circuit

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch OFF.
2) Clear DTC.
3) Start engine and run it for 1 min. or more.
4) Check DTC.

DTC Troubleshooting

NOTE

Upon completion of inspection and repair work, perform "DTC Confirmation Procedure:" "DTC Confirmation Procedure" and confirm that the trouble has been corrected.

Step	Action	Yes	No
1	*Was "A/T System Check" performed?*	Go to Step 2.	Go to "A/T System Check".
2	**Control module connector check** 1) Check connection of connectors of all control modules communicating by means by means of CAN. 2) Recheck DTC. *Is there DTC P1778?*	Go to Step 3.	Intermittent trouble. Check for intermittent referring to "Intermittent and Poor Connection Inspection in Section 00".
3	**DTC check in BCM (bus off)** 1) Check BCM for DTC referring to "DTC Check in Section 10B". *Is there DTC U1073?*	Go to "DTC U1073 (No. 1073): Control Module Communication Bus Off in Section 10B".	Go to Step 4.
4	**DTC check in ABS control module** 1) Check ABS control module for DTC referring to "DTC Check in Section 4E". *Is there DTC U1100?*	Go to "DTC U1100: Lost Communication with ECM (Reception Error) in Section 4E".	Go to Step 5.
5	**DTC check in ECM** 1) Check ECM for DTC referring to "DTC Check in Section 1A". *Is there DTC P1678?*	Check BCM power and ground circuit. If circuit is OK, substitute a known-good BCM and recheck.	Go to Step 6.
6	**CAN communication circuit check** 1) Turn ignition switch to OFF position. 2) Disconnect connectors of all control modules communicating by means of CAN. 3) Check CAN communication circuit between control modules for open, short and high resistance. *Is each CAN communication circuit in good condition?*	Check TCM power and ground circuit. If circuit is OK, substitute a known-good TCM and recheck.	Repair circuit.

DTC P1878: Torque Converter Clutch Shudder

S7RS0B5104042

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
The acceleration slip control function stops when the variation in the output revolution speed of the specified amplitude and specified cycle is detected within a specified period of time. When the specified variation is not detected after the acceleration slip control stops.	• Mismatching ATF • Torque converter clutch malfunction • Valve body • TCM

DTC Confirmation Procedure

! 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 with 2 persons, a driver and tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF.
2) Clear DTCs in TCM and ECM memories by using scan tool.
3) Start engine and warm it up to normal operating temperature.
4) Drive vehicle with 3rd or 4th gear in “D” range and slip controlled lock-up ON for 20 seconds or longer referring to “Automatic Gear Shift Table”.
5) Stop vehicle.
6) Check DTC, pending DTC and freeze-frame data.

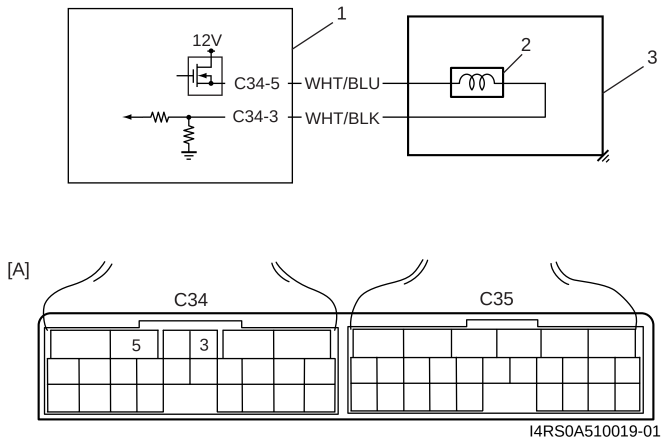
DTC Troubleshooting

Step	Action	Yes	No
1	*Was “A/T System Check” performed?*	Go to Step 2.	Go to “A/T System Check”.
2	Change A/T fluid referring to “A/T Fluid Change”. Check DTC after performing “DTC Confirmation Procedure”. *Is DTC P1878 still indicated?*	Faulty torque converter clutch. Replace torque converter.	System is in good condition.

DTC P2762: Torque Converter Clutch (TCC) Pressure Control Solenoid Control Circuit Range / Performance

S7RS0B5104050

Wiring Diagram



1. TCM	3. A/T
2. TCC solenoid valve	[A]: Terminal arrangement of TCM connector (viewed from harness side)

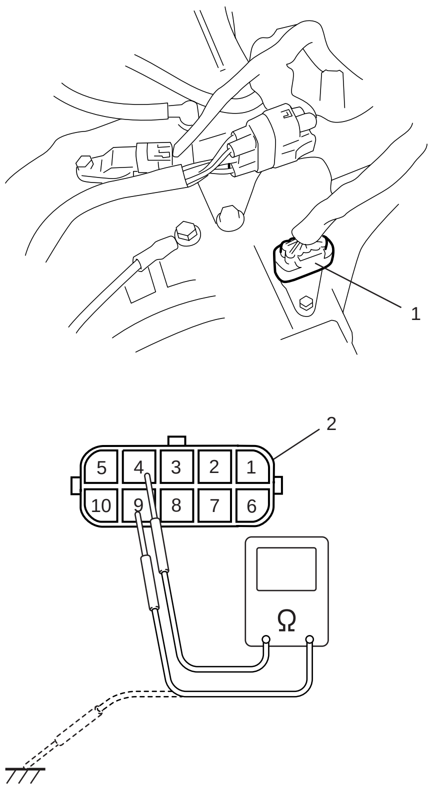
DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Difference between target current of TCC solenoid valve circuit and monitor current of TCC solenoid valve circuit is more than specification.	• TCC solenoid valve or its circuit malfunction • TCM

DTC Confirmation Procedure

1) Connect scan tool to DLC with ignition switch turned OFF.
2) Clear DTC in TCM memory.
3) Start engine.
4) Keep engine running at idle speed for 30 seconds or more.
5) Stop vehicle and check DTC.

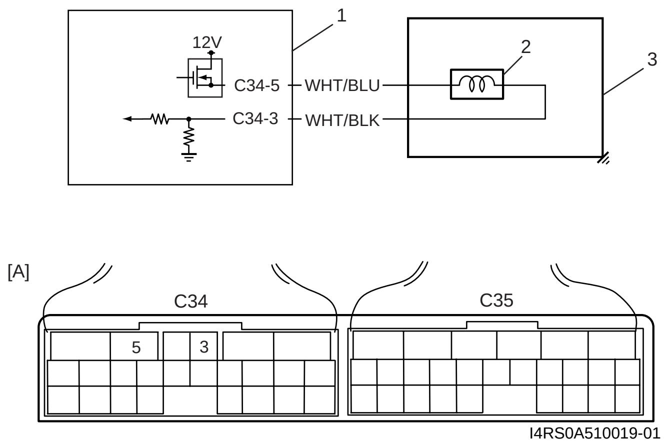
DTC Troubleshooting

Step	Action	Yes	No
1	*Was “A/T System Check” performed?*	Go to Step 2.	Go to “A/T System Check”.
2	**Check TCC solenoid valve resistance** 1) Turn ignition switch to OFF position. 2) Disconnect valve body harness connector (1), (2) on automatic transaxle. 3) Check for proper connection to terminal at “WHT/BLU” and “WHT/BLK” circuit. 4) Check resistance of TCC solenoid valve. <u>**TCC solenoid valve resistance**</u> **Between terminals of transaxle side valve body harness connector: 5.0 – 5.6 Ω at 20 °C (68 °F)** **Between terminals of transaxle side valve body harness connector and transaxle: Infinity**  I4RS0A510020-01 *Is check results satisfactory?*	Go to Step 3.	Replace TCC solenoid valve or valve body harness.
3	**Check for pressure control solenoid valve circuit** 1) Disconnect TCM connectors. 2) Check for proper connection to TCM at terminals “C34-3” and “C34-5”. If connection is OK, check circuit for open, short and high resistance for the following circuit. • Between “C34-3” terminal of TCM connector and “WHT/BLK” terminal of valve body harness connector. • Between “C34-4” terminal of TCM connector and “WHT/BLU” terminal of valve body harness connector. *Are they in good condition?*	Intermittent trouble or faulty TCM. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”. If OK, substitute a known-good TCM and recheck. If OK, substitute a known-good TCM and recheck.	Repair “WHT/BLU” and/or “WHT/BLK” circuit.

DTC P2763: Torque Converter Clutch Pressure Control Solenoid Control Circuit High

S7RS0B5104043

Wiring Diagram



1. TCM	3. A/T
2. TCC lock-up pressure control solenoid valve	[A]: Terminal arrangement of TCM connector (viewed from harness side)

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Voltage of TCC lock-up pressure control solenoid valve TCM terminal is high although TCM is commanding TCC lock-up pressure control solenoid to turn OFF.	• TCC lock-up pressure control solenoid valve circuit shorted to ground • Malfunction of TCC lock-up pressure control solenoid valve • TCM

DTC Confirmation Procedure

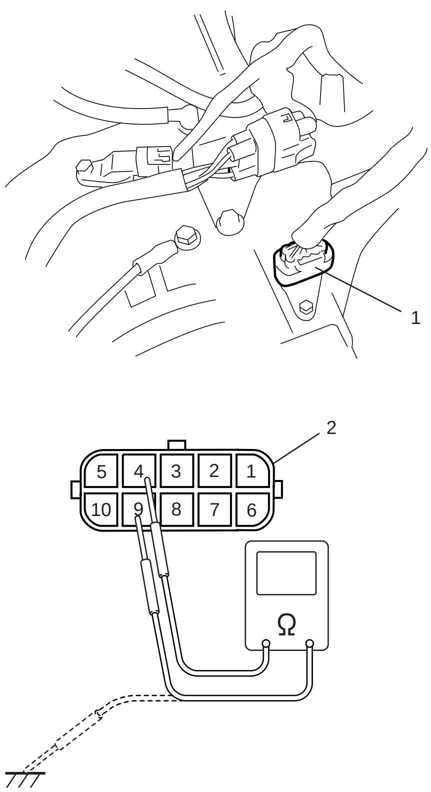
⚠ WARNING

- **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 with 2 persons, a driver and a tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF, if available.
2) Clear DTC in TCM memory.
3) Start engine.
4) Keep engine running at idle speed in “P” range for 10 seconds or more.
5) Check DTC.

DTC Troubleshooting

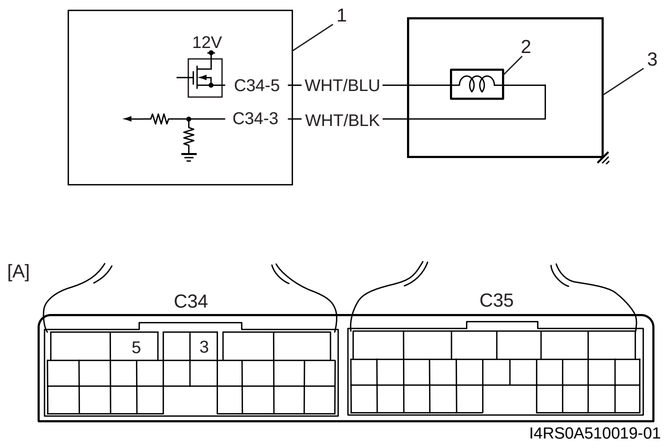
Step	Action	Yes	No
1	*Was “A/T System Check” performed?*	Go to Step 2.	Go to “A/T System Check”.

Step	Action	Yes	No
2	**Check TCC solenoid valve circuit for IG short** 1) Connect valve body harness connector. 2) Disconnect TCM connectors. 3) Check for proper connection to TCM at terminal “C34-3” and “C34-5”. 4) If connection is OK, turn ignition switch ON and measure voltage between terminal “C34-3” of disconnected harness side TCM connector and ground between terminal “C34-5” of disconnected harness side TCM connector and ground. *Are voltage 1 V or less?*	Go to Step 3.	“WHT/BLU” or “WHT/BLK” circuit shorted to power circuit.
3	**Check TCC lock-up pressure control solenoid valve resistance** 1) Turn ignition switch OFF. 2) Disconnect valve body harness connector (1), (2) on automatic transaxle. 3) Check for proper connection to solenoid at “WHT/BLU” and “WHT/BLK” circuits. 4) Check resistance of TCC lock-up pressure control solenoid valve. **<u>TCC lock-up pressure control solenoid valve resistance</u>** **Between terminals of transaxle side valve body harness connector: 5.0 – 5.6 Ω at 20 °C (68 °F)** **Between terminals of transaxle side valve body harness connector and transaxle: Infinity**  I4RS0A510020-01 *Is check results satisfactory?*	Intermittent trouble or faulty TCM. Check for intermittent trouble referring to “Intermittent and Poor Connection Inspection in Section 00”. If OK, substitute a known-good TCM and recheck.	Replace TCC lock-up pressure control solenoid valve or lead wire.

DTC P2764: Torque Converter Clutch Circuit Pressure Control Solenoid Control Circuit Low

S7RS0B5104044

Wiring Diagram



1. TCM	3. A/T
2. TCC pressure control solenoid valve	[A]: Terminal arrangement of TCM connector (viewed from harness side)

DTC Detecting Condition and Trouble Area

DTC detecting condition	Trouble area
Voltage of TCC lock-up pressure control solenoid valve TCM terminal is low although TCM is commanding TCC lock-up pressure control solenoid to turn ON.	• TCC lock-up pressure control solenoid valve circuit shorted to ground • Malfunction of TCC lock-up pressure control solenoid valve • TCM

DTC Confirmation Procedure

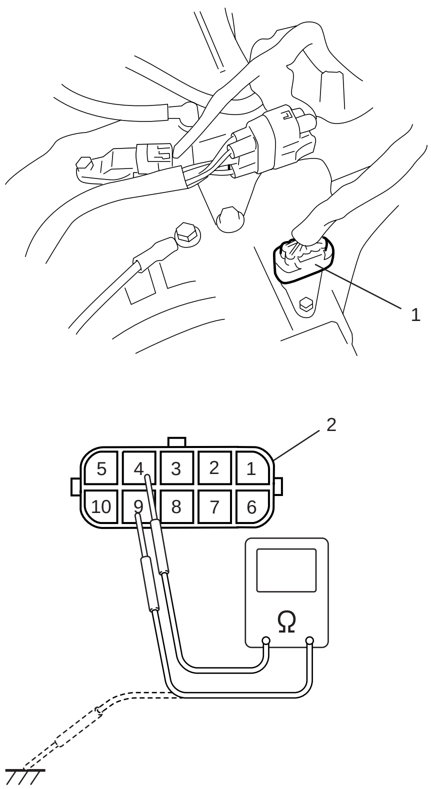
⚠ WARNING

- **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 with 2 persons, a driver and a tester, on a level road.**

1) Connect scan tool to DLC with ignition switch OFF, if available.
2) Clear DTC in TCM memory.
3) Start engine.
4) Keep engine running at idle speed in “P” range for 20 seconds or more.
5) Check DTC.

DTC Troubleshooting

Step	Action	Yes	No
1	*Was “A/T System Check” performed?*	Go to Step 2.	Go to “A/T System Check”.

Step	Action	Yes	No
2	**Check TCC lock-up pressure control solenoid valve resistance** 1) Turn ignition switch OFF. 2) Disconnect valve body harness connector (1), (2) on automatic transaxle. 3) Check for proper connection to solenoid at “WHT/BLU” and “WHT/BLK” circuits. 4) Check resistance of TCC lock-up pressure control solenoid valve. **<u>TCC lock-up pressure control solenoid valve resistance</u>** **Between shift terminals of transaxle side valve body harness connector: 5.0 – 5.6 Ω at 20 °C (68 °F)** **Between shift terminals of transaxle side valve body harness connector and transaxle: Infinity**  I4RS0A510020-01 *Is check results satisfactory?*	Go to Step 3.	Replace TCC lock-up pressure control solenoid valve or lead wire.
3	**Check TCC lock-up pressure control solenoid valve circuit for ground short** 1) Disconnect TCM connectors. 2) Check for proper connection to TCM at terminals “C34-3” and “C34-5”. 3) If connection is OK, check continuity between terminal “C34-5” of disconnected harness side TCM connector and ground, between terminal “C34-3” of disconnected harness side TCM connector and ground. *Are continuity indicated?*	“WHT/BLU” or “WHT/BLK” circuit shorted to ground.	Intermittent trouble or faulty TCM. Check for intermittent referring to “Intermittent and Poor Connection Inspection in Section 00”. If OK, substitute a known-good TCM and recheck.

Inspection of TCM and Its Circuits

S7RS0B5104045

TCM and its circuits can be checked at TCM wiring connectors by measuring voltage, pulse signal and resistance.

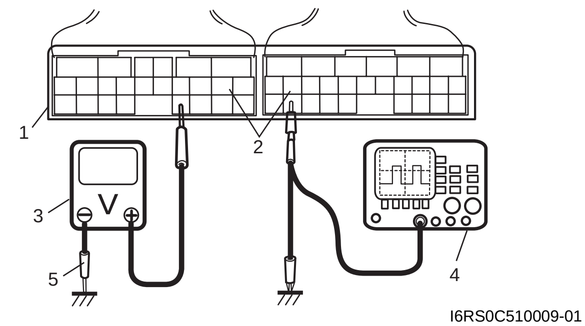
⚠ CAUTION

TCM cannot be checked by itself, it is strictly prohibited to connect voltmeter or ohmmeter to TCM with connector disconnected from it.

1) Remove TCM (1) from vehicle referring to “Transmission Control Module (TCM) Removal and Installation”.
2) Connect TCM connectors (2) to TCM.
3) Check voltage and/or pulse signal at each terminal of connectors connected using voltmeter (3) and oscilloscope (4).

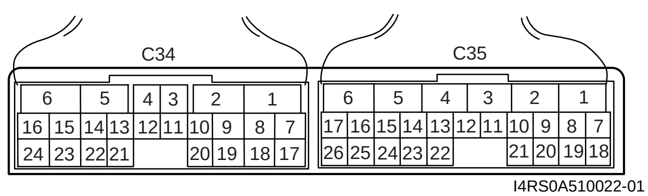
NOTE

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



5. Body ground

Terminal arrangement of TCM coupler (Viewed from harness side)



Connector “C34”

Terminal	Wire color	Circuit	Standard voltage	Condition
1	BLK	Ground	0 – 1 V	Ignition switch ON
2	LT GRN/ BLK	Pressure control solenoid valve (–)	0.6 – 1.0 V	Ignition switch ON
3	WHT/BLK	TCC pressure control solenoid valve (–)	0.6 – 1.0 V	Ignition switch ON
4	GRY	Pressure control solenoid valve (+)	*0 – 0.6 V ↑↓ 10 – 14 V (“Reference waveform No. 1: ”)	Engine running at idling. (Output signal is duty pulse. Duty ratio varies depending on throttle valve opening.)
5	WHT/BLU	TCC pressure control solenoid valve (+)	*0 – 0.6 V ↑↓ 10 – 14 V (“Reference waveform No. 2: ”)	Engine running at idling. (Output signal is duty pulse. Duty ratio varies depending on torque converter clutch operating condition.)
6	YEL/BLK	Power source	10 – 14 V	Ignition switch ON
7	WHT	CAN communication line (Low)	*2.5 – 3.6 V ↑↓ 1.6 – 2.5 V (“Reference waveform No. 3: ”)	Engine running at idling with after warming up. (CAN communication signal is pulse. Pulse signal frequency varies depending on engine condition.))
8	—	—	—	—
9	—	—	—	—
10	—	—	—	—
11	LT GRN	Transmission fluid temperature sensor (+)	2.9 – 3.1 V	Ignition switch ON, fluid temperature is 20 °C (68 °F)
			0.3 – 0.5 V	Ignition switch ON, fluid temperature is 100 °C (212 °F)
12	ORN	Transmission fluid temperature sensor (–)	0 – 1 V	Ignition switch ON
13	—	—	—	—
14	BLU/BLK	Timing solenoid valve	0 – 1 V	Ignition switch ON
15	BLK/YEL	Shift solenoid valve-B (No.2)	9 – 14 V	Ignition switch ON, select lever in “P” range
16	BRN	Shift solenoid valve-A (No.1)	9 – 14 V	Ignition switch ON, select lever in “P” range
17	RED	CAN communication line (High)	*2.5 – 3.6 V ↑↓ 1.6 – 2.5 V (“Reference waveform No. 3: ”)	Engine running at idling with after warming up. (CAN communication signal is pulse. Pulse signal frequency varies depending on engine condition.)
18	—	—	—	—
19	—	—	—	—
20	—	—	—	—
21	—	—	—	—
22	—	—	—	—
23	BLK	Ground	0 – 1 V	Ignition switch ON
24	WHT/RED	Power source for back-up	10 – 14 V	Constantly

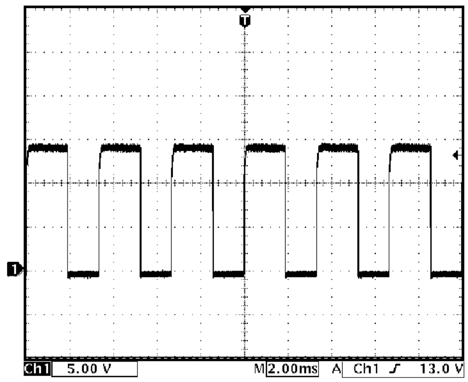
Connector “C35”

Terminal	Wire color	Circuit	Standard voltage	Condition
1	RED	Transmission range sensor (“R” range)	8 – 14 V	Ignition switch ON, select lever at “R” range
			0 – 1 V	Ignition switch ON, select lever at other than “R” range
2	—	—	—	—
3	—	—	—	—
4	—	—	—	—
5	—	—	—	—
6	WHT	Input shaft speed sensor (+)	2 – 3 V	Ignition switch turned ON, engine stops.
			*(“Reference waveform No. 4: ”)	While engine running. (Output signal is waveform. Waveform frequency varies depending on output shaft speed. (16 pulses are generated par 1 input shaft revolution.))
7	GRN	Transmission range sensor (“D” range)	8 – 14 V	Ignition switch ON, select lever at “D” range
			0 – 1 V	Ignition switch ON, select lever at other than “D” range
8	GRN/ORN	Transmission range sensor (“N” range)	8 – 14 V	Ignition switch ON, select lever at “N” range
			0 – 1 V	Ignition switch ON, select lever at other than “N” range
9	—	—	—	—
10	—	—	—	—
11	—	—	—	—
12	PPL/YEL	Diagnosis switch (if equipped)	8 – 14 V	Ignition switch ON
13	—	—	—	—
14	—	—	—	—
15	—	—	—	—
16	BLK	Input shaft speed sensor (–)	2 – 3 V	Ignition switch ON, engine at stop
17	—	—	—	—
18	LT GRN/ BLK	Transmission range sensor (“L” range)	8 – 14 V	Ignition switch ON, select lever at “L” range
			0 – 1 V	Ignition switch ON, select lever at other than “L” range
19	GRN/YEL	Transmission range sensor (“2” range)	8 – 14 V	Ignition switch ON, select lever at “2” range
			0 – 1 V	Ignition switch ON, select lever at other than “2” range
20	PNK/BLK	Transmission range sensor (“P” range)	8 – 14 V	Ignition switch ON, select lever at “P” range
			0 – 1 V	Ignition switch ON, select lever at other than “P” range
21	—	—	—	—
22	—	—	—	—
23	PPL/WHT	Data link connector	8 – 14 V	Ignition switch ON
24	—	—	—	—
25	PPL	Output shaft speed sensor	8 – 14 V	Ignition switch ON
			*0 – 1 V ↑↓ 10 – 14 V (“Reference waveform No. 5: ”)	Vehicle running. (Sensor signal is pulse. Pulse frequency varies depending on vehicle speed. (8190 pulses are generated par 60 km/h, 37.5 mile/h)
26	—	—	—	—

Reference waveform No. 1

Pressure control solenoid valve signal at engine idling.

Measurement terminal	CH1: “C34-4” to “C34-1”
Oscilloscope setting	CH1: 5 V/DIV TIME: 20 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed with “P” range.



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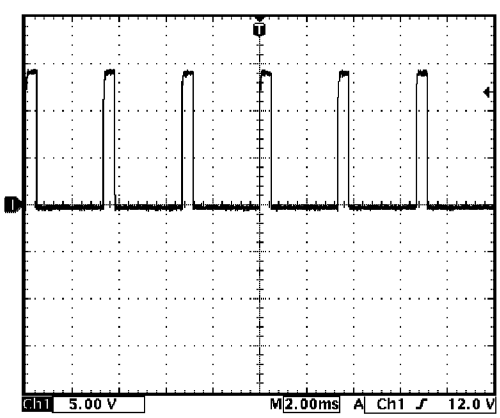
Reference waveform No. 2

TCC pressure control solenoid valve signal at engine idling.

Measurement terminal	CH1: “C34-5” to “C34-1”
Oscilloscope setting	CH1: 5 V/DIV Time: 2 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed with “P” range



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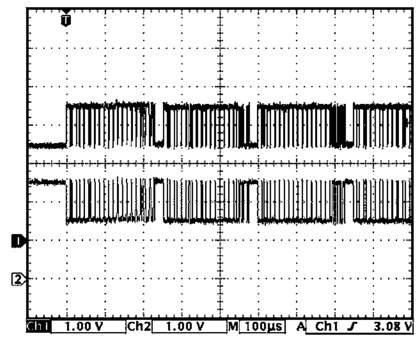
Reference waveform No. 3

CAN communication line (High & Low) signal at engine idling.

Measurement terminal	CH1: “C34-7” to “C34-1” CH2: “C34-17” to “C34-1”
Oscilloscope setting	CH1: 1 V/DIV TIME: 100 μs/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed with “P” range.



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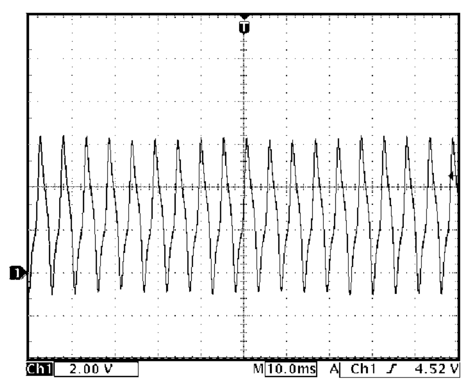
Reference waveform No. 4

Input shaft speed sensor signal at engine idling.

Measurement terminal	CH1: “C35-6” to “C34-1”
Oscilloscope setting	CH1: 2 V/DIV TIME: 10 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Engine at specified idle speed with “P” range.



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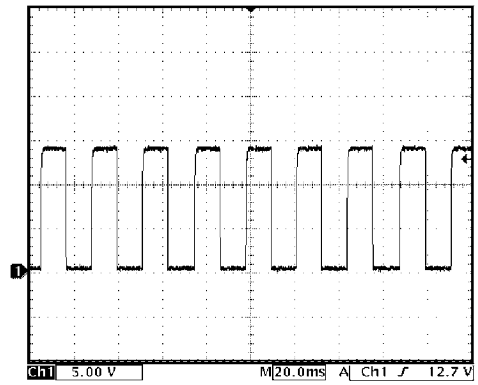
Reference waveform No. 5

Output shaft speed sensor signal at vehicle speed 60 km/h (37 mile/h).

Measurement terminal	CH1: “C35-25” to “C34-1”
Oscilloscope setting	CH1: 5 V/DIV TIME: 2 ms/DIV
Measurement condition	• After warmed up to normal operating temperature • Drive vehicle at 60 km/h (37 mile/h).

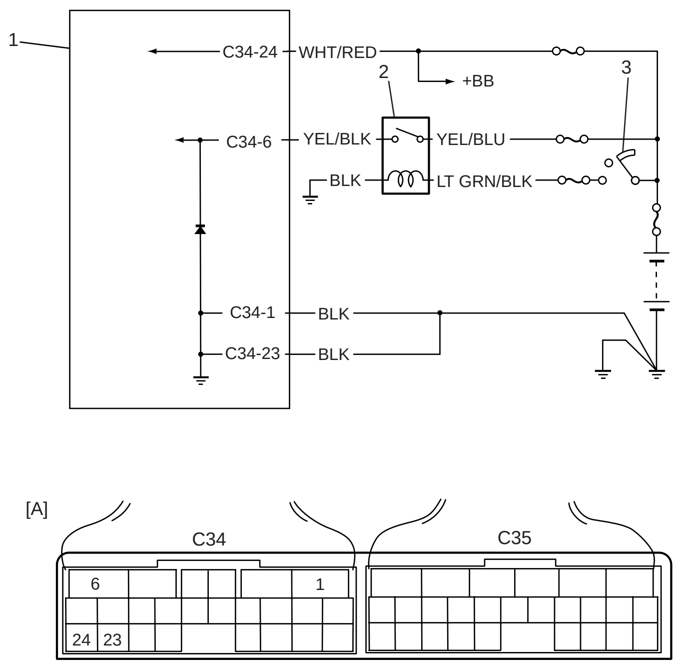


I3RM0B510028-01

TCM Power and Ground Circuit Check

S7RS0B5104046

Wiring Diagram



I4RS0A510023-01

1. TCM	3. Ignition switch
2. A/T relay	[A]: Terminal arrangement of TCM connector (viewed from harness side)

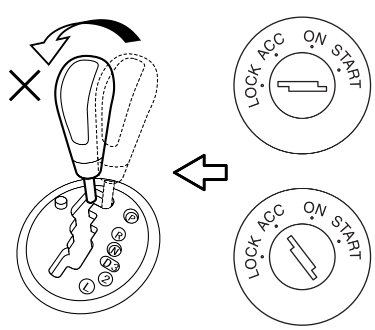
Troubleshooting

Step	Action	Yes	No
1	**Check TCM back-up power circuit** 1) Disconnect TCM connector with ignition switch OFF. 2) Check for proper connection to TCM at "C34-24" terminal. 3) If OK, check voltage at terminal "C34-24" of disconnected TCM connector. *Is it 10 – 14 V?*	Go to Step 2.	"WHT/RED" circuit open or shorted to ground.
2	**Check TCM power circuit** 1) Disconnect TCM connector with ignition switch OFF. 2) Check for proper connection to TCM at "C34-6" terminal. 3) If OK, turn ignition switch ON and check voltage at terminal "C34-6" of disconnected TCM connector. *Is it 10 – 14 V?*	Go to Step 4.	Go to Step 3.
3	**Check A/T relay operation** 1) Check A/T relay operation referring to "A/T Relay Inspection". *Is check result satisfactory?*	"YEL/BLK", "YEL/BLU", "LT GRN/BLK" or "BLK" circuit for power supply open.	Replace A/T relay.
4	**Check TCM ground circuit** 1) Turn ignition switch OFF. 2) With TCM connectors disconnected, check for proper connection to TCM at "C34-1" / "C34-23" terminal. 3) If OK, check resistance between "C34-1" / "C34-23" terminal of disconnected TCM connector and body ground. *Is continuity indicated?*	TCM power and ground circuits are in good condition.	"BLK" circuit for TCM ground open.

Brake Interlock System Inspection

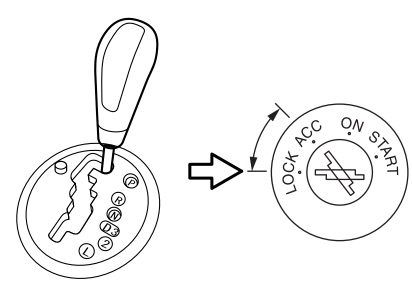
S7RS0B5104047

1) Check that select lever cannot be moved to any other range from "P" range position when ignition switch key is at ACC position, at LOCK position or it is removed from keyhole of ignition switch, or brake pedal is not depressed.



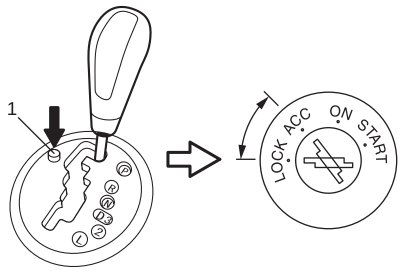
I4RS0A510047-01

2) Shift select lever to "P" range position, release knob button and check for the following.
   - Ignition key can be turned between LOCK and ACC positions back and forth and also it can be removed from ignition switch.



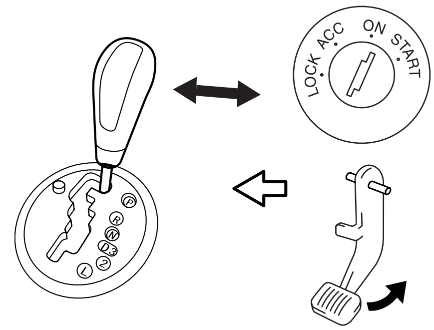
I4RS0A510048-01

- With ignition switch turned to ACC position, push shift lock solenoid release button (1). Then, select lever can be shifted from “P” range position to any other range.
- While ignition switch is at LOCK position, even when shift lock solenoid release button (1) is pressed, select lever cannot be shifted from P range position to any other range.



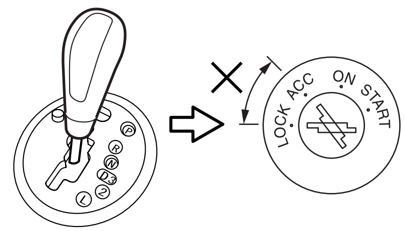
I6RS0C510010-01

- When ignition switch is turned ON and brake pedal is depressed, select lever can be shifted from “P” range position to any other range.



I4RS0A510050-01

3) With select lever shifted to any position other than “P” range, check that ignition key cannot be turned LOCK position and it cannot be removed from ignition switch unless it is at LOCK position.



I4RS0A510051-01

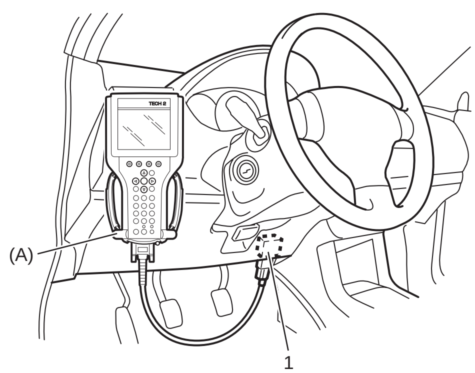
Repair Instructions

Learning Control Initialization

S7RS0B5106001

1) Connect san tool to DLC (1) with ignition switch OFF.

Special tool
(A): SUZUKI scan tool



I4RS0B510004-01

2) Start engine and shift select lever to “P” range.
3) Select “Misc Test” mode on scan tool.
4) Perform “AT learned initialize” on scan tool.

A/T Fluid Level Check

S7RS0B5106002

⚠ **CAUTION**

Do not use any fluid other than the specified ATF. Use of any fluid other than the specified ATF may cause juddering or some other faulty condition to occur.

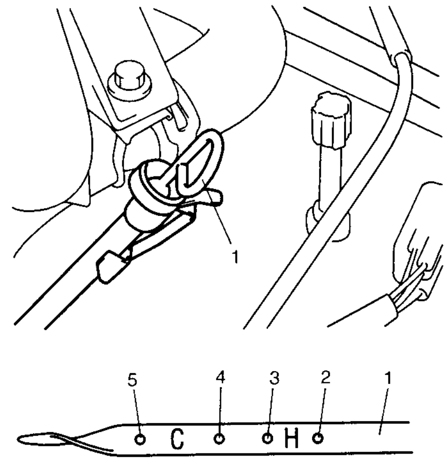
Level Check at Normal Operating (Hot) Temperature – Hot Check

1) Drive vehicle so that A/T fluid temperature reach the normal operating temperature (70 – 80 °C (158 – 176 °F)).
2) Stop vehicle with engine running and place it level.
3) With select lever at “P” range, apply parking brake and place chocks against wheels.
4) Keep engine idling and shift selector slowly to “L” and back to “P” position.
5) With engine idling, pull out fluid level gauge, wipe it off with a clean cloth and put it back into place.
6) Pull out fluid level gauge (1) again and check fluid level indicated on it. The lowest fluid level should be between FULL HOT (2) and LOW HOT (3). If it is below LOW HOT, add SUZUKI ATF 3317 or Mobil ATF 3309 up to FULL HOT.

Automatic transaxle fluid
SUZUKI ATF 3317 or Mobil ATF 3309

NOTE

- **Do not race engine while checking fluid level, even after the engine start.**
- **Do not overfill. Overfilling can cause foaming and loss of fluid through breather. Then slippage and transaxle failure can result.**
- **Bringing the level from LOW HOT to FULL HOT requires 0.4 liters (0.85 / 0.70 US/Imp. pt).**
- **If vehicle was driven under high load such as pulling a trailer, fluid level should be checked about half an hour after it is stopped.**



I3RM0B510032-01

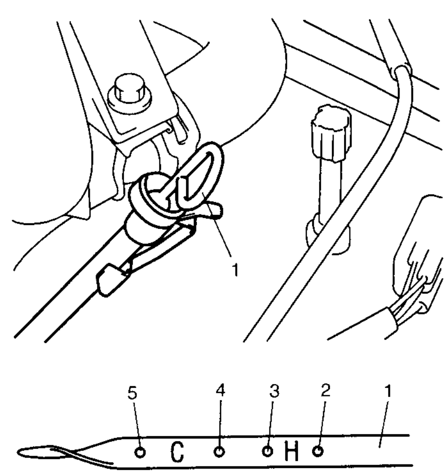
4. “FULL COLD” mark	5. “LOW COLD” mark

Level Check at Room (Cold) Temperature – Cold Check

Fluid level can be checked temporarily at room (cold) temperature which correspond to 20 – 30 °C (68 – 86 °F). This level check is considered to be preparation before performing level check under normal operating (hot) temperature. Checking procedure itself is the same as that described in “Level Check at Normal Operating (Hot) Temperature – Hot Check: ”. If fluid level is between “FULL COLD” (4) and “LOW COLD” (5), proceed to test drive. And when fluid temperature has reached normal operating temperature, check fluid level again and adjust it as necessary.

⚠ **CAUTION**

Fluid level check at room (cold) temperature is recommended only for preparation of level check under normal (hot) operating condition.
Failure to perform fluid level check under normal (hot) operating temperature may result in damage to transaxle.



I3RM0B510032-01

1. Fluid level gauge	2. “FULL HOT” mark	3. “LOW HOT” mark

A/T Fluid Change

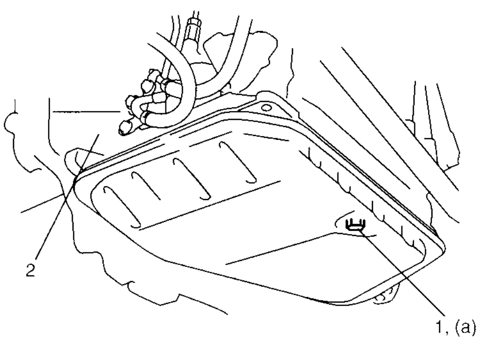
S7RS0B5106003

⚠ CAUTION

Do not use any fluid other than the specified ATF. Use of any fluid other than the specified ATF may cause juddering or some other faulty condition to occur.

1) Lift up vehicle.
2) When engine is cool, remove drain plug (1) from transaxle housing (2) and drain A/T fluid.
3) Install drain plug (1).

Tightening torque
A/T fluid drain plug (a): 17 N·m (1.7 kgf-m, 12.5 lb-ft)

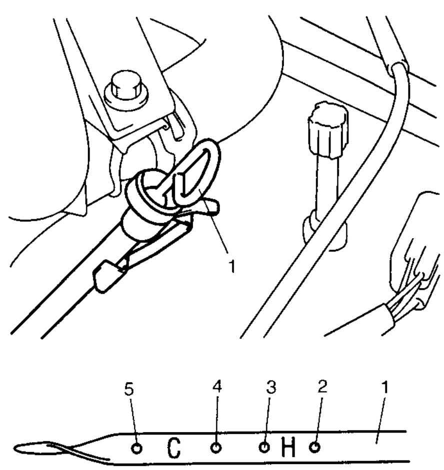


I3RM0B510033-01

4) Lower vehicle and pour proper amount of SUZUKI ATF 3317 or Mobil ATF 3309.
5) Check fluid level referring to "A/T Fluid Level Check".

Automatic transaxle fluid
: SUZUKI ATF 3317 or Mobil ATF 3309

Automatic transaxle fluid capacity
When draining from drain plug hole: 3.3 liters (6.97 / 5.81 US/Imp. pt.)
When overhauling: 5.6 liters (11.83 / 9.86 US/Imp. pt.)

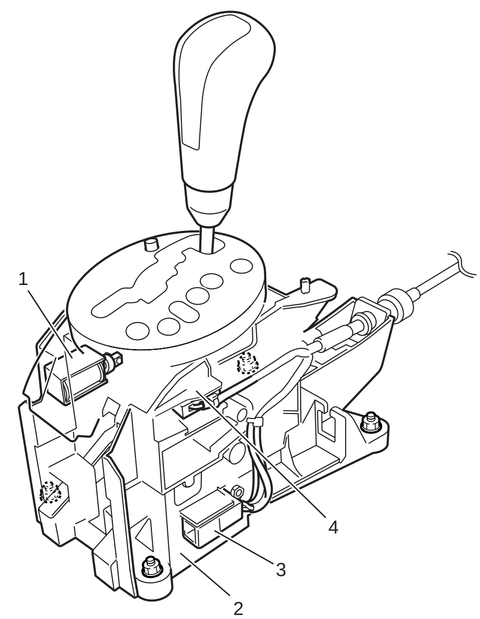


I3RM0B510032-01

1. Fluid level gauge	3. "LOW HOT" mark	5. "LOW COLD" mark
2. "FULL HOT" mark	4. "FULL COLD" mark	

Select Lever Components

S7RS0B5106004



I4RS0A510052-01

1. Shift lock solenoid	3. Connector
2. Select lever assembly	4. "3" position switch

Select Lever Assembly Removal and Installation

S7RS0B5106005

Remove and install select lever referring to "Select Lever Components." When installing select lever noting the following.

- After installing select lever, adjust select cable referring to "Select Cable Adjustment".

Select Lever Knob Installation

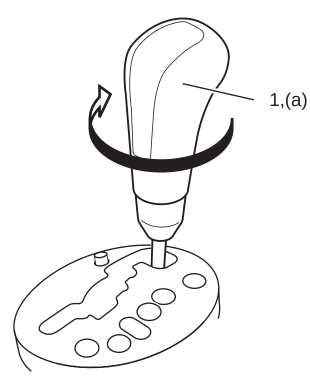
S7RS0B5106006

Screw select lever knob onto select lever by specified numbers of rotation below.

Rotation numbers for select lever knob installation
(a): 11 – 12 rotations

⚠ CAUTION

When installing select lever knob, do not turn more than specified numbers of rotation. Otherwise select lever knob is damaged.



I4RS0B510006-01

Select Lever Inspection

S7RS0B5106007

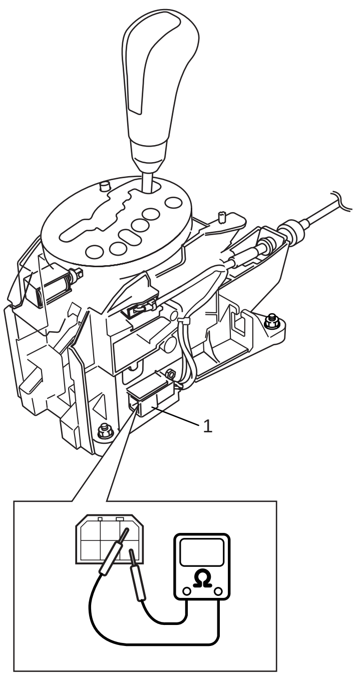
Check select lever for smooth and clear-cut movement individually. If a malfunction is found, replace select lever assembly.

"3" Position Switch Inspection

S7RS0B5106008

1) Remove console box referring to "Console Box Components in Section 9H".
2) Disconnect "3" position switch connector (1).
3) Check continuity between "3" position switch terminals.

<u>"3" position switch specification</u>
Shift select lever to "3" or "2" range: Continuity
Shift other above range: No continuity

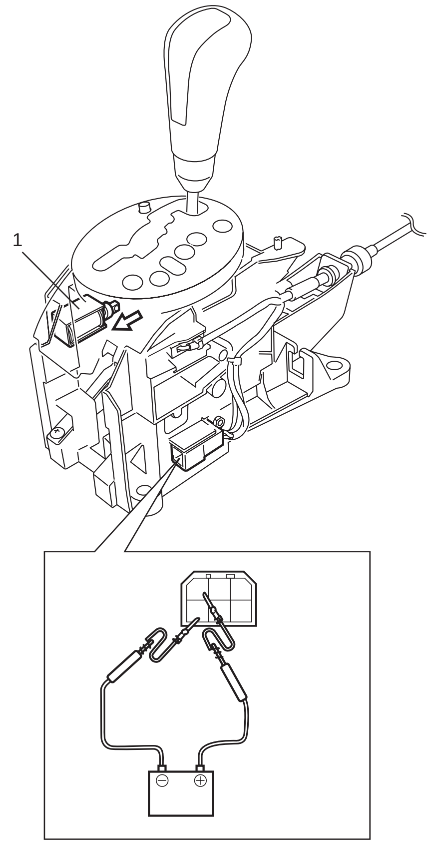


I4RS0A510026-01

Shift Lock Solenoid Inspection

S7RS0B5106009

Check that shift lock solenoid rod (1) moves smoothly when battery voltage is conducted and it moves back. If solenoid rod does not move smoothly, replace.

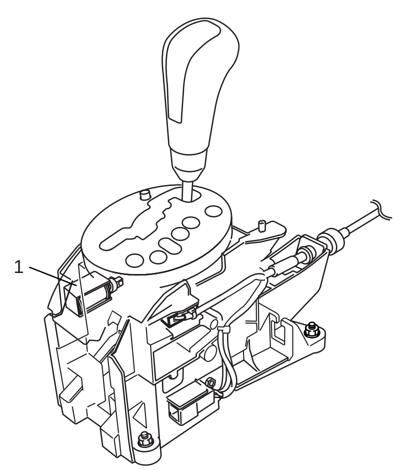


I6RS0C510011-01

Shift Lock Solenoid Replacement

S7RS0B5106010

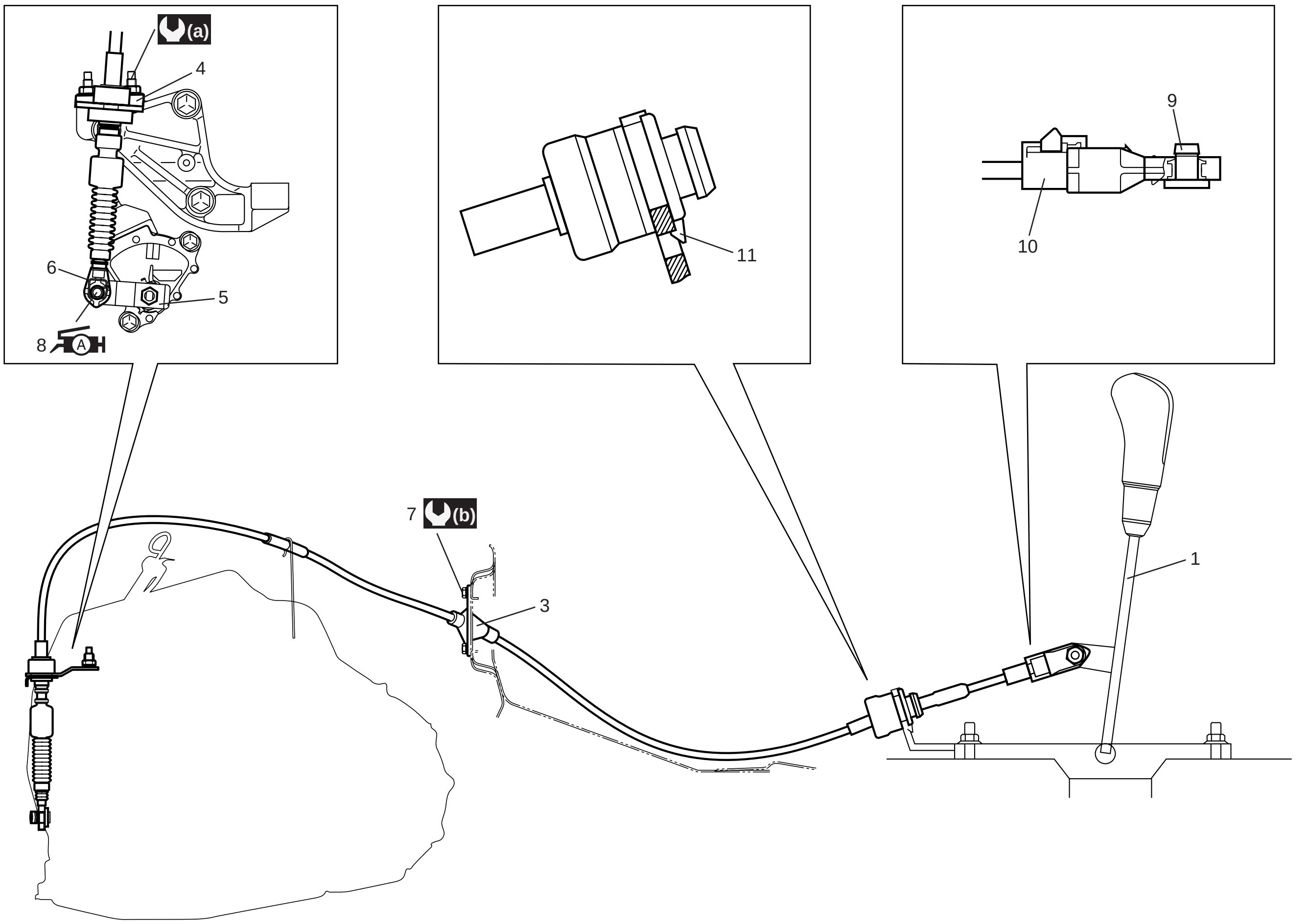
1) Remove console box referring to "Console Box Components in Section 9H".
2) Replace shift lock solenoid (1) using flat head or like.
3) Install covers as they were.



I4RS0A510053-01

Select Cable Components

S7RS0B5106011



I4RS0A510025-01

1. Select lever assembly	6. Clip	11. Lock
2. Select cable	7. Select cable retainer bolt	(a) : 23 N·m (2.0 kgf-m, 17.0 lb-ft)
3. Select cable retainer	8. Manual select lever pin : Apply lithium grease 99000-25011 to all around pin (0.15 g)	(b) : 5.0 N·m (0.55 kgf-m, 4.0 lb-ft)
4. Cable bracket	9. Select lever pin : Apply lithium grease 99000-25011 to all around pin (0.15 g)	
5. Manual select lever	10. Adjuster case	

Select Cable Removal and Installation

S7RS0B5106012

Removal

1) Remove parking brake lever cover.
2) Remove console box.
3) Disconnect select cable from select lever and then detach from bracket.
4) Remove clip and disconnect select cable from manual select lever.
5) Remove select cable retainer from dash panel.

Installation

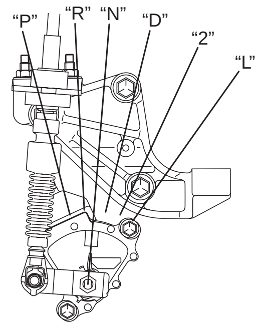
Install select cable by reversing removal procedure. The important steps in installation are as follows.

- Apply grease to pin and cable joint.
- Tighten bolts to specified torque referring to “Select Cable Components”.
- Adjusting procedure is as follows. Refer to “Select Cable Adjustment”.

Select Cable Adjustment

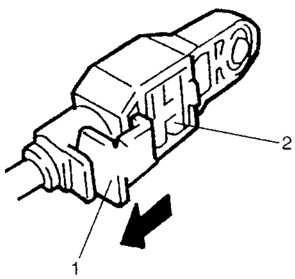
S7RS0B5106013

1) Shift manual shift lever to “N” range (transmission range sensor “N” range).



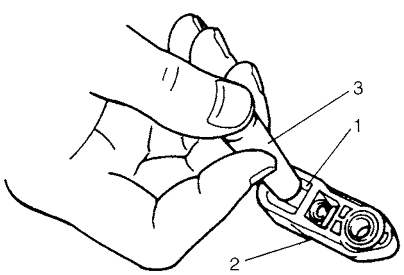
I3RM0B510036-01

2) Remove adjuster (cable end) from select lever pin of select lever assembly.
3) Release lock plate (1) which restrict moving of cable end holder (2).



I2RH01510046-01

4) Push cable end holder (1) out from eye-end (2) using an appropriate tool (3) to disengage cable.

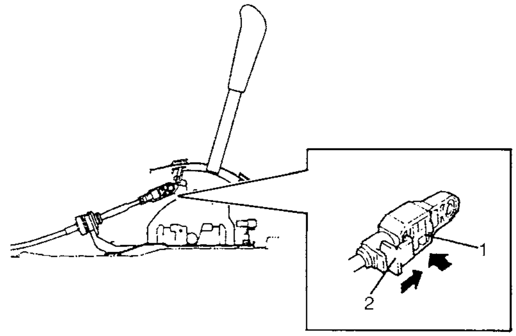


I2RH01510047-01

5) Shift select lever to “N” position.
6) Apply grease to select lever pin and install adjuster (cable end) to it.

: Grease 99000–25011 (SUZUKI Super Grease A)

7) With both select lever and transmission range sensor kept each “N” position, drive cable end holder (1) in until it locks cable.
8) Slide lock plate (2) to secure cable end holder in position.



I3RM0B510037-01

9) After select cable was installed, check for the following.
   - Push vehicle with select lever shifted to “P” range. Vehicle should not move.
   - Vehicle can not be driven in “N” range.
   - Vehicle can be driven in “D”, “3”, “2” and “L” ranges.
   - Vehicle can be backed in “R” range.

Key Interlock Cable Removal and Installation

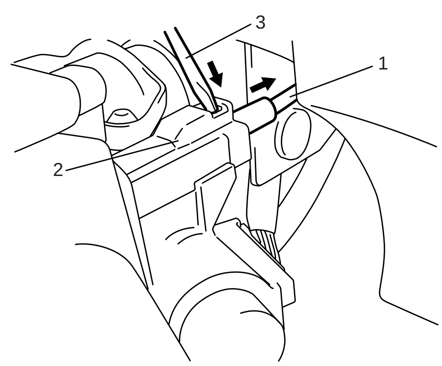
S7RS0B5106014

NOTE

Don’t bend interlock cable excessively when removing and installing it, or system will not operate correctly.

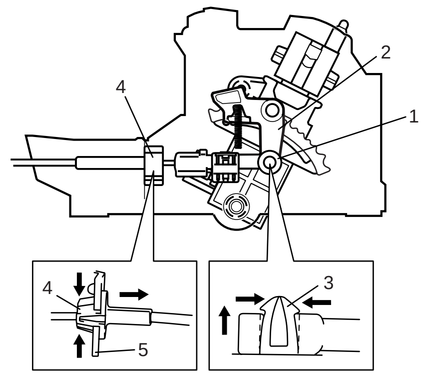
Removal

1) If the vehicle is equipped with air bag system, disconnect negative cable at battery and disable air bag system, referring to “Disabling Air Bag System in Section 8B”.
2) Remove steering column cover.
3) Turn ignition switch to ACC position.
4) Pull out key interlock cable (1) from key cylinder cover (2) while pressing check hook with slotted screwdriver (3) or the like.



I2RH01510083-01

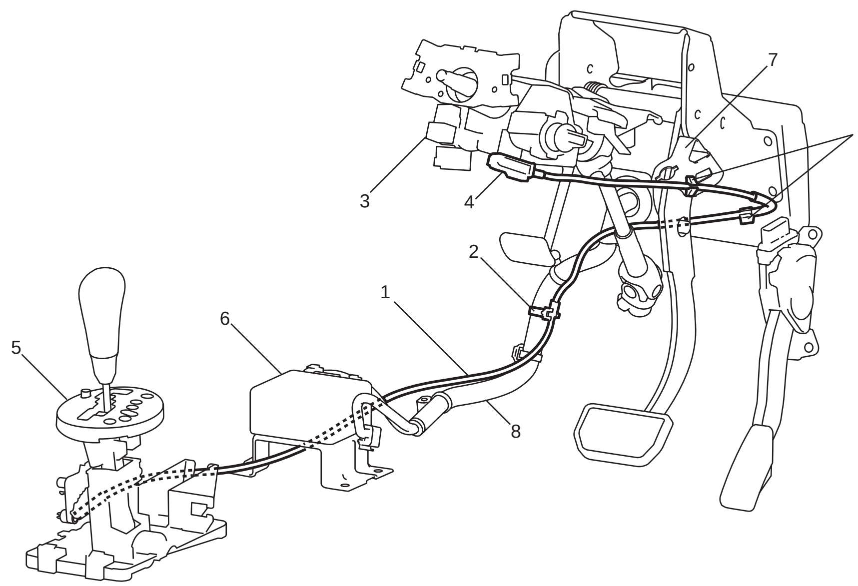
5) Turn ignition switch to LOCK position.
6) Remove parking brake cover and console box.
7) Detach cable end (1) from interlock cam (2) while pressing claws (3) of interlock cam boss.
   At this time, be careful not to cause damage to its claws.
   Detach cable casing cap (4) from selector bracket (5) while pressing check hook.
8) Remove interlock cable.



I4RS0A510054-01

Installation

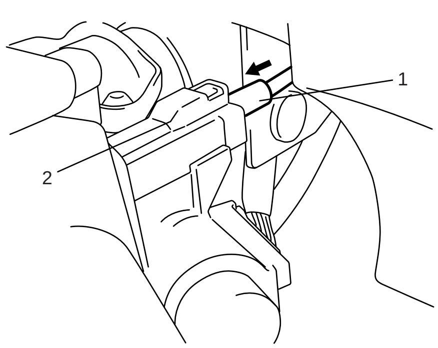
1) Lay interlock cable to its original cabling route.



I6RS0C510013-01

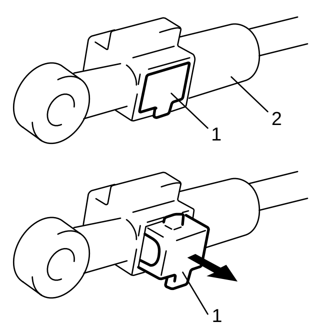
1. Key interlock cable	4. Key cylinder cover	7. Brake switch bracket
2. Clamp	5. Select lever assembly	8. Wiring harness
3. Steering lock assembly / Steering lock unit (Keyless start model)	6. EPS control module	9. Marking

2) Turn ignition switch to ACC position.
3) Insert cable casing cap (1) into key cylinder cover (2) securely.



I2RH01510085-01

4) Pull out lock button (1) of selector side cable end (2).



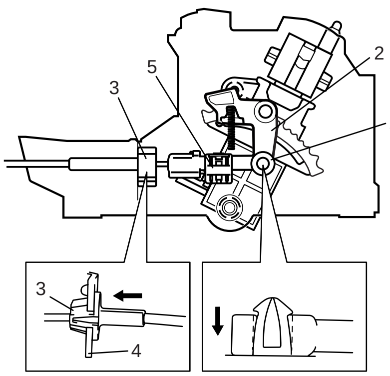
I2RH01510086-01

5) Shift select lever to “N” position.

NOTE

If select lever is in “P” position, shift select lever referring to “Select Lever Inspection”.

6) Install cable casing cap (3) to selector bracket (4).
7) Connect cable end (1) to interlock cam (2) with ignition switch turned to ACC position.
8) Drive lock button (5) in cable end until it locks cable expansion and contraction.



I4RS0A510055-01

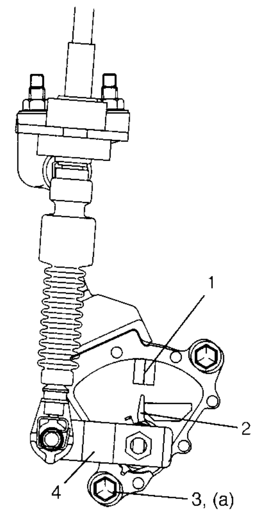
9) With select lever set at “P” position, turn ignition key to ACC position and then check for the following conditions.
   - With knob button released, ignition key can be turned from ACC position to LOCK position.
   - With knob button pressed, ignition key cannot be turned from ACC position to LOCK position.
10) Install steering column cover.
11) If the vehicle is equipped with air bag system, connect negative cable at battery and enable air bag system, referring to “Enabling Air Bag System in Section 8B”.

Transmission Range Sensor (Shift Switch) Inspection and Adjustment

S7RS0B5106015

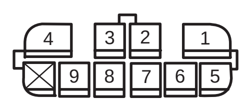
1) Shift manual select lever (4) to “N” range.
2) Check that needle direction shaped on lock washer (2) and “N” reference line (1) on transmission range sensor are aligned. If not, loosen sensor bolts (3) and align them.

   Tightening torque
   Transmission range sensor bolt (a): 5.5 N·m (0.55 kgf-m, 4.0 lb-ft)



I3RM0B510038-01

3) Check that engine starts in “N” and “P” ranges but it doesn’t start in “D”, “2”, “L” or “R” range. Also, check that back-up lamp lights in “R” range.
   If faulty condition cannot be corrected by adjustment, disconnect transmission range sensor connector and check that continuity exists as shown by moving manual select lever.



Sensor Position	Terminal No. 1	2	3	4	5	6	7	8	9
P	○	—	—	○			○	—	○
R							○	○	
N	○	—	—	○	○	—	○		
D			○	—	—	—	○		
2						○	○		
L		○	—	—	—	—	○		

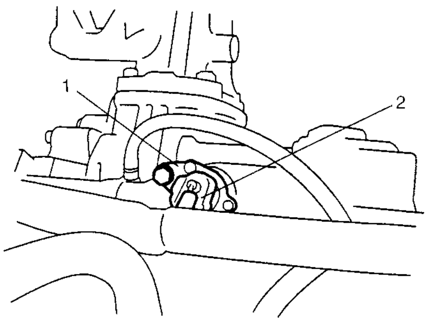
I3RM0B510039-01

Output Shaft Speed Sensor Removal and Installation

S7RS0B5106016

Removal

1) Disconnect negative cable at battery.
2) Disconnect output shaft speed sensor connector (2).
3) Remove output shaft speed sensor (1) by removing its bolt.



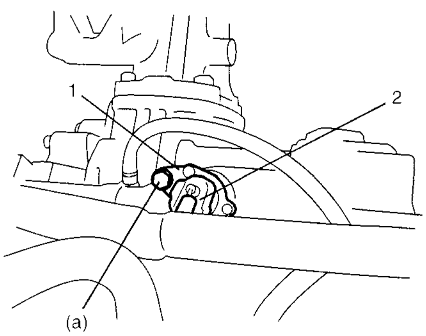
I3RM0B510040-01

Installation

1) Apply A/T fluid to output shaft speed sensor O-ring.
2) Install output shaft speed sensor (1) to A/T case and tighten bolt to specified torque.

   Tightening torque
   Output shaft speed sensor bolt (a): 13 N·m (1.3 kgf-m, 9.5 lb-ft)

3) Connect output shaft speed sensor connector (2) to output shaft speed sensor (1).



I3RM0B510041-01

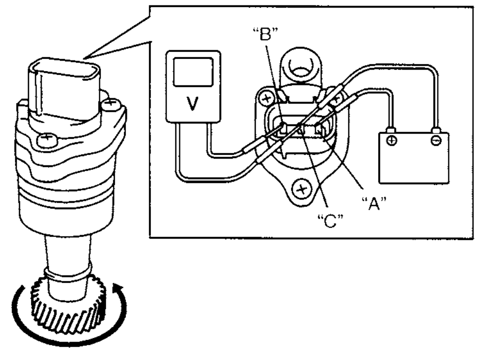
4) Connect negative cable to battery.

Output Shaft Speed Sensor Inspection

S7RS0B5106017

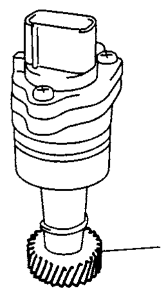
1) Connect positive cable of 12 volt battery to “A” terminal of sensor and ground cable to “C” terminal. Then using voltmeter, check voltage between “B” terminal and “C” terminal with output shaft speed sensor driven gear rotated.
   If measured voltage (pulse signal) is not as specified, replace sensor.

   <u>**Output shaft speed sensor output voltage**</u>
   Pulse signal of alternating 0 – 1 V and 10 – 14 V



I2RH0B510045-01

2) Check output shaft speed sensor driven gear (1) for wear.
   Replace if necessary.



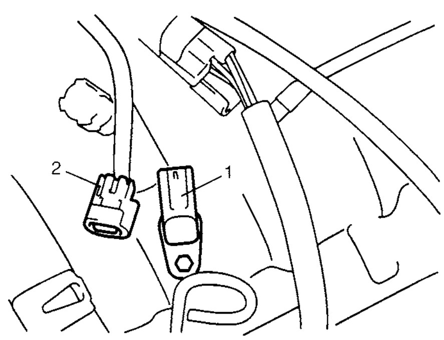
I2RH0B510046-01

Input Shaft Speed Sensor Removal and Installation

S7RS0B5106018

Removal

1) Disconnect negative cable at battery.
2) Disconnect input shaft speed sensor connector (2).
3) Remove input shaft speed sensor (1) by removing its bolt.



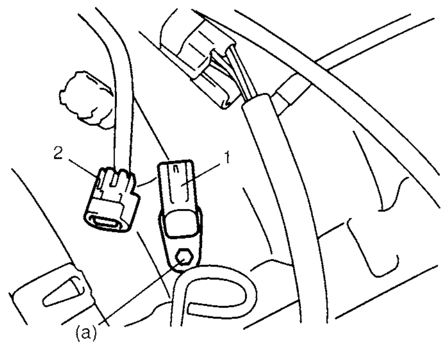
I2RH0B510047-01

Installation

1) Apply A/T fluid to input shaft speed sensor O-ring.
2) Install input shaft speed sensor (1) to A/T case and tighten bolt to specified torque.

   Tightening torque
   Input shaft speed sensor bolt (a): 5.5 N·m (0.55 kgf-m, 4.0 lb-ft)

3) Connect input shaft speed sensor connector (2) to input shaft speed sensor (1).



I2RH0B510048-01

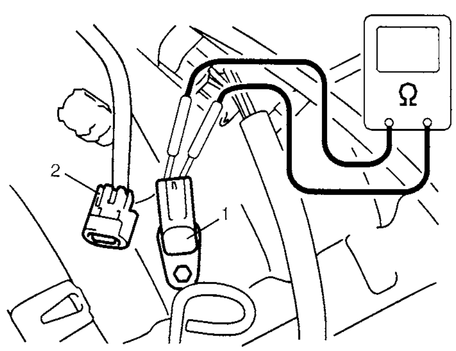
4) Connect negative cable to battery.

Input Shaft Speed Sensor Inspection

S7RS0B5106019

1) Disconnect negative cable at battery.
2) Disconnect input shaft speed sensor connector (2).
3) Check resistance between input shaft speed sensor (1) terminals.

   <u>Input shaft speed sensor resistance</u>
   Standard: 560 – 680 Ω at 20 °C (68 °F)



I2RH0B510049-01

Transmission Fluid Temperature Sensor Removal and Installation

S7RS0B5106020

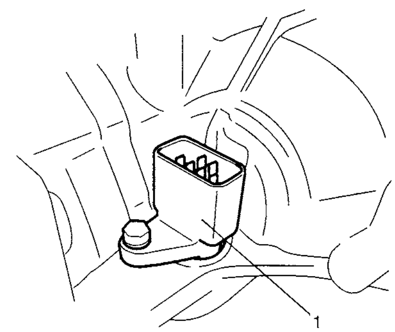
Removal

1) Disconnect negative cable at battery.
2) Lift up vehicle.
3) With engine is cool, remove drain plug and drain A/T fluid.
4) Install drain plug. Refer to “A/T Fluid Change”.
5) Remove A/T oil pan.
6) Remove oil strainer assembly.
7) Remove valve body assembly referring to “Automatic Transaxle Unit Disassembly”.

   ⚠ CAUTION

   When pulling solenoid wire harness out of transaxle case, take care not to damage transmission fluid temperature sensor at narrow exit of case.
   Careless sensor treatment might cause sensor malfunction.

8) Remove solenoid wire harness (1).



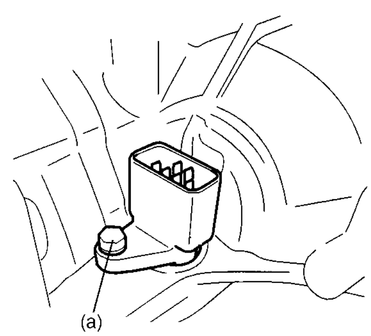
I2RH0B510050-01

Installation

Reverse removal procedure to install solenoid wire harness and valve body assembly noting the following points.

- For details of valve body assembly and their connectors installation, refer to “Automatic Transaxle Unit Assembly”.
- For details of A/T oil pan installation, refer to “Automatic Transaxle Unit Assembly”. Use new oil pan gasket.
- Tighten valve body harness connector bolt to specified torque.

  Tightening torque
  Valve body harness connector bolt (a): 7.0 N·m (0.7 kgf-m, 5.0 lb-ft)



I2RH0B510051-01

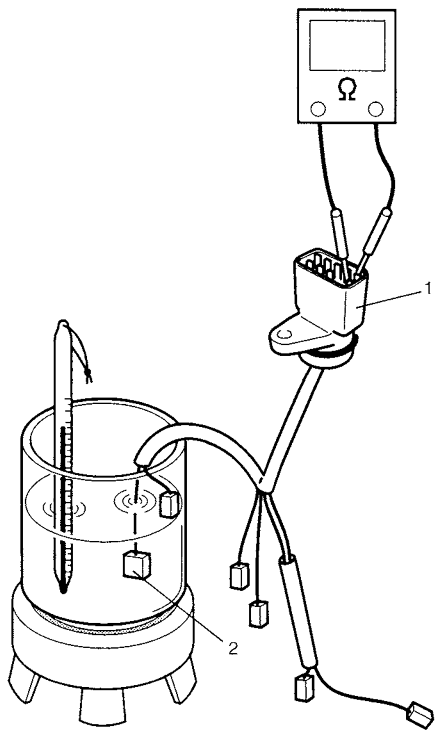
- Pour A/T fluid and check fluid level according to procedure described in “A/T Fluid Change”.
- Check for fluid leakage after warming up A/T.

Transmission Fluid Temperature Sensor Inspection

S7RS0B5106021

Warm up transmission fluid temperature sensor (2). Check resistance between terminals of valve body harness connector (1). Thus make sure its resistance decrease as its temperature increase.

Transmission fluid temperature sensor resistance
10 °C (50 °F): 5.8 – 7.1 kΩ
110 °C (230 °F): 231 – 263 Ω
145 °C (293 °F): 105 – 117 Ω



I2RH0B510052-01

Solenoid Valves (Shift Solenoid Valves and Timing Solenoid Valve) Removal and Installation

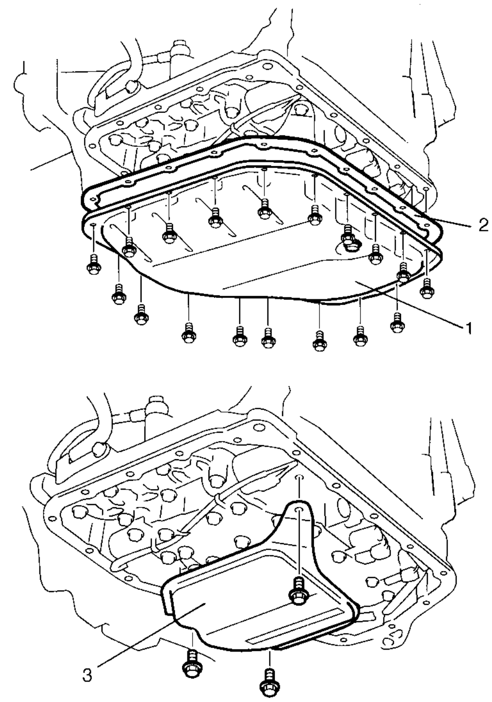
S7RS0B5106022

Removal

1) Disconnect negative cable at battery.
2) Lift up vehicle.
3) Remove drain plug and drain A/T fluid.
4) Install drain plug.

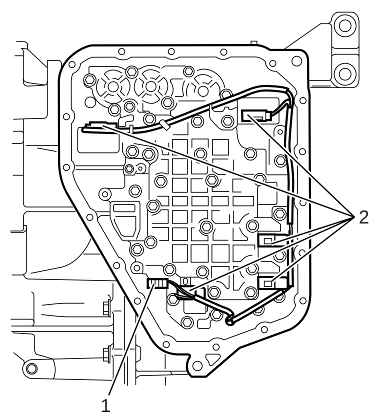
   Tightening torque
   A/T fluid drain plug: 17 N·m (1.7 kgf-m, 12.5 lb-ft)

5) Remove A/T oil pan (1) and oil pan gasket (2).
6) Remove oil strainer assembly (3).



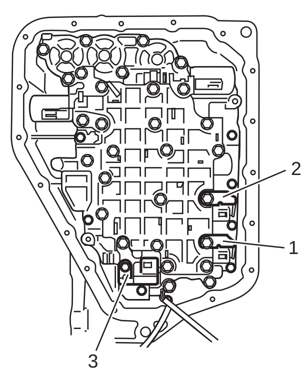
I2RH0B510054-01

7) Remove transmission fluid temperature sensor (1) from sensor clamp.
8) Disconnect solenoid connectors (2).



I4RS0A510027-01

9) Remove shift solenoid valve-A (No.1) (1), shift solenoid valve-B (No.2) (2) and timing solenoid valve (3) by removing bolts.

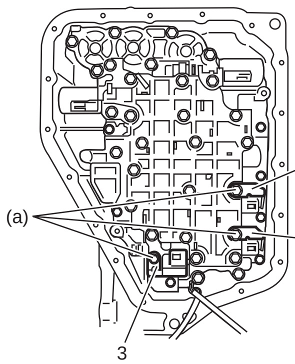


I4RS0A510028-01

Installation

1) Install shift solenoid valve-A (No.1) (1), shift solenoid valve-B (No.2) (2) and timing solenoid valve (3).

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

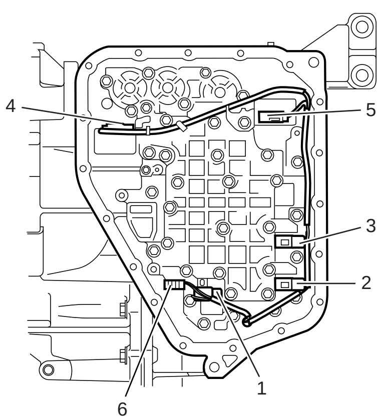


I4RS0A510029-01

2) Connect solenoid connectors identifying their installing positions by wire color.

Solenoid coupler	Wire color
Shift solenoid valve-A (No.1) (2)	White
Shift solenoid valve-B (No.2) (3)	Black
Timing solenoid valve (1)	Yellow
TCC pressure control solenoid valve (4)	Light green / Brown
Pressure control solenoid valve (5)	Green / Gray

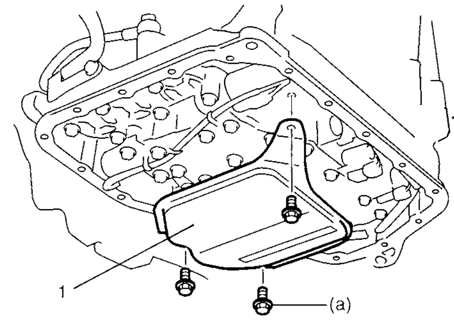
3) Install transmission fluid sensor (6) and sensor wire to clamp.



I4RS0A510030-01

4) Install oil strainer assembly (1).

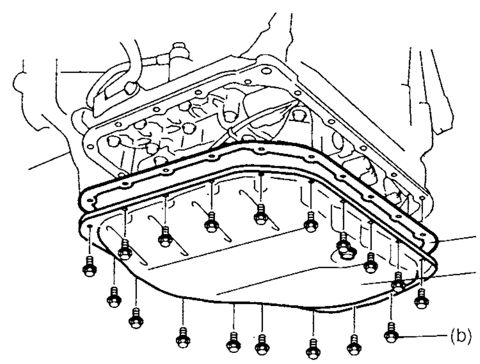
   Tightening torque
   Oil strainer bolt (a): 10 N·m (1.0 kgf-m, 7.5 lb-ft)



I2RH0B510059-01

5) Install new oil pan gasket (1) and oil pan (2).
6) Tighten oil pan bolts to specified torque diagonally and little by little.

   Tightening torque
   Oil pan bolt (b): 7.0 N·m (0.7 kgf-m, 5.0 lb-ft)



I2RH0B510060-01

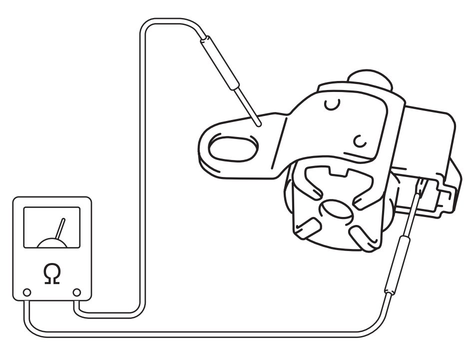
Solenoid Valves (Shift Solenoid Valves, and Timing Solenoid Valve) Inspection

S7RS0B5106023

Resistance Check

Check shift solenoid valves and timing solenoid valve.

Shift solenoid valves and timing solenoid valve resistance
Standard: 11 – 15 Ω at 20 °C (68 °F)



I2RH0B510061-01

Operation Check

Shift solenoid valve-A (No.1) and -B (No.2)

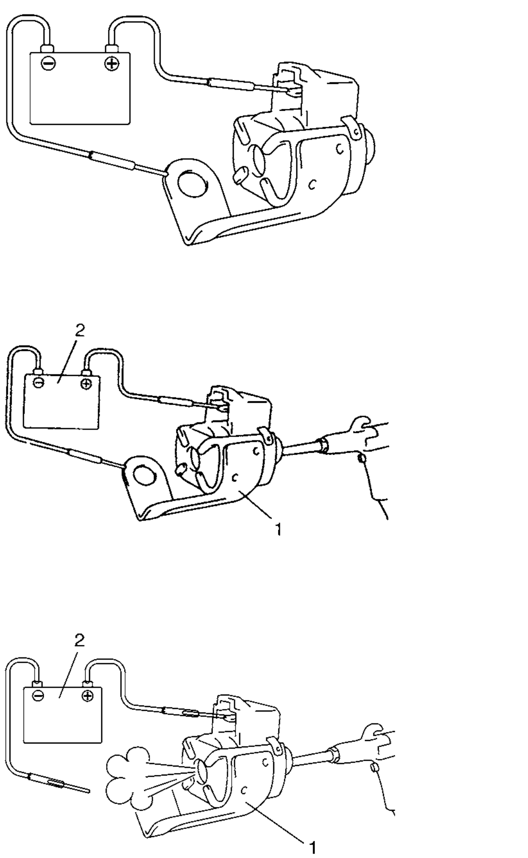
⚠ **CAUTION**

- **Do not insert air gun against strainer installed on inlet of solenoid valve too deeply, when blowing air into solenoid valve. If not, the strainer will be damaged.**
- **Be very careful as dust etc. does not enter when solenoid valves are inspected.**

- Check that solenoid valve (1) actuate with click sound when battery voltage is conducted.
- When solenoid valve (1) is connected to battery (2), confirm that solenoid valve is close condition by blowing air (50 – 200 kPa, 0.5 – 2.0 kg/cm^2, 7 – 28.5 psi) into solenoid valve as shown in figure.
- When solenoid valve (1) is not connected to battery (2), confirm that solenoid valve is open condition by blowing air (50 – 200 kPa, 0.5 – 2.0 kg/cm^2, 7 – 28.5 psi) into solenoid valve as shown in figure.

NOTE

Do not fail to inspect with air to prevent mistaken checking because return spring for valve is not installed into solenoid valve.



I2RH0B510062-01

Timing solenoid valve

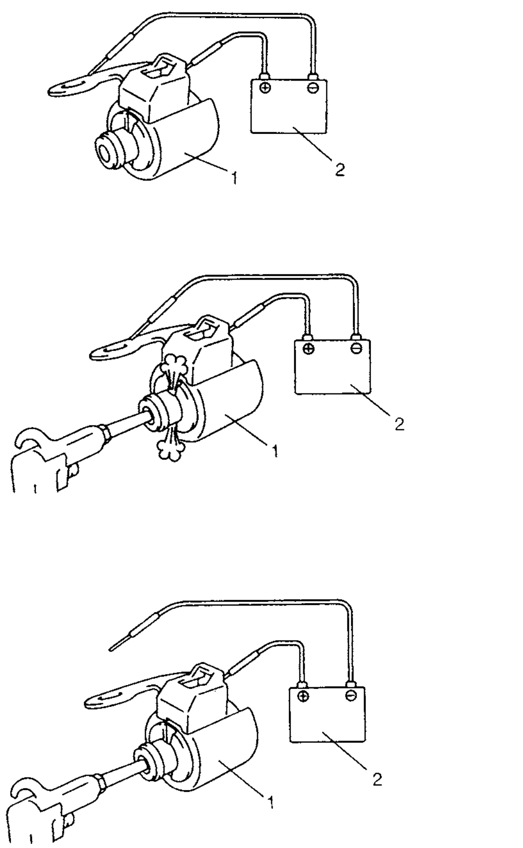
⚠ **CAUTION**

- **Do not insert air gun against strainer installed on inlet of solenoid valve too deeply, when blowing air into solenoid valve. If not, the strainer will be damaged.**
- **Be very careful as dust etc. does not enter when solenoid valves are inspected.**

- Check that solenoid valve (1) actuate with click sound when battery voltage is conducted.
- When timing solenoid valve (1) is connected to battery (2), confirm that timing solenoid valve is open condition by blowing air (50 – 200 kPa, 0.5 – 2.0 kg/cm^2, 7 – 28.5 psi) into solenoid valve as shown in figure.
- When timing solenoid valve (1) is not connected to battery (2), confirm that timing solenoid valve is close condition by blowing air (50 – 200 kPa, 0.5 – 2.0 kg/cm^2, 7 – 28.5 psi) into solenoid valve as shown in figure.

NOTE

Do not fail to inspect with air to prevent mistaken checking because return spring for valve is not installed into solenoid valve.



I2RH0B510063-01

Pressure Control Solenoid Valves (Pressure Control Solenoid and TCC Pressure Control Solenoid) Removal and Installation

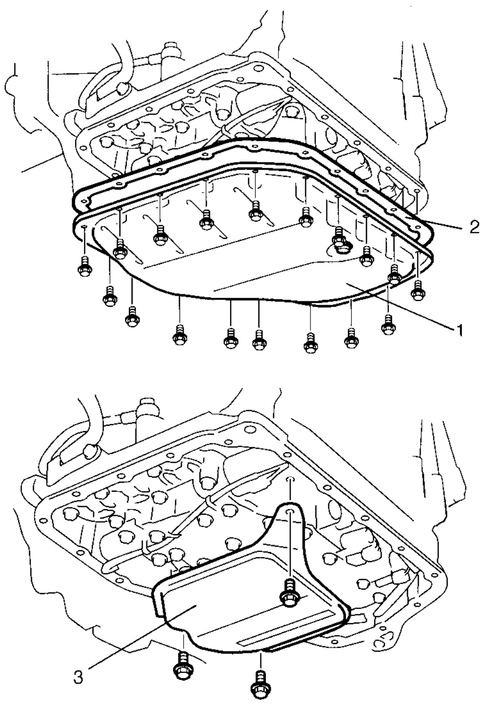
S7RS0B5106024

Removal

1) Disconnect negative cable at battery.
2) Lift up vehicle.
3) Remove drain plug and drain A/T fluid.
4) Install drain plug.

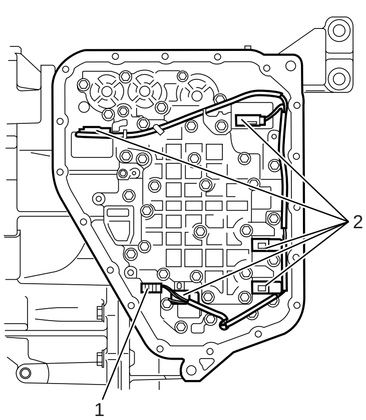
Tightening torque
A/T fluid drain plug: 17 N·m (1.7 kgf-m, 12.5 lb-ft)

5) Remove A/T oil pan (1) and oil pan gasket (2).
6) Remove oil strainer assembly (3).



I2RH0B510054-01

7) Remove transmission fluid temperature sensor (1) from sensor clamp.
8) Disconnect solenoid connectors (2).



I4RS0A510027-01

9) Remove valve body assembly referring to "Automatic Transaxle Unit Disassembly".
10) Remove pressure control solenoid valve and TCC pressure control solenoid valve referring to "Valve Body Assembly Disassembly and Reassembly".

Installation

Reverse removal procedure to install pressure control solenoid valve and valve body assembly noting the following points.

- For detail of pressure control solenoid valve and TCC pressure control solenoid valve installation, refer to "Valve Body Assembly Disassembly and Reassembly".
- For detail of valve body assembly installation, refer to "Automatic Transaxle Unit Assembly".
- For detail of installing wire harness for solenoid valves and sensor, refer to "Automatic Transaxle Unit Assembly". Use new O-rings.
- For detail of A/T oil pan and oil strainer assembly installation, refer to "Automatic Transaxle Unit Assembly". Use new oil pan gasket.
- Pour A/T fluid and check fluid level according to procedure described in "A/T Fluid Change".
- Check for fluid leakage after warming up A/T.

Pressure Control Solenoid Valve Inspection

S7RS0B5106025

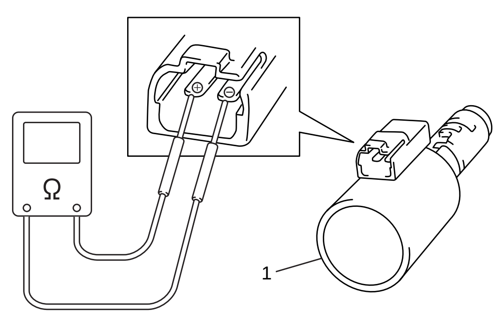
⚠ CAUTION

- **Be very careful as dust etc. does enter when pressure control solenoid valves are inspected.**

Resistance Check

Measure resistance between pressure control solenoid valves (Pressure control solenoid and TCC pressure control solenoid) (1) terminals.

<u>Pressure control solenoid valve and TCC pressure control solenoid valve resistance</u>
Standard: 5.0 – 5.6 Ω at 20 °C (68 °F)



I2RH01510071-01

Operation Check

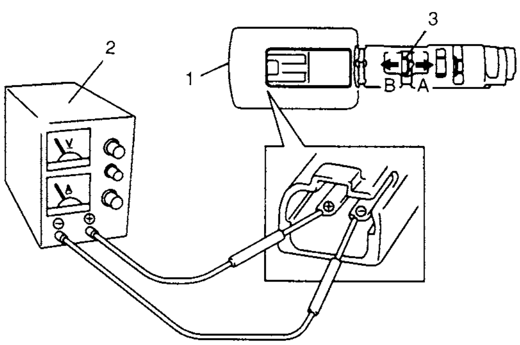
Check pressure control solenoid valves (Pressure control solenoid and TCC pressure control solenoid) operation in the either manner of the following.

Using regulated DC power supply

1) Connect pressure control solenoid valve (1) with regulated DC power supply (2) as shown in figure.
2) Turn regulated DC power supply switch ON and increase voltage of power supply keeping current within 1.0 A.
3) Check for gradual movement of valve (3) in the direction of arrow “A” as voltage is increased.
4) Check movement of valve (3) in the direction of arrow “B” as voltage is decreased.
5) Turn power supply switch OFF.

⚠ CAUTION

Do not pass current 1.0 A or more, or pressure control solenoid is burned out.



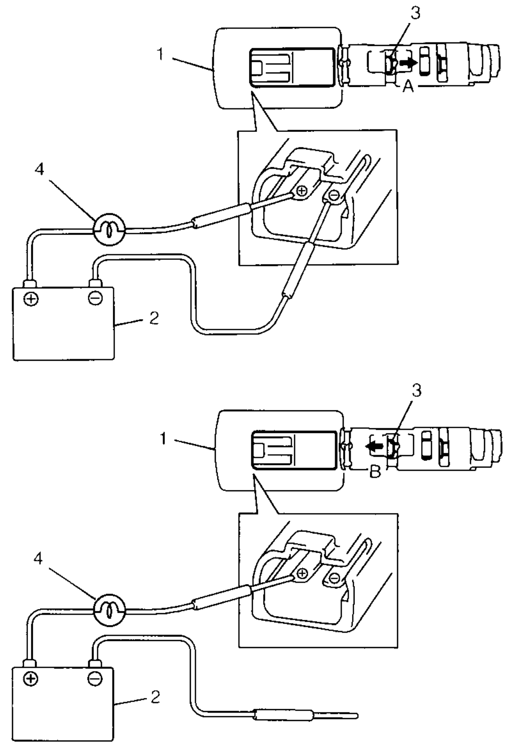
I2RH0B510064-01

Not using regulated DC power supply

1) Connect pressure control solenoid valve (1) to battery (2) setting 21 W bulb (4) on the way as shown in figure.
2) Check for movement of valve (3) in the direction of arrow “A”.
3) Disconnect pressure control solenoid valve (1) from battery (2) and check movement of valve (3) in the direction of arrow “B” as shown in figure.

⚠ CAUTION

Set 21 W bulb on the way, or pressure control solenoid valve is burned out.



I4RS0A510031-01

Transmission Control Module (TCM) Removal and Installation

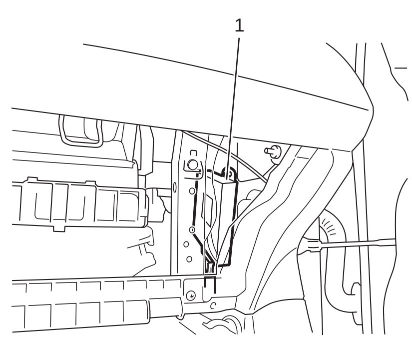
S7RS0B5106026

⚠ CAUTION

- **TCM and ECM consists of highly precise parts, therefore when handling it, be careful not to expose to excessive shock.**
- **When replacing TCM with used one, all learned contents, which have been stored in TCM memory by executing learning control, should be initialized after replacement.**

Removal

1) Disconnect negative cable at battery.
2) If the vehicle is equipped with air bag system, disable air bag system. Refer to “Disabling Air Bag System in Section 8B”.
3) Disconnect connectors from TCM (1).
4) Remove TCM by removing its bolts.



I4RS0B510007-01

Installation

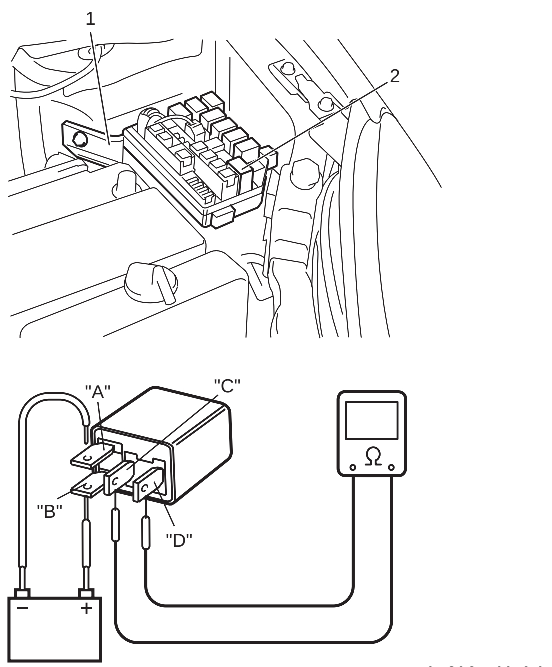
Reverse removal procedure noting the following.

- Connect TCM connectors securely.
- If the vehicle is equipped with air bag system, be sure to enable air bag system after TCM is back in place. Refer to “Enabling Air Bag System in Section 8B”.

A/T Relay Inspection

S7RS0B5106027

1) Disconnect negative cable at battery.
2) Remove A/T relay (2) from fuse and relay box (1).
3) Check that there is no continuity between terminal “C” and “D”.
   If continuity is indicated, replace A/T relay.
4) Connect battery positive (+) terminal to terminal “A” of A/T relay and battery negative (–) terminal to terminal “B” of A/T relay.
   Check continuity between terminal “C” and “D” of A/T relay.
   If continuity does not indicated, replace A/T relay.

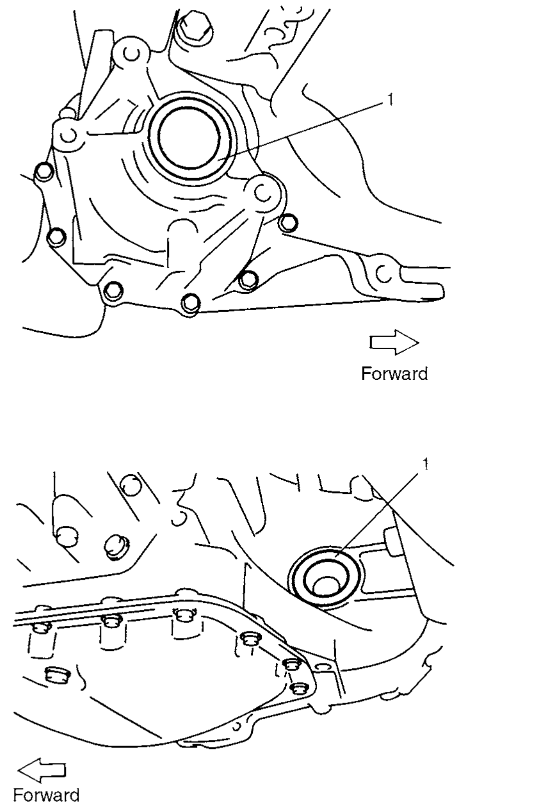


I6RS0C510012-01

Differential Side Oil Seal Replacement

S7RS0B5106028

1) Lift up vehicle and drain automatic transaxle fluid.
2) Remove drive shaft joints from differential gear of transaxle. Refer to “Front Drive Shaft Assembly Removal and Installation in Section 3A” for procedure to disconnect drive shaft joints.
   For differential side oil seal removal, it is not necessary to remove drive shafts from steering knuckle.
3) Remove differential side oil seal (1) by using screwdriver or the like.



I2RH0B510067-01

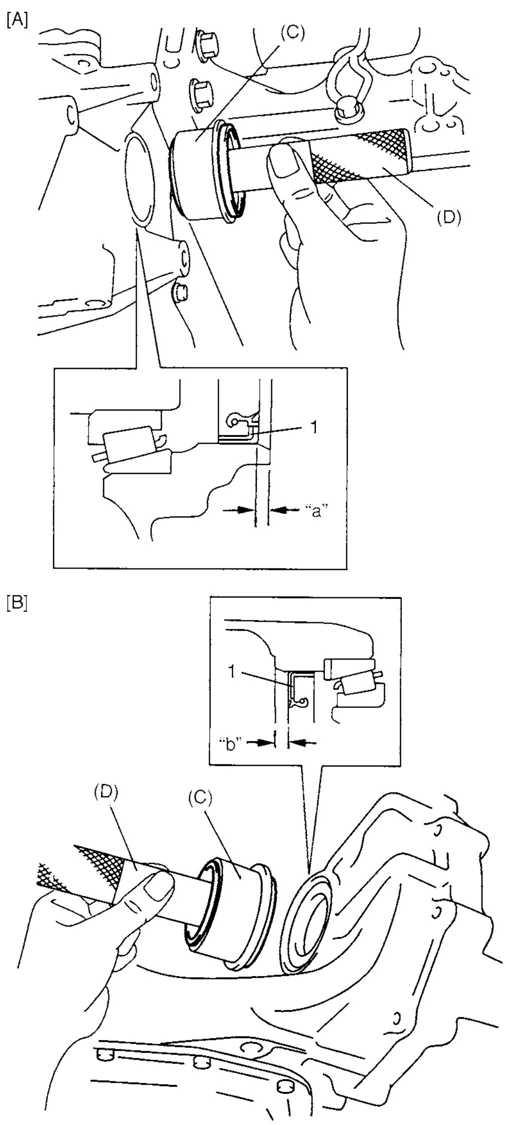
4) Apply grease to new differential side oil seal lips.

   : Grease 99000–25030 (SUZUKI Super Grease C)

5) Install new differential side oil seals (1) by using special tool.

   Special tool
   (C): 09944–88220
   (D): 09924–74510

   Differential side oil seal installing depth
   Right side "a": 2.6 – 3.6 mm (0.10 – 0.14 in.)
   Left side "b": 3.8 – 4.8 mm (0.15 – 0.19 in.)



I2RH0B510068-01

[A]: Right side	[B]: Left side

6) Install drive shaft referring to "Front Drive Shaft Assembly Removal and Installation in Section 3A".

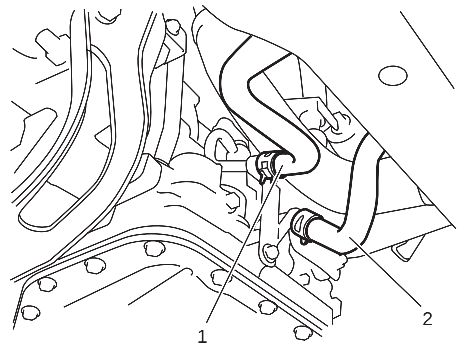
7) Pour A/T fluid referring to "A/T Fluid Change".

A/T Fluid Cooler Hoses Replacement

S7RS0B5106029

The rubber hoses for the A/T fluid cooler should be checked at specified interval. If replacing them, be sure to note the following.

- to replace clamps at the same time
- to insert hose as far as its limit mark
- to clamp clamps securely

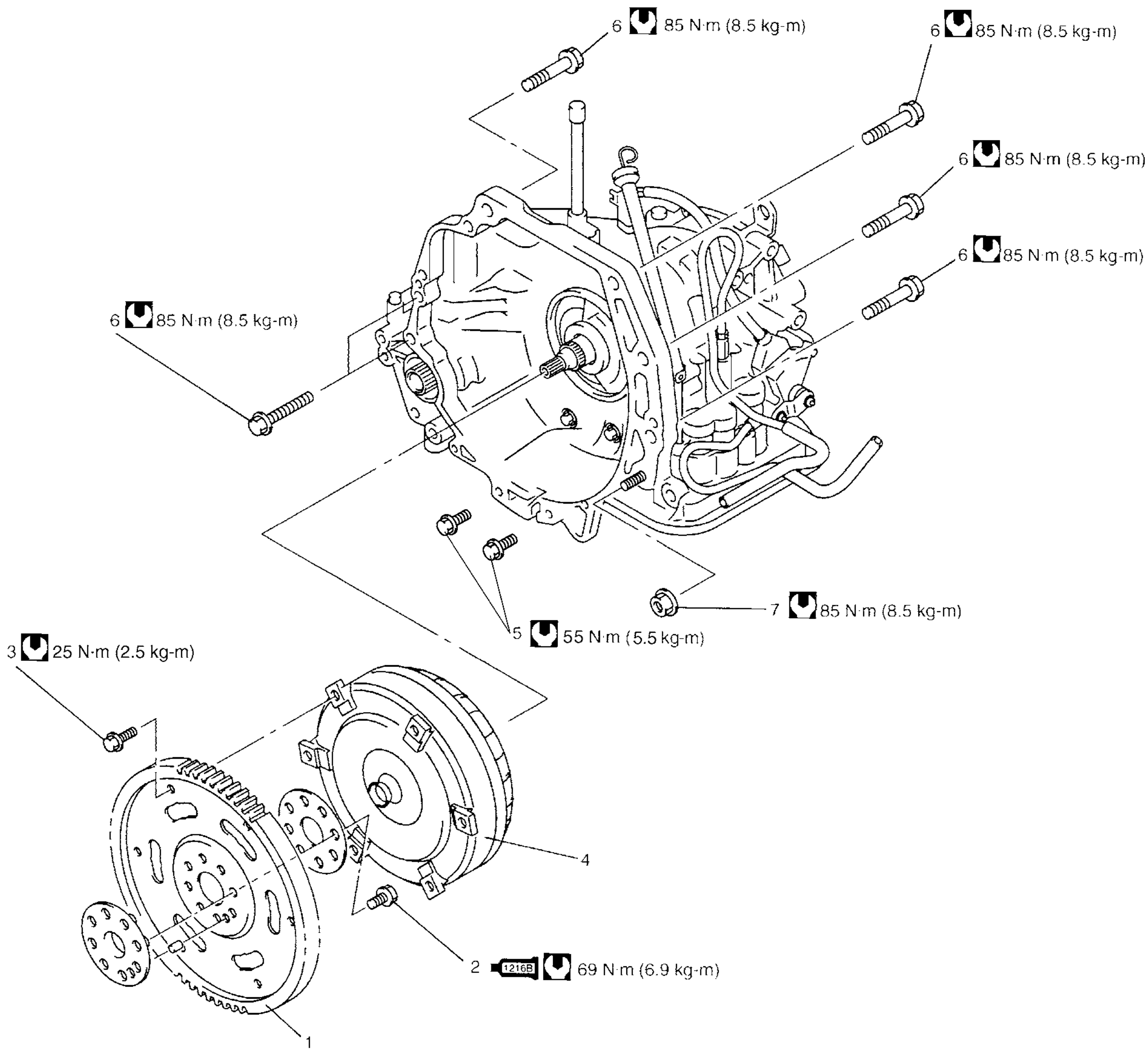


I4RS0A510057-01

1.	Inlet hose (Outlet from A/T fluid cooler)
2.	Outlet hose (Inlet to A/T fluid cooler)

Automatic Transaxle Unit Components

S7RS0B5106030



I4RS0A510035-01

1. Drive plate	4. Torque converter	7. Transaxle and engine fastening nut
1216B 2. Drive plate bolt : Apply sealant 99000-31230 to thread.	5. Transaxle stiffener bolt	: Tightening torque
3. Drive plate to torque converter bolt	6. Transaxle and engine fastening bolt	

Automatic Transaxle Unit Dismounting and Remounting

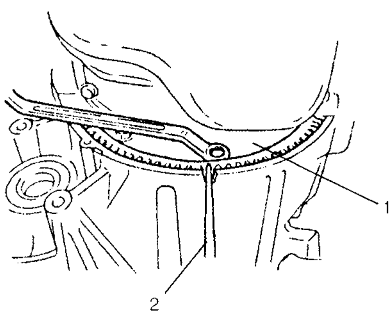
S7RS0B5106031

Dismounting

1) Take down transaxle with engine. For its procedure, refer to “Engine Assembly Removal and Installation in Section 1D”.
2) Remove transaxle housing lower plates (1).

I4RS0A150004-01

3) Remove drive plate to torque converter bolts (1) engage flat head rod or the like (2) with drive plate ring gear.



I3RM0B510047-01

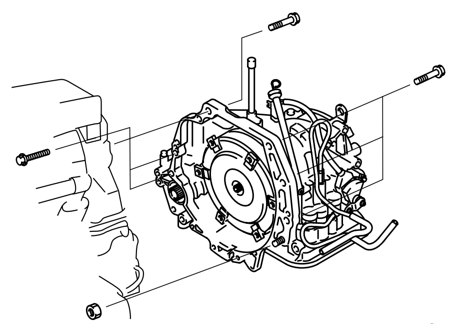
4) Remove starting motor.
5) Remove bolts and nut fastening engine and transaxle, then detach transaxle from engine.

⚠ WARNING

Be sure to keep transaxle with torque converter horizontal or facing up throughout the work. Should it be tilted with torque converter down, converter may fall off and cause personal injury.

NOTE

When detaching transaxle from engine, move it in parallel with crankshaft and use care so as not to apply excessive force to drive plate and torque converter.



I3RM0B510049-01